TEKTRONIX®

AM 503
CURRENT PROBE AMPLIFIER

INSTRUCTION MANUAL

Tektronix, Inc.
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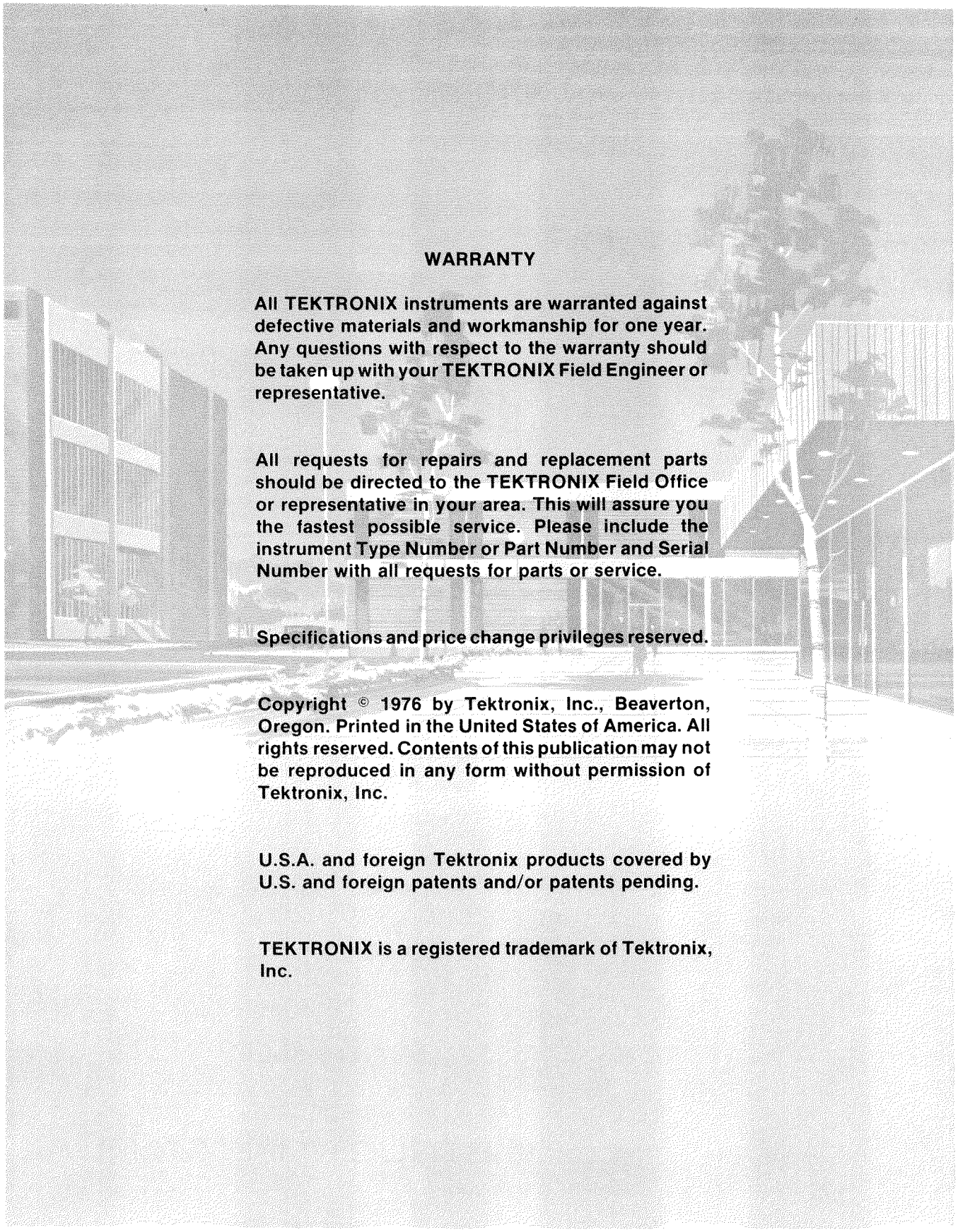

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

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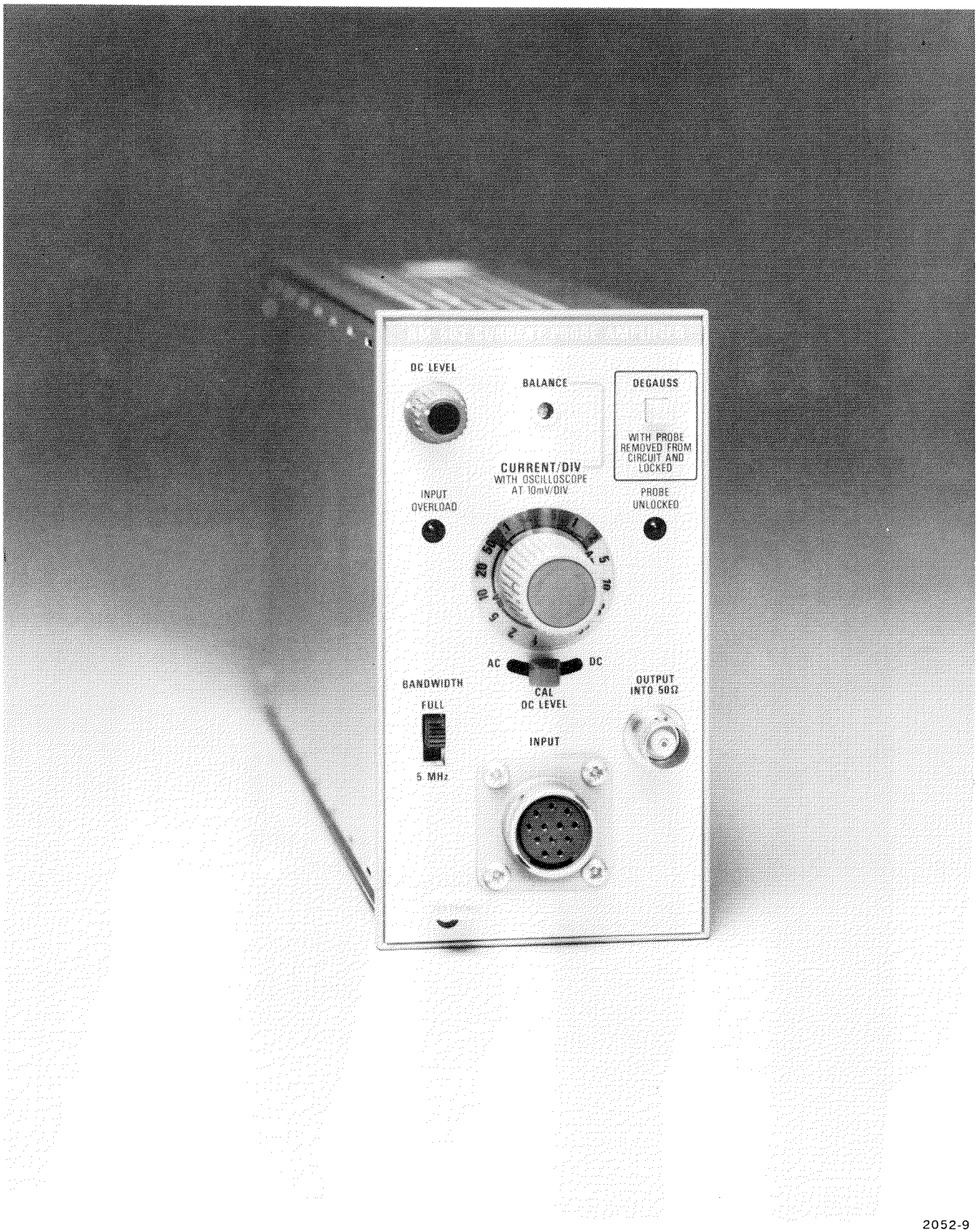

Fig. 1-1. AM 503 Current Probe Amplifier.

GENERAL INFORMATION

This section contains a brief description of the AM 503 and its performance characteristics and the accessories and documents supplied.

INTRODUCTION

Description

The Tektronix AM 503 is a plug-in[1] current-probe amplifier designed for use with the P6302 and some future probes. The AM 503 is used with an oscilloscope system having an input sensitivity of 10 mV/Div and an input impedance of either 50 ohms or 1 megohm (if test oscilloscope has 1 megohm input, terminate the connecting coaxial cable in 50 Ω).

TM 500-Series Instruments

The Tektronix AM 503 Current Probe Amplifier is a member of the growing TM 500 line of Test and Measurement Instruments. This product line consists of both general and special-purpose instruments such as digital multimeters, counter-timers, variable dc power supplies, pulse generators, function generators, calibration generators, signal processors, and others. Each instrument is a plug-in module.

Power module mainframes with 1, 3, 4, 5, and 6 compartments are available. The power module provides power and a housing for the plug-in modules, and permits internal signal interconnection between plug-in instruments to reduce clutter or to allow two or more instruments to perform a function which neither could perform alone.

Each user can thus select from a board choice of instruments to assemble a multi-function test set to fit his needs. This test set is compact and portable; yet it can be quickly reconfigured by exchanging plug-in instruments when test needs change. The TM 500-systems can be reconfigured for bench-top, rackmount, roll-about, and portable applications. For more information on the TM 500-line, contact your local Tektronix Field Office or representative.

[1] Use in TM 500-Series Power Module.

INSTALLATION

The AM 503 is calibrated and ready for use when received. It is designed to operate in a TM 500-Series Power Module only.

CAUTION

Turn the power module off before inserting or removing the AM 503; otherwise, the AM 503 circuitry may be damaged.

To install (refer to figure 1-2), align the upper and lower rails of the AM 503 with the power module tracks and push the AM 503 into the module until the front panel is flush with the front of the power module.

To remove the AM 503, pull on the release latch at the bottom of the front panel. Continue pulling on the release latch to slide the AM 503 out of the power module.

REPACKAGING FOR SHIPMENT

If the instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner, name of an individual (with address) at your firm who can be contacted, complete instrument serial number, and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

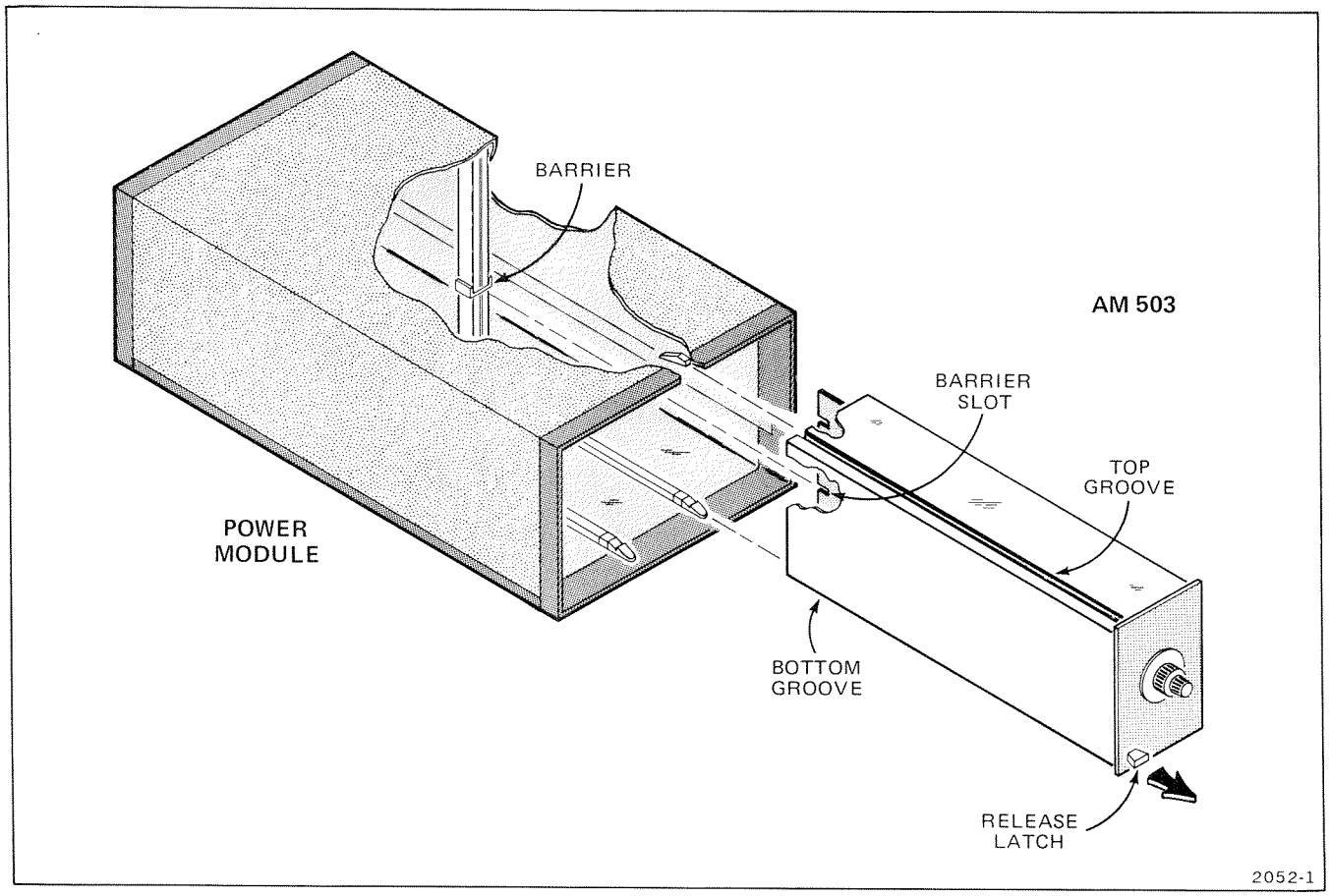

Fig. 1-2. AM 503 installation and removal.

1. Obtain a corrugated cardboard carton having inside dimensions no less than six inches more than the instrument dimensions; this will allow for cushioning. See Table 1-1 for carton test strength requirements.

TABLE 1-1

Shipping Carton Test Strength

Gross Weight	Carton Test Strength
0-4.5 kg (0-10 lbs)	90 kg (200 lbs)
4.5-13.5 kg (10-30 lbs)	124 kg (275 lbs)
13.5 kg (30-120 lbs)	169 kg (375 lbs)
54-63 kg (120-140 lbs)	225 kg (500 lbs)
63-72 kg (140-160 lbs)	270 kg (600 lbs)

2. Surround the instrument with polyethylene sheeting to protect the instrument finish.

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

4. Seal carton with shipping tape or industrial stapler.

SPECIFICATION

The following instrument specification applies over an ambient temperature range from 0° to +50°C, providing the instrument was adjusted in an ambient temperature range from +20° to +30°C. The instrument and probe must be warmed up for at least 20 minutes before making measurements.

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TABLE 1-2
Electrical

Characteristic	Performance Requirement
Bandwidth (–3 dB)	
FULL	
With P6303 Probe	DC to at least 15 MHz
With P6302 Probe	DC to at least 50 MHz
5 MHz	DC to 5 MHz ±1 MHz
AC Coupled, Lower Limit	7 Hz or less
Risetime (FULL Bandwidth)	
With P6303 Probe	23 ns or less
With P6302 Probe	7 ns or less
Noise	
Random	
With P6302 Probe	0.3 mA or less (measured tangentially)
Probe Random Trace Shift	
With P6302 Probe	1.5 mA peak-to-peak or less
Deflection Factor (Oscilloscope Set to 10 mV/Div)	
With P6302 Probe	1 mA to 5 A/Div in 1, 2, 5 sequence

TABLE 1-2 (cont)

Characteristic	Performance Requirement
Attenuator Accuracy	Within 3% of indicated current/div
Output Dynamic Range (Output Terminated into 50 ohms)	+80 mV and –80 mV with less than 5% compression
ENVIRONMENTAL	
Temperature	
Operating	0° to +50°C
Non-operating	–55° to +75°C
PHYSICAL	
Dimensions	
Length	≈29.7 cm (11.7 inches)
Height	≈12.7 cm (5 inches)
Width	≈6.7 cm (2.6 inches)

STANDARD ACCESSORIES

1	Instruction Manual	070-2052-00
1	Cable, Coaxial BNC, 50 ohm, 42 inch	012-0057-01
1	Termination, BNC, 50 ohms	011-0049-01

OPERATING INFORMATION

This section of the manual will familiarize the operator or technician with the location and operation of the external controls, connectors, and indicators.

FRONT-PANEL CONTROLS, CONNECTORS, AND INDICATORS

Controls, connectors, and indicators are located on the front panel, as shown in Fig. 2-1, followed by a brief description of each.

Operating information is provided under Functional Check in this section.

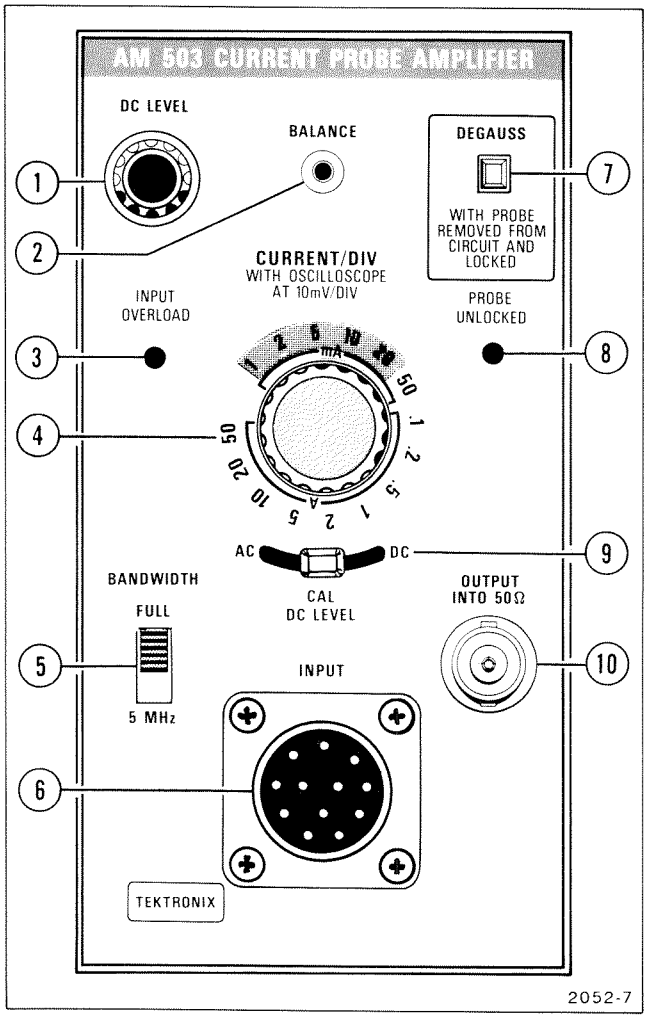


Fig. 2-1. Controls, indicators, and connectors.

(1) **DC LEVEL Control:** Adjusts the OUTPUT dc level to at least + and −100 mV.

(2) **BALANCE (screwdriver adjustment):** Permits operator to balance probe for minimum trace shift as CURRENT/DIV settings are changed.

(3) **INPUT OVERLOAD Indicator:** Indicates that the measured current exceeds the maximum dc current rating of the Current Probe.

(4) **CURRENT/DIV Switch:** Selects deflection factor from 1 mA/Div to 5 A/Div with P6302 Current Probe. Oscilloscope system deflection factor is set for 10 mV/Div. Auto scaling changes the dial range by a factor of 10 when using some future current probes.

(5) **BANDWIDTH Switch:** Provides a choice of bandwidths.

FULL: Permits amplifier and probe system to operate at full rated bandwidth.

5 MHz: Reduces the bandwidth to about 5 MHz to increase the signal-to-noise ratio for low-frequency, low-level measurements.

(6) **INPUT Connector:** Provides connection for current probe, and provides quick connect-disconnect capability when changing probes.

(7) **DEGAUSS (push-button switch):** Momentary contact switch for energizing probe degauss circuit.

(8) **PROBE UNLOCKED Indicator:** Indicates probe slider is not in CLOSED position.

(9) **AC-CAL DC LEVEL-DC Switch:** Selects signal input coupling mode.

AC: The ac component of the signal is coupled to the amplifier and the dc component is blocked.

DC: Both ac and dc components of the input signal are coupled to the Output Amplifier input.

CAL DC LEVEL: Grounds the Output Amplifier input to permit adjusting the Output Amplifier output dc level. Adjust front panel DC LEVEL control for zero volts out at OUTPUT (into 50 ohms), J390.

(10) **OUTPUT Connector:** BNC connector for connecting amplifier output to oscilloscope system (must be terminated into 50 ohm).

NOTE

The user may desire to route the signal out the rear connector of the Mainframe to permit interconnection between the AM 503 output signal and the input of an adjacent plug-in instrument. This may be accomplished by disconnecting the coax end plugged into J390 (OUTPUT) and plugging it into J480 (See diagram 4). No termination is required, since J480 is already terminated on the board (R480).

FUNCTIONAL CHECK

General Information

The bandwidth of the oscilloscope used with the AM 503 depends upon the frequency of the signal being measured. Oscilloscope vertical bandwidth should be at least twice the frequency of the signal being measured.

Conventional current flowing in the direction of the arrow on the current-probe slider produces a positive deflection of the oscilloscope display.

Ground-Clip Leads

Ground-clip leads are furnished with the P6302 Current Probe to ground the cable shield at the probe end, when desired. The ground lead is used to reduce high-frequency electrostatic voltages that could couple into the probe current transformer. The ground lead is normally not used in the 1, 2, 5, and 10 mA positions of the CURRENT/DIV switch, due to undesirable chassis currents that may appear in the more sensitive positions.

When observing high-frequency signals, use the short ground-clip lead.

Connecting the AM 503

Plug the AM 503 into the TM 500-Series Power Module.

Connect a 50 Ω cable with BNC connectors (and 50Ω termination for 1 megohm input) to the oscilloscope vertical input.

Set the oscilloscope vertical deflection to 10 mV/Div.

The oscilloscope Time/Div setting should be consistent with the signal frequency being examined.

Connect the current probe connector to the AM 503 probe INPUT connector.

Switch the TM 500-Series Power Module and oscilloscope power switches on.

NOTE

To remove any magnetic flux present in the probe transformer core, always degauss the probe after initial turn on and after making measurements in excess of the instrument range. To degauss, press and release the DEGAUSS button (front panel of AM 503) while the current probe transformer core is disconnected from any current-carrying conductor. Be sure that the slider is in the CLOSED position.

Using the AM 503 And Probe

Switch the AM 503 AC-CAL DC LEVEL-DC switch to the CAL DC LEVEL position.

Set the oscilloscope input AC-GND-DC switch to GND and position the trace vertically to graticule center.

Move the AC-GND-DC switch to DC and adjust DC LEVEL control on AM 503 to position the oscilloscope trace to graticule center.

Press and release the DEGAUSS button on the AM 503. Set AC-CAL DC LEVEL-DC switch to DC. Adjust the BALANCE control (screwdriver control on front panel) to set the oscilloscope trace to graticule center.

Connect the current-probe transformer core around the 5 mA current loop on the Calibration Generator.

Set the AM 503 CURRENT/DIV to 1 mA.

With the oscilloscope vertical Volts/Div set at 10 mV, you should see 5 divisions of vertical deflection, indicating 5 mA.

NOTE

Probes may be connected or disconnected with the instrument turned on.

High Currents

When measuring high currents, do not disconnect the probe cable from the AM 503 while the probe is clamped around the conductor. With the probe cable unterminated, the high voltage developed in the secondary winding may damage the current probe transformer.

Maximum Input Current

Fig. 2-2 shows the maximum input current (approximate) in amperes, peak-to-peak, vs. signal frequency. Current is derated for a continuous signal to prevent excessive heating in the probe head.

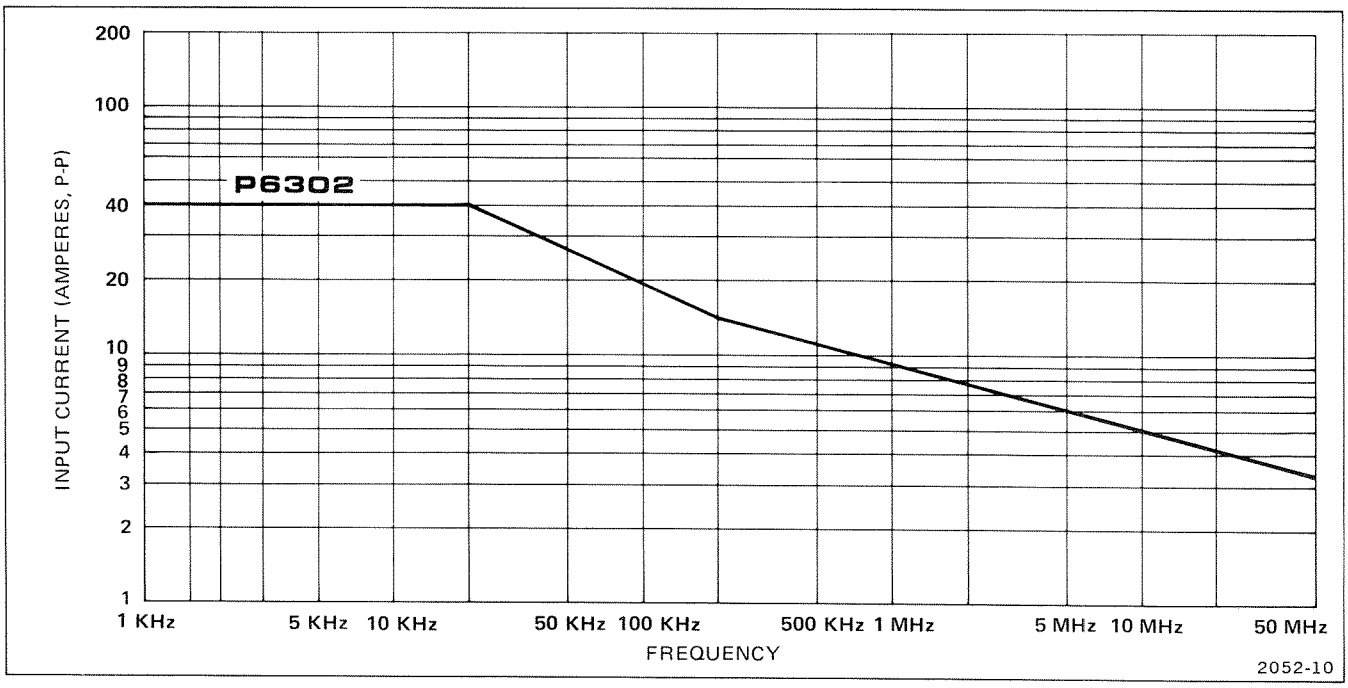


Fig. 2-2. Maximum input current vs. frequency.

Insertion Impedance

The insertion impedance of the current probe is the equivalent circuit that is placed in the circuit under test when the probe is clamped around a conductor. When observing fast-rise signals, the insertion impedance should be considered. Fig. 2-3 shows the relationship of frequency to insertion impedance for the P6302 Current Probe.

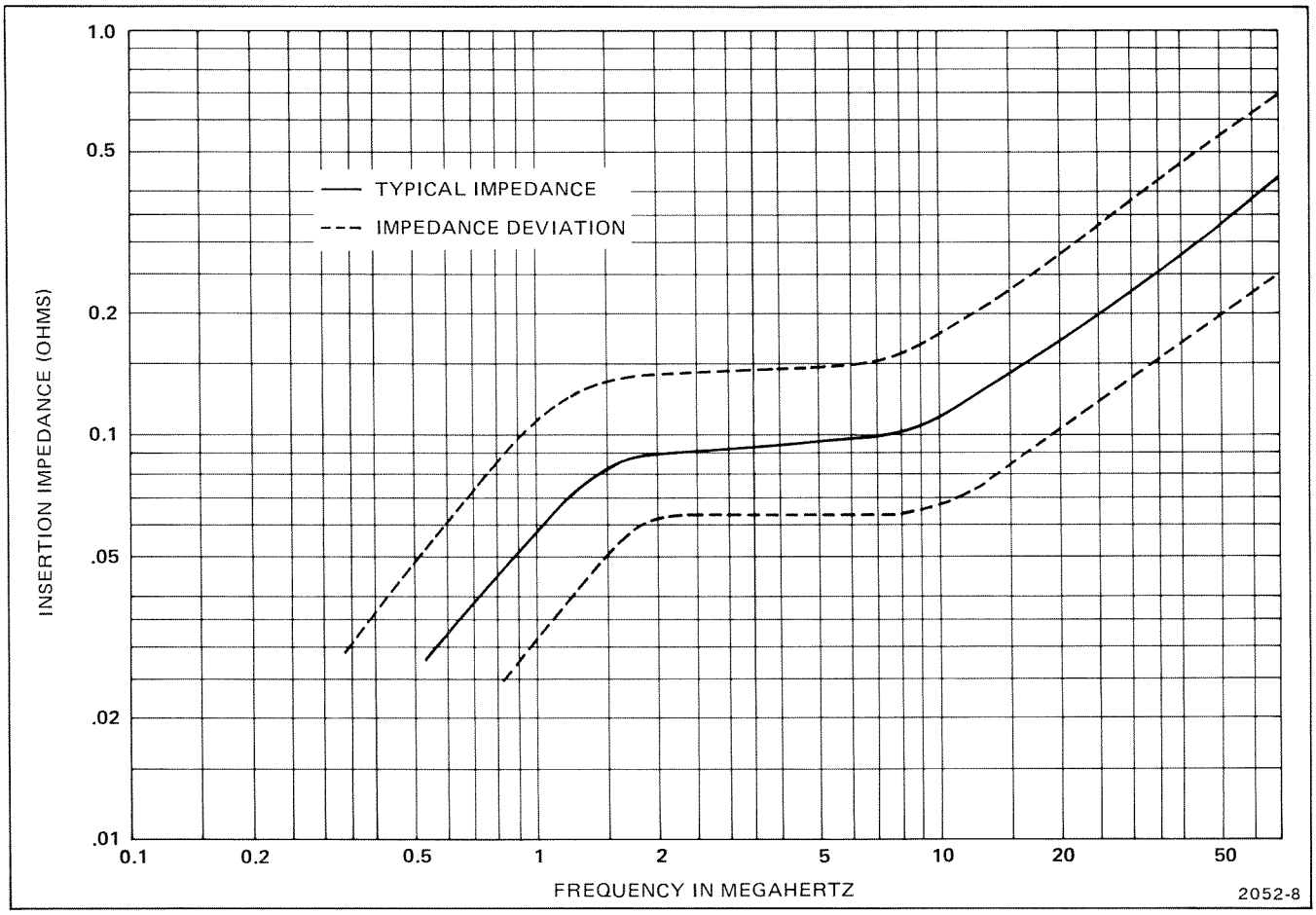


Fig. 2-3. Probe insertion impedance vs. frequency.

THEORY OF OPERATION

This section of the manual contains a description of the circuitry in the AM 503 Current Probe Amplifier. The description begins with a discussion of the instrument using the Block Diagram in the Diagrams section to show the major interconnections between circuits. Each circuit is then described in detail in the Detailed Circuit Description.

BLOCK DIAGRAM DESCRIPTION

Current Probe

The current probe Hall device output is fed to the Hall Device Preamp (part of the DC Amplifier), FET switch, and X3 Gain Amplifier. The X3 Gain Amplifier output is fed back through the probe transformer to the input attenuators.

The Hall device output and the probe transformer output are combined as shown in Fig. 3-1, to produce the square wave that is fed to the attenuators (Fig. 3-1D) and is seen at the AM 503 output.

DC Amplifier

The Hall Device Preamp provides single-ended output to the FET switch (Q115) which switches the Hall device output out of the circuit when using the degauss function.

The X3 Gain Amplifier provides gain, crossover-frequency compensation, and input overload indication.

The Degauss Oscillator provides a decaying sine-wave signal, through the X3 Gain Amplifier, to the probe transformer to remove residual magnetism in the core.

The DC Amplifier also contains a deflection sensitivity indicator circuit. With the P6302 Probe connected to the input, the X1 lamp is lighted behind the knob skirt to indicate deflection sensitivity. An X10 lamp is lit behind the knob skirt when using future X10 probes.

A PROBE UNLOCKED lamp (on) indicates that the probe slider is not completely closed and locked.

Attenuator

The attenuator provides current/division sensitivities from 1 mA to 5 A, in a 1-2-5 sequence. It also provides a 25-ohm input termination for the DC Amplifier in all attenuator positions.

The attenuator also includes a source follower (Q230 A and B) that isolates the attenuator output from the X2 Gain Amplifier (on the Output Amplifier block diagram).

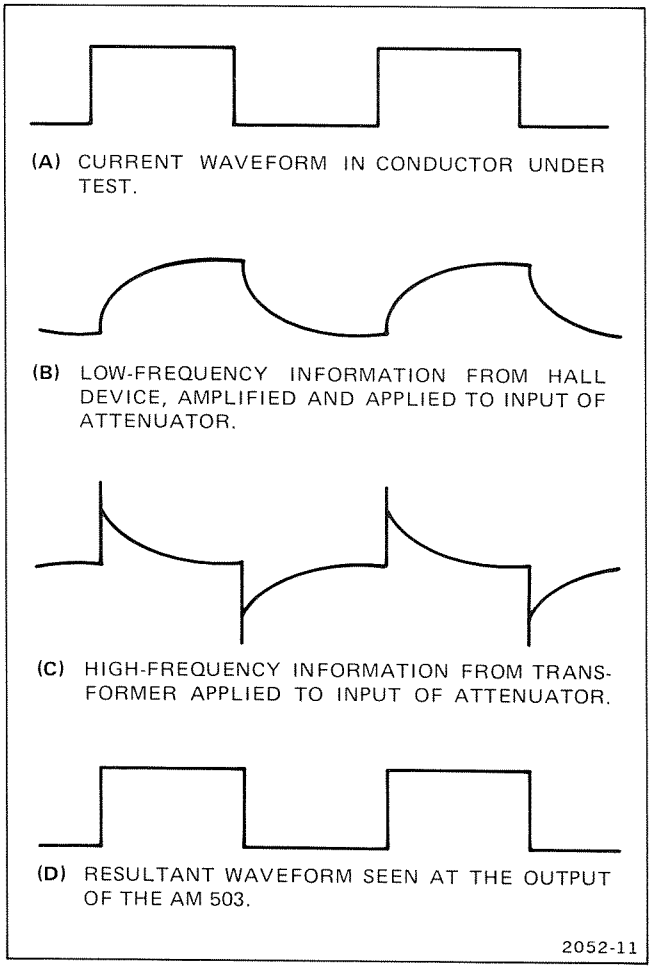


Fig. 3-1. AM 503 and probe waveforms.

Output Amplifier

The X2 Gain Amplifier provides gain (X2) and a means of setting the Output Amplifier dc level (front-panel DC LEVEL control) to offset large dc input signals.

The Selectable Gain Amplifier provides a choice of two gains: one gain when the P6302 Probe is connected, and the other when pin B is connected to ground through pin L when a probe other than the P6302 is connected.

The Selectable Bandwidth Amplifier provides a choice of either full bandwidth or bandwidth limited to 5 MHz. The bandwidth is selected by BANDWIDTH Switch (S370).

The Output Amplifier provides current drive to the 50-ohm output, J390. It also provides, via S200A, 5X attenuation in the 5 mA to 5 A CURRENT/DIV switch positions.

Power Supply

The Power Supply provides four regulated voltages, −16, +16, −19.3, and +19.3 volts to the AM 503 circuits.

DETAILED CIRCUIT DESCRIPTION

Circuits unique to this instrument are described in detail in this discussion. Circuits commonly used in the electronics industry are not described in detail. Complete schematic diagrams are located in the Diagrams section of this manual. Refer to these schematics throughout the following circuit description. The number inside the diamond after a heading refers to the schematic diagram for that circuit.

CURRENT PROBES

Current probes used with the AM 503 contain a stationary core around which is wound a secondary winding, a movable core which slides over the end of the stationary core, and a Hall generator device. The Hall device is a thin rectangular sheet of semiconductor material sandwiched in the stationary portion of the transformer core. A resistor network in the probe and the dc voltages from pins A and D of the front-panel INPUT connector J100 establish a dc bias current of approximately 20 milliamperes through the length of the Hall device.

When the probe is coupled around a current-carrying conductor, the magnetic field of the conductor develops a voltage at the Hall device output terminals. The resultant output voltage varies in direct proportion to the current passing through the conductor. When the Hall device is subjected to a low-frequency current, the output is a differential signal proportional to the low frequency current. This Hall device output voltage is applied to the Hall Device Preamp, U110, via pins E and F of J100. The polarity of the output waveform is determined by the direction of current flow in the conductor (see figure 3-2).

Because of feedback, the transformer core operates at very low flux densities. This is accomplished by applying the DC Amplifier output voltage to the transformer coil. The current through the coil generates a magnetic flux in the core opposite and approximately equal to the flux generated by the current signal being measured.

DC AMPLIFIER

Deflection Sensitivity Lamp Drivers ◇1

This circuit is composed of Q180, Q185, VR187, DS190, DS192, and associated components.

One of the two lamps (DS190 or DS192), located behind the CURRENT/DIV knob skirt, illuminates the selected deflection factor to provide direct readout.

When pin L of the INPUT connector is not grounded by the probe, Q180 is biased off through R176. With Q180 biased off, Q185 is biased on through divider network R181, R182, R183, and DS190 (current in DS190 is not sufficient to light the lamp). With Q185 biased on (saturated), Q185 collector is at about −15.5 volts, lighting DS192 (X1) through R189. Divider R185-R187 sets the voltage at pin 1 of J195 at about zero volts.

When pin L of the INPUT connector is grounded by the probe, the anode of CR175 is pulled up to ground and Q180 is biased on (saturated) through R175-R176. Q180 collector pulls down, Q185 is biased off, turning off DS192, and DS190 (X10) is lit. When Q185 turns off, VR187 clamps the junction of R185-R187 at +5.1 volts (puts +5.1 volts on pin 1 of J195).

Hall Device Preamplifier ◇1

The Hall Device Preamplifier consists of operational amplifier U110 and associated components, including a balance control.

With the probe core coupled around a current-carrying conductor, the magnetic field of the conductor develops a voltage at the output of the Hall device. The resultant low-frequency output voltage is applied from pins E and F of the INPUT connector via R104 and R105, to pins 2 and 3 of U110.

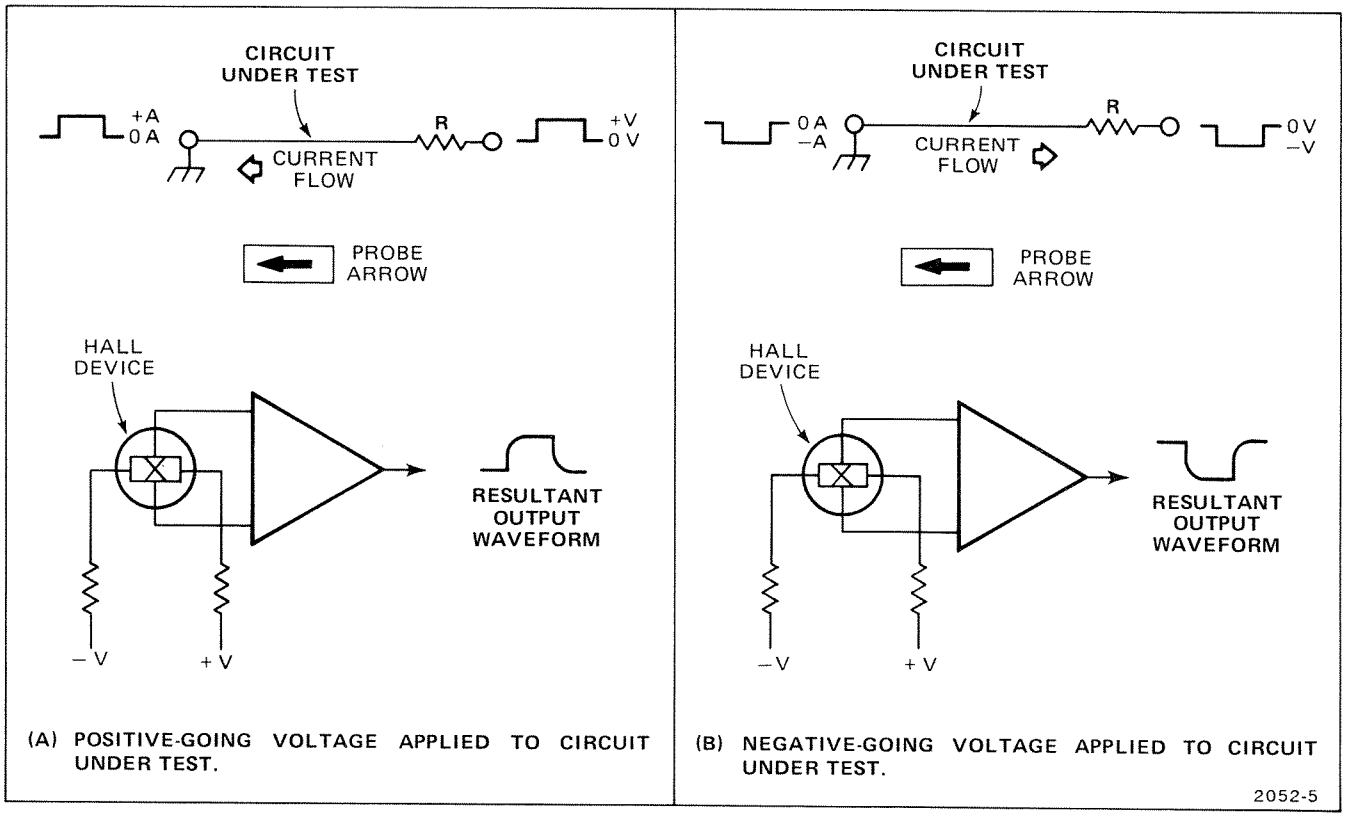


Fig. 3-2. Hall device output polarity related to direction of current flow.

To cancel any offset from the Hall device, a portion of the Hall device dc bias voltage is applied through a selected resistor in the probe, via pin H of the INPUT connector and R102, to pin 2 of U110.

The front-panel BALANCE control (R120) provides fine adjustment to cancel dc offset in the probe.

R112 is selected to cancel the effects of high-frequency signals inductively coupled through the half-turn leads between the Hall device and pins E and F of the INPUT connector.

FET Switch ①

The FET switch consists of CR115, CR116, and Q115. In normal operation, Q115 gate is at about zero volts and Q115 is conducting. Low-frequency signals from U110 are applied to Q115 drain through R116 and passed through Q115 to pin 2 of U145. Diodes CR115 and CR116 clamp Q115 drain when the signal level exceeds about + or –0.5 volt.

When the DEGAUSS switch (S125) is pushed in, –16 volts is applied through R122 to Q115 gate and the junction of R124 and C124. C124 discharges and Q115 turns off.

When the DEGAUSS switch is released, Q115 remains biased off for approximately 1 second by the time constant of C124-R124, allowing the degauss oscillator to decay to zero. The result is that the dc and low-frequency signal path is interrupted when the DEGAUSS button is pressed and released, permitting the probe transformer core to be degaussed (by the degaussing oscillator).

Degauss Oscillator ①

The Degauss Oscillator is composed of a phase-shift oscillator (U135), a gain-regulating FET (Q130), and associated components, including an output amplitude control R136.

In normal operation (DEGAUSS switch open), C126 is charged to –16 volts through R127. FET Q130 is biased off and the oscillator circuit is not operating.

When the DEGAUSS switch (S125) is pushed in, C126 is shorted to ground and Q130 is biased on. The Q130 drain-to-source "on" resistance, in series with the parallel combination of R130 and RT135, increases the gain of U135, causing the circuit to oscillate. The RC network (R138, C138, R137, C137) applies positive feedback to U135 non-inverting input and sets the frequency of oscillation at approximately 160 Hz.

The oscillator (U135) output amplitude is maintained at the desired level by an AGC circuit composed of CR133, C133, R132, and R133. The oscillator output is rectified by CR133 and filtered by C133. This negative voltage is applied through R132 to Q130 gate to control its drain-to-source resistance to maintain the oscillator output at a constant level.

Oscillator output is applied through R140 and R142 to pin 2 of U145.

When the DEGAUSS switch is released, Q130 remains biased on for approximately 0.5 second by R127-C126 time constant. As Q130 drain-to-source resistance increases (as Q130 goes toward cutoff) the oscillator output amplitude decays, degaussing the probe core.

X3-Gain Amplifier ①

This circuit consists of U145, Q155, Q165, VR166, VR167, CR167, CR168, and associated components, including Degauss Offset, R152.

The 160 Hz degaussing signal or the low-frequency signal from U135 is applied to pin 2 of U145. Degauss Offset (R152) adjusts for zero volts out (at J160) of the X3 Gain Amplifier with no signal applied at pin 2 of U145.

Output signals from U145 (pin 6) drive the bases of Q155 and Q165 (a complementary Darlington amplifier). R159, R156, R160, and R162 form the dc bias network for Q155-Q165. Thermal resistors RT156-RT160 stabilize bias current changes due to temperature variation.

From dc to the crossover region (about 1 MHz) the Hall device provides all or most of the signal to the input attenuators. Above the crossover point, the probe transformer core provides the signal to the input attenuators.

A feedback system permits the Hall device and transformer core to operate at very low flux densities. This is accomplished by applying the X3 Gain Amplifier (Q155 Q165) output voltage to the probe transformer coil. The current through the transformer coil causes a flux in the core opposite and approximately equal to the flux generated by the current signal being measured. This feedback system permits the Hall element and ferrite core to operate at very low flux densities, providing excellent dynamic range and linearity.

Above the crossover point the Hall device output drops off. At this point L168 blocks the ac signal from the X3 Gain Amplifier and the cable between the input attenuator and J160 is terminated in 50 ohms by C168-R168.

The remainder of the resistance-capacitance networks, R121, R129, R123, and C125 provide smooth transition in the crossover region. L202-R202, in series with the 25 ohm input impedance of the attenuator terminates the coaxial cable at high frequencies.

Input Overload ①

If the output from Q155-Q165 swings about 12 volts above or below zero, CR168 is lit.

Zeners VR166 and VR167 (back to back) provide approximately 10 volts drop from the output of Q155-Q156. Bridge rectifier CR167 provides drive to CR168 on both negative and positive output swings.

ATTENUATOR

Attenuator Source Follower ②

Q230A is a source follower with Q230B providing constant current. R220 limits current drive to Q230A gate. Dual diode CR226 provides current protection by limiting Q230 gate voltage swing to about ±10 volts.

R204, R216, and the attenuator sections provide a constant 25 Ω input termination throughout the full attenuator range.

OUTPUT AMPLIFIER

X2-Gain Amplifier ③

This circuit consists of Q310, Q320, Q315, Q325, and associated components in a cascode amplifier having a gain of 2.

DC LEVEL control (R302) sets the dc level of the output amplifier (at the 50 Ω output connector, J390) to offset large dc input signals.

Selectable Gain Amplifier ③

The Selectable Gain Amplifier consists of U350, Gain control R346, and associated components.

When pin B of input connector J100 is grounded, the gain of U350 is decreased by a factor of approximately 2. This gain is adjusted by R346.

R344 is a gain adjust and R345 is high-frequency compensation.

Selectable Bandwidth Amplifier ◇3

This amplifier consists of U370 and associated components, including HF Comp (R363), LF Comp (R364), a bandwidth selecting switch (S370), and networks R370-R372, R373-R374.

In the 5 MHz position of the BANDWIDTH switch, the IC output is from pins 6 and 8, through a low-pass filter network L380-L383, C380-C383, to Q390.

In the full bandwidth position the signal path out of the IC is on pins 5 and 9 and the low-pass filter network is bypassed.

Q360 is a current source for U370. Q360 current level is established by the voltage level set by Q385 circuitry. A common-mode signal is fed back from VR380 to the base of Q360, thus minimizing common-mode dc bias drift. VR380 (normally not conducting) is protection for the IC, U370.

Output Amplifier ◇3

Q390 and Q395, cascaded emitter followers, isolate the IC output from the output connector, J390.

Switch S200A (CURRENT/DIV) switches in a 5X attenuation network in the 5 mA to 5 A positions.

POWER SUPPLY ◇4

The ac voltages from the mainframe (pins 13A, 13B, 1A, and 1B of the edge connector) are rectified by bridge rectifiers CR402 and CR406. The rectifier output is filtered by C402 and C406.

The regulating circuit consists of a dual-tracking regulator IC (U410) and two series-pass transistors to provide regulated −16 and +16 volts.

The output voltage of the −16 volt supply is adjusted by the Volts control (R405). The Balance control (R415) sets the +16 volt supply output to match the −16 volt supply.

R403 and R407 are the load current sensing resistors and set the bias on the series-pass transistors (located on the power module mainframe). The output voltage is sensed at the Sense input (pins 4 and 11 of the IC). This sense voltage determines the quantity of current in R403 and R407. For example, if the output +16 volts decreases, the + sensing circuit increases the current in R403 which increases the bias on the series-pass transistor. Thus, the output voltage increases back up to +16 volts.

The 19.3 volt supplies are Zener regulated. VR452-VR462 set the pass-transistor bases (Q450 and Q460) at +20 volts, thus setting the output at about 19.3 volts.

MAINTENANCE

This section of the manual contains information for performing preventive maintenance, troubleshooting, and corrective maintenance for the AM 503.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis will improve the reliability of the instrument. The severity of the environment to which the AM 503 is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding adjustment of the instrument.

Cleaning

The AM 503 should be cleaned as operating conditions require. Accumulation of dirt on the components acts as an insulating blanket and prevents efficient heat dissipation which can cause overheating and component breakdown.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. In particular, avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

EXTERIOR. Loose dust accumulated on the front panel can be removed with a soft cloth or small brush. Remaining dirt can be removed with a cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

INTERIOR. Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air. Remove any remaining dirt 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.

Visual Inspection

The AM 503 should be inspected occasionally for such defects as broken connections, improperly seated semiconductors, damaged circuit boards, and heat-damaged parts.

The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

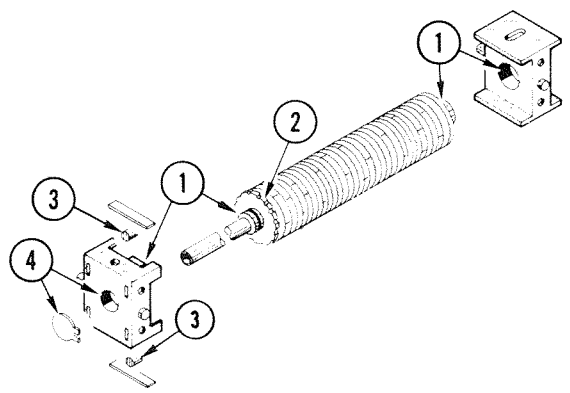
Lubrication

Generally, there are no components in the AM 503 that will require lubrication during the life of the instrument.

PUSH-BUTTON AND SLIDE SWITCHES. The switches are lubricated prior to leaving the factory and should not require further lubrication. However, if they should become electrically noisy, cleaning and lubrication with No Noise may solve the problem.

CAM SWITCHES. In most cases, the factory lubrication of these switches should be adequate for the life of the instrument. The switch contacts are designed to operate dry for the life of the switch.

If the switch has been disassembled for replacement of switch sub-parts, a lubrication kit containing the necessary lubricating materials and instructions is available through any Tektronix Field Office. Order Tektronix Part 003-0342-01. General Electric Versilube silicone grease may be applied sparingly so that the lubricant does not get on the contacts. Refer to figure 4-1 for lubrication instructions.



(1) Apply lubricant to the drum journals and mating surface in the mounting bearings.

(2) Apply lubricant to the wear surface of the index wheel.

(3) Apply lubricant to the index roller and roller guide in the front bearing. A thin film should be applied to the inner face of the detent springs if more than one spring is replaced.

(4) Ensure that some lubricant is present at the interface between the bearing and retainer clip.

2052-2 (1481-40)

Fig. 4-1. Lubrication procedure for a typical camswitch.

Should it become necessary to remove a switch for replacement or cleaning, refer to Repair and Replacement in this section.

Semiconductor Checks

Periodic checks of the semiconductors in the AM 503 are not recommended. The best check of semiconductor performance is actual operation in the instrument. More details on checking semiconductor operation are given under Troubleshooting.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

Obtaining Replacement Parts

All electrical and mechanical part replacements for this instrument can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the instrument, particularly at high frequencies. Each part should be a direct replacement unless it is known that a different component will not adversely affect instrument performance.

Some electrical parts are manufactured or selected by Tektronix, Inc. to satisfy particular requirements, or are manufactured for Tektronix, Inc. to our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. To determine the manufacturer of parts, refer to parts list cross index, Mfr. Code number to Manufacturer.

When ordering replacement parts from Tektronix, Inc., include the following information:

1. Instrument type.
2. Instrument serial number.
3. A description of the part (if electrical, include circuit number.
4. Tektronix part number.

TROUBLESHOOTING

The following information is provided to help troubleshoot the AM 503. Information contained in other sections of this manual should be used along with the following information to aid in locating a defective component. An understanding of the circuit operation is very helpful in locating troubles, particularly where integrated circuits are used.

TROUBLESHOOTING EQUIPMENT

The following equipment, in addition to that listed in the Performance Check and Adjustment sections, is useful for troubleshooting the AM 503.

Transistor Tester

Description: Dynamic type tester.

Purpose: Test semiconductors.

Recommended Tektronix types: 576 Curve Tracer, 577/177 Curve Tracer System, 7CT1N Curve Tracer plug-in and a 7000-Series oscilloscope system, or a 5CT1N Curve Tracer plug-in and a 5000-Series oscilloscope system.

Multimeter

Description: Voltmeter, 10 megohm input resistance; range, from zero to at least 50 volts dc; accuracy, within 0.1%. Ohmmeter, zero to 20 megohms. Test probes should be insulated to prevent accidental shorting.

Purpose: Check voltage and resistance.

Test Oscilloscope

Description: Frequency response, dc to 100 megahertz minimum; deflection factor, 5 millivolts to 5 volts/division. A 1X voltage probe should be used for observing waveforms.

Purpose: Check operating waveforms.

TROUBLESHOOTING TECHNIQUES

This troubleshooting procedure is arranged to check the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connections, operation, and adjustment. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced using the replacement procedure given under Corrective Maintenance.

1. CHECK CONTROL SETTINGS. Incorrect control settings can indicate a trouble that does not exist. If there is any question, about the control or function of any control, see the Operating Instructions section.

2. CHECK ASSOCIATED EQUIPMENT. Before proceeding with troubleshooting of the AM 503, check that the equipment used with this instrument is operating correctly. Check that the signal is properly connected and that the interconnecting cables are not defective. Also, check that the power source voltage does not exceed the Range Selector switch position in the power module. If necessary, reposition the Range Selector to the correct voltage (see power module manual). If the trouble persists, the AM 503 may be at fault.

3. VISUAL CHECK. Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visible indications such as unsoldered connections, broken wires, damaged circuit boards, damaged components, etc.

4. CHECK INSTRUMENT ADJUSTMENT. Check the adjustment of the AM 503, or the affected circuit if the trouble appears in one circuit. The apparent trouble may be only a result of misadjustment. Complete adjustment instructions are given in the Adjustment section.

5. ISOLATE TROUBLE TO A CIRCUIT. To isolate trouble to a circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuit by taking voltage and waveform readings. Also, check for the correct output signals at the front-panel output connectors with a test oscilloscope. Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct supply voltages. However, a defective component elsewhere in the instrument can appear as a power-supply trouble and may also affect the operation of other circuits.

6. CHECK VOLTAGES. Often the defective component can be located by checking for the correct voltage in the circuit. Refer to the diagrams section for correct voltages.

Power Supply. If incorrect operation of the power supply is suspected, first check that the power-module line selector block is in the correct position (see Power Module Instruction Manual). Use a dc voltmeter to check each supply voltage, and check ripple with a test oscilloscope. Voltages are measured between the power supply test points and chassis ground. Power supply test points are shown on the Adjustment and Test Point Locations pullout at the rear of this manual. Check that each power supply is within the tolerance given in Table 4-1.

If a power supply is within the tolerance in Table 4-1, the supply can be assumed to be working correctly. If outside the given tolerance, the supply may be misadjusted or operating incorrectly. Use the proceedure given in the Adjustment section to adjust the 16-volt power supplies.

TABLE 4-1
Power Supply Tolerances

Power Supply	Test Point	Output Voltage	Maximum Ripple Peak-to-Peak
+16 V	See compo-	15.9 to 16.1	2 mV
−16 V	nent location		
+19.3 V	pullout,	18.3 to 20.3	150 mV
−19.3 V	Section 9		

7. CHECK INDIVIDUAL COMPONENTS. The following procedures describe methods of checking individual components in the AM 503. Two-lead components that are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

CAUTION

To avoid component damage, turn off or disconnect the power source before removing or replacing semiconductors.

Semiconductors. A good check of transistor operation is actual performance under operating conditions. A transistor can be most effectively checked by substituting a new component or one that has been checked previously. However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

IC's (integrated circuits). IC's can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is desirable when troubleshooting circuits using IC's. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together.

Lead configurations for the semiconductors used in this instrument are shown in figure 4-2.

Diodes. A diode can be checked for an open or shorted condition by measuring the resistance across the junction with an ohmmeter scale having a low internal source current, such as the R x 1 kΩ scale. The resistance should be very high in one direction and very low when the meter leads are reversed.

CAUTION

Do not use an ohmmeter scale that has a high internal current. High current may damage the diode.

The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot. The cathode and anode ends of metal-cased diodes are identified by the diode symbol marked on the case. For most silicon or germanium diodes with a series of stripes, the color code identifies the four significant digits of the JEDEC or vendor number using the resistor color-code system (e.g., a diode color-code yellow-brown-green-red indicates a 1N4152 diode).

Resistors. Resistors normally do not need to be replaced unless damaged or the measured value varies widely from that specified. Refer to the Replaceable Electrical Parts list for the value and tolerance.

Inductors. Check for open inductors with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response (causes rolloff).

Capacitors. A leaky or shorted capacitor can usually be detected by checking resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after the initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking if the capacitor passes ac signals.

8. REPAIR AND ADJUSTMENT. When a defective component is located, follow the replacement procedures given in Corrective Maintenance. After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as the adjustment of other closely related circuits. In some cases, minor troubles may be revealed or corrected by adjustment.

SOLDERING TECHNIQUES

Accuracy and reliability of this instrument can be maintained if proper soldering techniques are used when repairing or replacing parts. The choice of soldering iron is determined by the repair to be made.

WARNING

To avoid electric shock, disconnect the instrument from the power source before soldering.

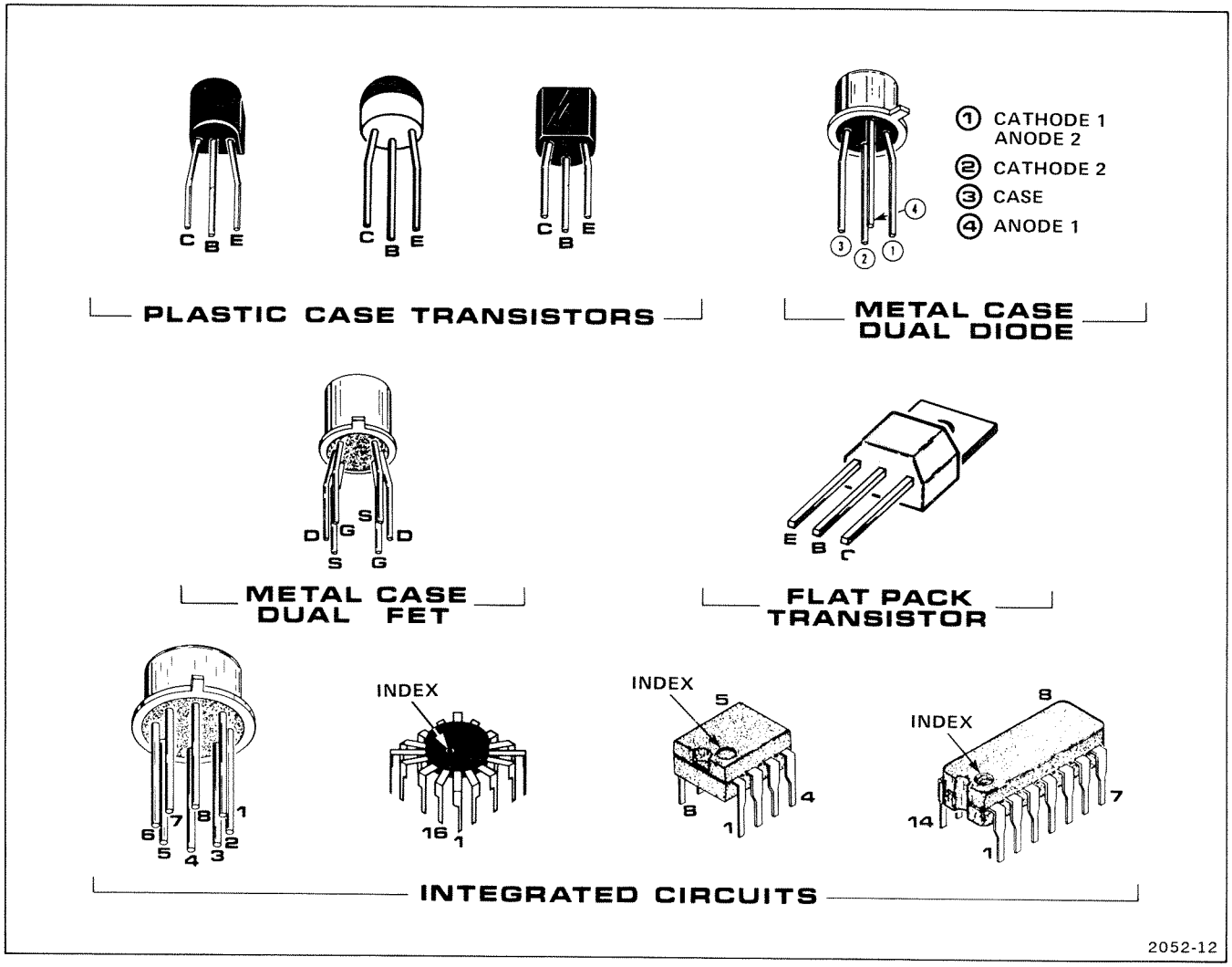


Fig. 4-2. Semiconductor lead configurations.

When soldering on circuit boards, use a 15 to 40-watt pencil-type soldering iron with a 1/8-inch wide, wedge-shaped tip. Keep the tip properly tinned for best heat transfer to the solder joint. Avoid excessive heat; apply heat only long enough to remove the component or to make a good solder joint. Use only 60/40 rosin-core, electronic grade solder. Apply only enough solder to make a firm solder joint; do not apply too much solder.

CAUTION

The circuit board in this instrument is a multi-layer type board with conductive paths laminated between the top and bottom board layers. All soldering should be done with extreme care to prevent breaking the connections to the center conductors; only experienced maintenance personnel should attempt repair of these boards.

For metal terminals, (e.g., switch terminals, protentiometers, etc.) a higher wattage soldering iron may be required. Match the soldering iron to the work being done. For example, if the component is connected to the chassis or other large heat-radiating surface, a 75-watt, or larger, soldering iron may be required.

The following technique should be used to replace a component on a circuit board:

1. Grip the component lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board, as it may damage the board.

2. When the solder begins to melt, gently pull the lead out. If unable to pull the lead without using force, try removing the opposite end of the component.

NOTE

The reason that some component leads seem troublesome to remove is due to a bend placed on each lead during machine insertion of the component in the manufacturing process. The purpose of the bent lead is to hold the component in place during a flow-soldering process.

If a component lead is extremely difficult to remove, it may be helpful to straighten the leads on the back side of the board with a small screwdriver or pliers while heating the soldered connection.

If it is desired to remove solder from a circuit-board hole for installation of a new component, use a solder-removing wick or solder sucker.

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

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

6. Clean the area around the solder connection with a flux-removing solvent. Be careful not to remove information printed on the board.

COMPONENT REMOVAL AND REPLACEMENT

WARNING

To avoid electric shock, disconnect the instrument from the power source before replacing components.

The exploded-view drawing associated with the Replaceable Mechanical Parts List may be helpful in the removal or disassembly of individual components or subassembles. Component locations and circuit board locations are shown in the Diagrams section.

Circuit Boards

If a circuit board is damaged beyond repair, replace the entire board assembly. Part numbers are given in the Replacement Electrical Parts List for completely wired boards.

Circuit Board Removal

1. Remove the knob from the CURRENT/DIV switch, and pull the knob off of the AC-CAL DC LEVEL-DC switch.

2. Disconnect all cables that terminate on the circuit board.

3. Remove 4 screws holding circuit board to frame tabs.

4. Slide circuit board toward rear of frame until clear of front panel, and lift out.

5. To replace the circuit board, reverse the order of removal.

Switches

Three types of switches are used in this instrument; push-button, cam, and slide. The push-button or slide switch should be replaced as a unit if damaged. The following information is provided for the cam switch. Your local Tektronix Field Office or representative can provide additional repair information.

CAM SWITCHES. The cam switch used in this instrument consists of a rotating cam which mates with contacts on the circuit board. These contacts are activated by lobes on the cam as the switch is rotated. A cam switch can be disassembled for inspection, cleaning, repair, or replacement.

CAUTION

Repair of a cam switch sould be undertaken only by experienced maintenance personnel.

A cam switch repair kit is available (Tektronix part number 003-0708-00) which contains special tools for use in repairing or replacing the switch contacts.

Use the following procedure to remove and replace a cam switch:

1. Remove the circuit board following instructions given previously.

2. Remove 8 screws that secure switch to circuit board.

3. Remove cam-switch assembly from board.

4. To replace cam switch, reverse the order of removal.

Semiconductors

Semiconductors should not be replaced unless actually defective. Unnecessary replacement of semiconductors may affect the adjustment of the instrument. If removed from their sockets during routine maintenance, return them to their original sockets.

CAUTION

To avoid component damage, power must be turned off before removing or replacing semiconductors.

Replacement devices should be of the original type or a direct replacement. Figure 4-2 shows the lead configurations of the semiconductors used in this instrument. When removing integrated circuits, pull the device out of the socket slowly and evenly. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as pulling unevenly may damage pins.

Interconnecting Pins

Two methods of interconnection are used to connect the circuit board with other components. When the interconnection is made with a coaxial cable, a special lead-end connector plugs into a socket on the board. When the interconnection is made with a wire lead, a lead-end pin connector is used. This connector mates with the interconnecting pin soldered into the board.

COAXIAL-TYPE LEAD-END CONNECTORS. Replacement of the coaxial-type lead-end connectors requires special tools and techniques; only experienced maintanance personnel should attempt to remove and replace these connectors. It is recommended that the cable be replaced as a unit. For cable part numbers, see Replaceable Mechanical Parts List. An alternative solution is to refer the replacement of the defective connector to your local Tektronix Field Office or representative.

LEAD-END PIN CONNECTORS. The pin connectors used to connect the wires to the interconnecting pins are clamped to the ends of the associated leads. To remove and replace a damaged lead-end connector, remove the old pin connector from the lead and clamp the replacement connector to the lead.

If the lead-end connectors become dislodged from the plastic holder, they can be re-installed as follows (see Fig. 4-3):

1. Bend grooved portion of holder (part nearest cable) away from cable in direction of its hinged side.

2. Re-insert terminal connector into its proper hole in holder and bend grooved part of holder back to its vertical position so connector(s) is inserted into groove.

Some of the pin connectors are grouped together and mounted in a plastic holder; the result is that these connectors are removed and installed as a multi-pin connector. To provide correct orientation of this multi-pin connector when it is replaced, an arrow is stamped on the circuit board and a matching arrow is molded into the plastic housing of the multi-pin connector. See Fig. 4-3. Be sure these arrows are aligned as the multi-pin connector is replaced. If the individual lead-end pin connectors are removed from the plastic holder, note the color of the individual wires for replacement.

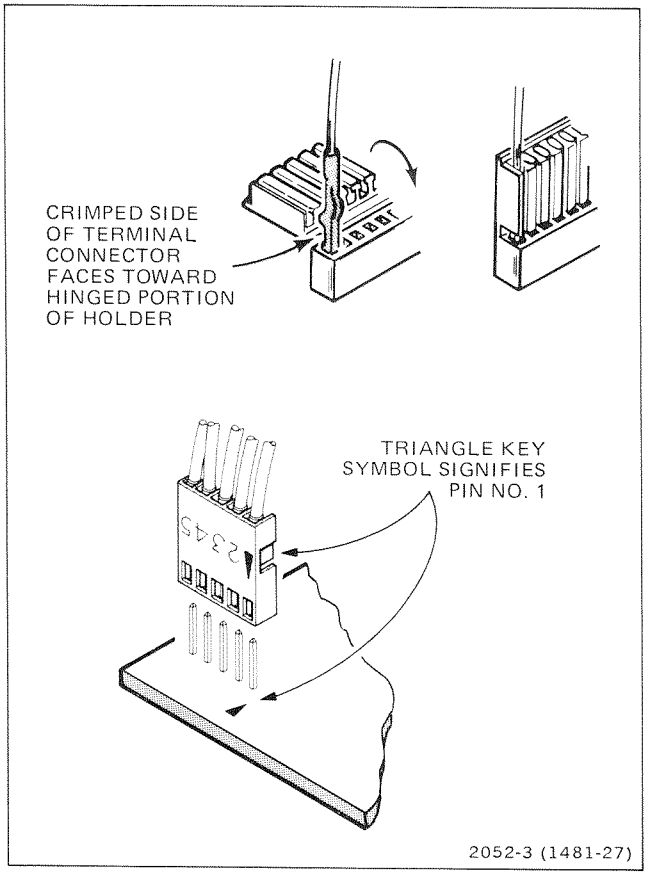


Fig. 4-3. Lead-end connector installation.

CIRCUIT-BOARD PINS. Replacement of circuit-board pins on multi-layer boards is not recommended; refer such repairs to your local Tektronix Field Office or representative.

A circuit-board pin replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix part number 040-0542-00.

Use the following procedure to remove and replace a damaged circuit-board pin.

1. Grip the pin with long-nose pliers. Touch the soldering iron to the pin at the solder connection. Do not lay the iron directly on the board, as the board may be damaged.

2. When the solder begins to melt, gently pull the damaged pin from the board. Leave the ferrule in the hole, if possible. Refer to Fig. 4-4.

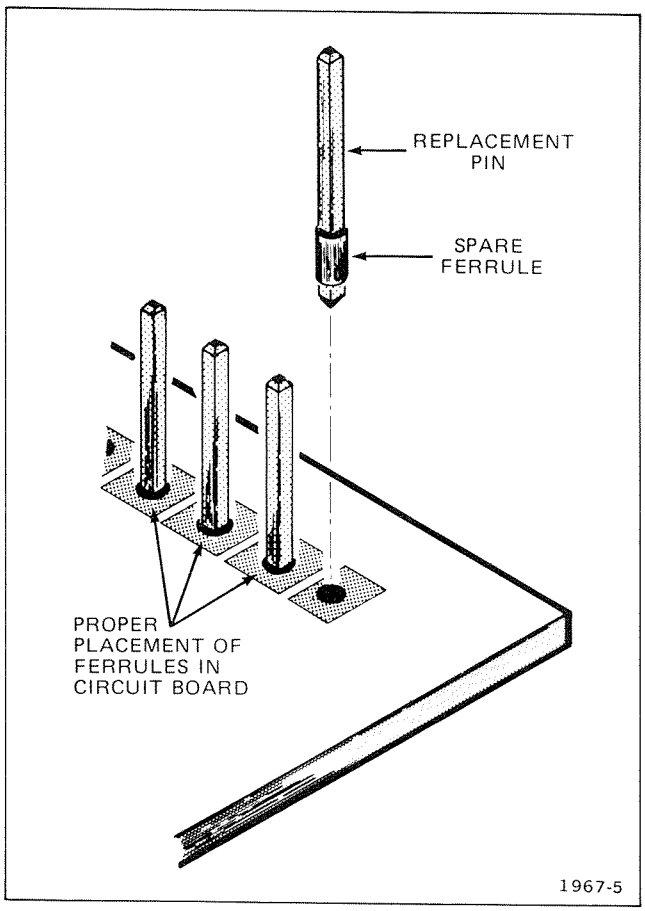


Fig. 4-4. Circuit-board pin and ferrule assembly.

3. If the ferrule remains in the circuit board, remove the spare ferrule from the replacement pin and press the new pin into the hole in the circuit board.

If the ferrule is removed with the damaged pin, carefully clean out the hole using a solder-removing wick and a scribe. Then press the replacement pin, with attached spare ferrule, into the hole.

4. Position the replacement pin in the same manner as the old pin.

5. Solder the pin to the circuit board on each side of the board.

TROUBLESHOOTING PROCEDURE

This procedure lists most of the probable causes of a number of possible troubles. The trouble symptom is followed by a check procedure that lists the components that should be checked. See component locator grid preceding each schematic for component location.

TABLE 4-2
Troubleshooting

A. TROUBLE SYMPTOM: No signal at OUTPUT connector.	
CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
1. Cable from J380 is properly installed	
2. ±16 V Supply	a. F402, F406 b. C402, C406 c. U410 d. Q155, Q166 e. R412, R422
3. ±19.3 V Supply	a. Q450, Q460 b. VR452, VR462 c. U145
4. ±3 V Supply	a. VR100 b. VR172

@

TABLE 4-2 (cont.)

CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
5. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p with probe connected	a. Cables from J100 to P160 and P202 are properly installed b. Q155, Q165 c. Q115 d. U145 e. U135 f. Q130
6. Press and release DEGAUSS button and set level at P202 to zero volt with BALANCE control. Voltage at P202 should be 20 mV, p-p, with 40 mA, p-p, into P6302.	a. U110 b. Check probe as shown in Probe Check following this troubleshooting table.
7. Set Coupling to CAL DC LEVEL, adjust DC LEVEL control for zero volt out of OUTPUT connector and check bias voltages on schematics 2 and 3 in Section 9.	a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q320 i. Q315, Q325
8. Rotate CURRENT/DIV throughout its full range and note that there is no sudden loss of signal at OUTPUT connector.	a. R206 b. R208 c. R210 d. R212 e. R214

B. TROUBLE SYMPTOM: Unable to zero output level with Coupling in CAL DC LEVEL

CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
1. ±16 V Supply	a. F402, F406 b. R403, R407 c. U410 d. Q155, Q166
2. Check bias voltages on schematics 2 and 3	a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q320 i. Q315, Q325
3. Wiper of R302 adjusts between — and + 15 volts with no sudden discontinuities	a. R302 b. R300, R304

C. TROUBLE SYMPTOM: Unable to set signal at OUTPUT to zero with BALANCE control

CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
1. P160 and P202 plugged into the correct sockets	
2. ±19.3 V Supply	a. Q450, Q460 b. VR452, VR462
3. ±3 V Supply	a. VR100 b. VR172
4. Voltage at P202 with DEGAUSS depressed is 11 V p-p with probe connected	a. Cables from J100 to P160 and P202 are proerply installed b. Q155 c. Q115 d. U145 e. U135 f. Q130
5. With probe removed and INPUT pin E shorted to pin F, BALANCE should vary dc voltage at P160 from at least —5 V to greater than +5 V.	a. P110 b. U110 c. R120

TABLE 4-2 (cont.)

CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
6. With probe reconnected, press and release DEGAUSS button and set OUTPUT level to zero with BALANCE control	a. U110 b. Check probe using "Probe Check" following this shooting table.
D. TROUBLE SYMPTOM: No Degauss Signal	
CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
1. ±16 V Supply	a. F402, F406 b. U410 c. Q155, Q166 d. R403, R407
2. ±19.3 V Supply	a. Q450, Q460 b. VR452, VR462
3. Voltage at U135, pin 6, with DEGAUSS button depressed is 7 V p-p ±1 V at about 160 Hz	a. Q130 b. U135 c. R136
4. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p with probe connected	a. Q155 b. Q115 c. U145
E. TROUBLE SYMPTOM: Excessive Droop in Pulse Response	
CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary
1. Probe is CLOSED	
2. ±3 V Supply	a. VR100 b. VR172
3. R364 Adjustment	

TABLE 4-2 (cont.)

CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
4. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p, with probe connected	a. Cables from J100 to P160 and P202 are properly installed. b. Q155, Q165 c. Q115 d. U145
5. Press and release DEGAUSS button and set OUTPUT voltage at P202 to zero with BALANCE control. Voltage at P202 should be 20 mV, p-p, with 40 mA, p-p, into P6302 probe.	a. U110 b. Check probe as shown in "Probe Check" following this troubleshooting table.
F. TROUBLE SYMPTOM: Excessive Pulse Aberrations or Poor Bandwidth	
CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
1. ±16 V Supply	a. F402, F406 b. U410 c. Q155, Q166 d. R403, R407
2. Gain Adjustment (R344)	a. Set gain per step B in Adjustments procedure, Section 6.
3. Aberration Adjustments (R345 and R363)	a. Adjust per step C2 in Adjustments procedure, Section 6.
4. With Coupling set to CAL DC LEVEL, adjust DC LEVEL for zero volt at OUTPUT connector and check bias voltages on schematics 2 and 3 in Section 9	a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q320 i. Q315, Q325
5. Press and release DEGAUSS button and set voltage out at J202 to zero volt. Voltage at P202 should be 20 mV, p-p, with less than 3% droop with 40 mA, p-p into P6302 probe.	a. U110 b. ±3 V Supply c. Check probe as shown in "Probe Check" following this troubleshooting table.

TABLE 4-2 (cont)

G. TROUBLE SYMPTOM: Excessive Line-Frequency Ripple at AM 503 OUTPUT connector	
CHECK:	If CHECK indicates a problem, examine the following components and replace, if necessary.
1. Is AM 503 grounded to display device (test oscilloscope)?	a. Be sure AM 503 is grounded to display device.
2. Voltage level across C402 or C406 should be between 24 and 34 volts with maximum ripple 4.5 V, p-p.	a. Circuit-board edge connector is properly plugged into power supply module. b. F402, F406
3. ±16 V Supply level and ripple shown in Table 4-1.	a. U410 b. R403, R407
4. ±19.3 V Supply level and ripple shown in Table 4-1.	a. Q450, Q460 b. VR452, VR462

Probe Check

If the system risetime or aberrations are not within specifications, use the following procedure to determine whether the trouble is in the probe or the AM 503.

Equipment Required (P6302 Probe)

1. Pulse Generator (Tektronix PG506[1] or 106 Pulse Generator).

2. 50-ohm current loop (Tektronix part number 067-0559-00).

3. Adapter, Peltola connector to BNC (Tektronix part number 131-1315-00). Two required.

4. 50-ohm termination (Tektronix part number 011-0049-00). Two required.

5. 50-ohm coaxial cable with BNC connectors.

6. X1 passive voltage probe.

7. Oscilloscope. 100 MHz minimum bandwidth.

8. Digital Voltmeter.

9. 50-ohm, 2X attenuator. Tektronix part number 011-0069-02. Two required.

10. Extender Cable. Tektronix part number 067-0645-01.

[1] **Requires TM 500-Series Power Module**

Procedure

a. Set up the test as shown in Fig. 4-5. Set pulse generator frequency to 1 KHz and peak amplitude for 100 mA into the 50-ohm current loop.

b. Connect digital voltmeter between cathode of VR100 and chassis ground.

c. CHECK—for +2.8 to +3.4 V dc.

d. Connect digital voltmeter between anode of VR172 and chassis ground.

e. CHECK—for −2.8 to −3.4 V dc.

f. Connect X1 voltage probe (from test oscilloscope vertical input) to pin 6 of U110 (see Fig. 4-5).

g. Set test oscilloscope Volts/Div to 200 mV and Time/Div to 200 μs.

h. Set test oscilloscope Input Coupling to Gnd. Position the trace vertically to graticule center line.

i. Swtich test oscilloscope Input Coupling to DC.

j. Adjust BALANCE (front panel) to vertically center displayed square wave.

k. CHECK—for 600 mV, peak-to-peak minimum square-wave amplitude (if not 600 mV, U110 or probe may be defective). Remove X1 voltage probe.

l. Connect a coaxial cable between P202 and test oscilloscope via 2X attenuator and 50-ohm termination. Check that decay time at the 63% point (2½ divisions in 4) is 12 μsec minimum. NOTE: Before making this check be sure to dislodge any dirt particles which may have accumulated on the face of the core by wiping each core face with a lint free cloth.

m. Adjust test oscilloscope Volts/Div and Time/Div as necessary to make the following checks for probe only. Connect the 50-ohm current loop to a high amplitude pulse generator output. (e.g. Tektronix Type 109 with 100 nsec minimum of delay cable). Set the peak amplitude of the 109 output for 5 V into the 50-ohm current loop.

n. CHECK—aberrations in the first 100 ns are within +3%, −3%, with peak-to-peak aberrations of 4% maximum.

o. CHECK—for risetime (10 to 90% of maximum) of 7 ns maximum.

p. CHECK—that peak amplitude is 50 mV ±3%.

q. Disconnect all test equipment and plug P160 and P202 back into the appropriate sockets in the AM 503.

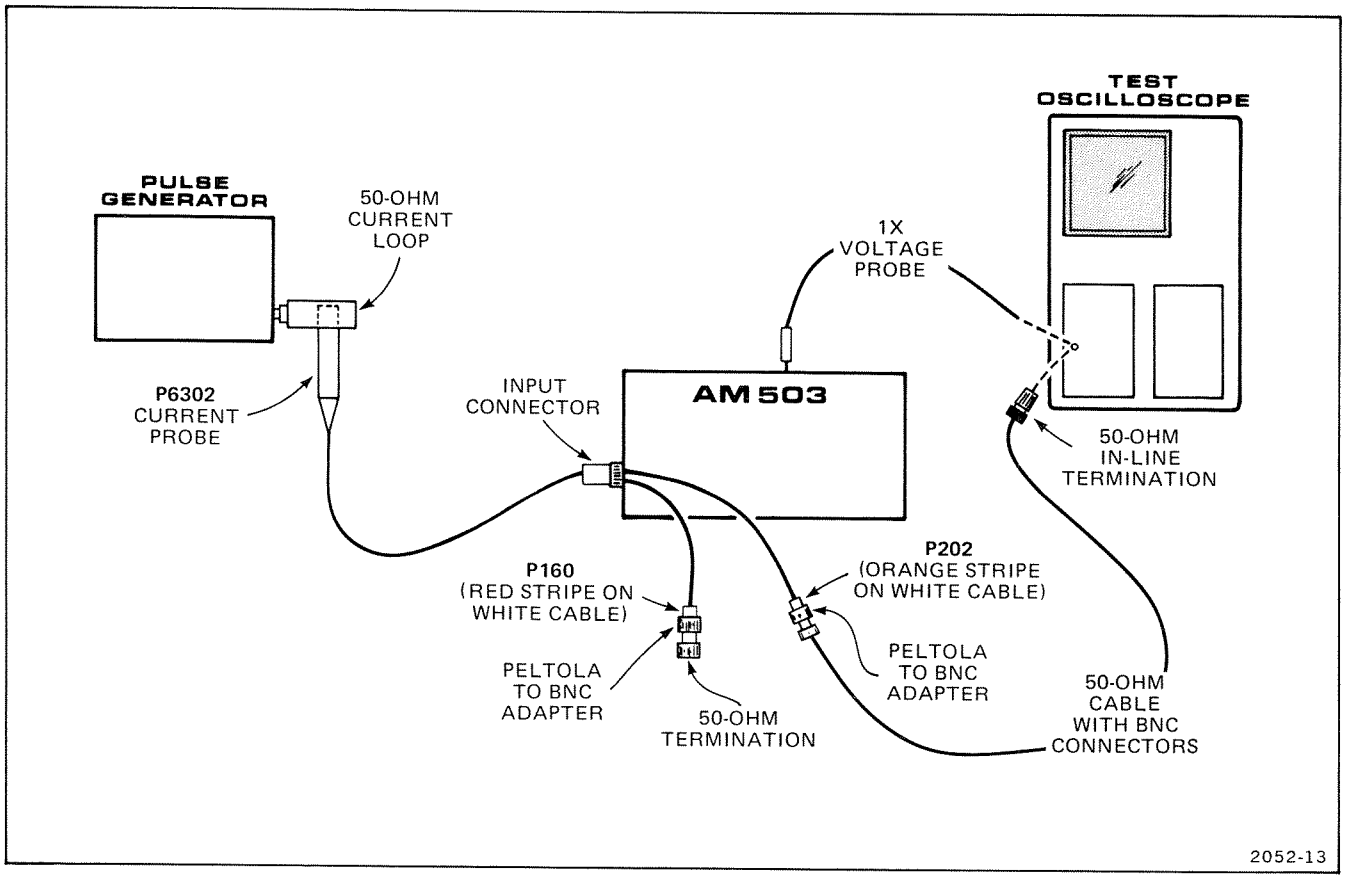


Fig. 4-5. Test setup to check P6302 Current Probe.

ADJUSTMENT AFTER REPAIR

After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as other closely related circuits. Refer to the Adjustment section of the manual.

PERFORMANCE CHECK

This section contains information necessary to perform a complete instrument performance check. Limits given in the procedure are those shown in the Specification, Section 1.

PRELIMINARY INFORMATION

Adjustment Interval

To maintain instrument accuracy, check the instrument performance every 1000 operating hours, or every six months if used infrequently.

Tektronix Field Service

Tektronix Field Service Centers and the Factory Service Center provide instrument repair and adjustment service. Contact your Tektronix Field Office or representative for further information.

Using This Procedure

This Performance Check procedure should be used for a complete check of instrument performance. Completion of each step in the procedure ensures that the instrument is operating within the specified limits.

INDEX. An index precedes the performance check to aid in locating particular steps.

PARTIAL PROCEDURE. The following procedure is written to completely check the instrument against the Performance Requirement in Section 1, Specification. If the applications for which the instrument is used do not require the full performance check, the procedure and required equipment can be shortened accordingly.

A partial performance check may be desirable after replacing components. To check only part of the instrument, refer to Equipment Required list that precedes that portion of the procedure to be performed.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 5-1 is required for a complete performance check. The specifications given in Table 5-1 for test equipment are the minimum necessary to meet the Performance Requirements listed in Section 1, Specification.

TABLE 5-1
Test Equipment Required For Performance Check

Description	Minimum Specifications	Usage	Examples
1. Test Oscilloscope	Bandwidth: dc to 150 MHz; minimum vertical deflection 5 mV/Div; minimum Time/Div, 2 ns.	All amplifier output measurements	Tektronix 7704A with 7A16A Amplifier and 7B80 Time Base
2. Power Module TM 500-Series		Provide power to AM 503 and test equipment	Tektronix TM 506[1] or TM 503[1] or TM 515[1]
3. Digital Voltmeter	Ranges (ac RMS), 0-200 mV, 0-2 V; Accuracy, ±0.5% ±1 count at 1 kHz.	Current/Div accuracy	Tektronix DM 502[1]

[1] Requires TM 500-Series Power Module

TABLE 5-1 (cont.)

Description	Minimum Specifications	Usage	Examples
4. Calibration Generator	Amplitude Calibrator and two pulse modes: High Amplitude and Fast Rise. Amplitude Calibrator. Amplitude to 5 V, p-p into 50 Ω; period, approx. 1 ms. High Amplitude Output: Period 1 μs to 10 ms; duty cycle, approx. 50%; amplitude range, 0.5 V or less to at least 5 V. Leading edge aberrations within 2%, into 50 Ω. Fast Rise Output. Period, 1 μs to 10 ms; duty cycle, approx. 50%; amplitude range, 100 mV or less to at least 1.0 V into 50 Ω. Risetime (terminated in 50 Ω), 1.0 ns or less; leading edge aberrations, within 2% during first 10 ns; flatness within 0.5% after first 10 ns; trigger output (terminated in 50 Ω), positive-going signal is at least 1.0 V.	Square-Wave response/ Droop. Tangential Noise. Risetime-Bandwidth	Tektronix PG506[1] Pulse Generator
5. Constant Amplitude Sine Wave Generator	Frequency range, to at least 50 MHz with 50 kHz reference frequency; Amplitude range to 4 V p-p; impedance, 50 Ω; amplitude accuracy (50 kHz reference) within 3% of indicated amplitude on 5 V range, into 1% termination; flatness, output amplitude does not vary more than 3% from actual amplitude of 50 kHz reference, to 50 MHz	Bandwidth Checks	Tektronix SG 503[1] Leveled Sine Wave Generator Tektronix 191 Constant Amplitude Signal Generator
6. Low Frequency Constant Amplitude Sine Wave Generator	Output frequency, approx. 5 Hz to 1 kHz; amplitude, (into 50 Ω), 5 V p-p; Amplitude flatness (sine wave), ±1.5 dB thoughout required frequency range	Ac low frequency −3 dB point check	Tektronix FG 502[1]

[1] Requires TM 500-Series Power Module

TABLE 5-2 (cont)

Description	Minimum Specifications	Usage	Examples
7. Cable (2 required)	Impedance, 50 Ω; length, 42 inches; connectors, BNC	One used in all test setups. Second used in amplifier tangential noise checks.	Tektronix 012-0057-01
8. Termination (2 required)	Impedance, 50 Ω, in-line; connectors, BNC	One used in all test setups. Second used in amplifier tangential noise checks.	Tektronix 011-0049-01
9. 1X Passive Probe		DC Repeatability, Probe Voltage Injection, Current/Division Accuracy	Tektronix P6062A, 010-6062-01
10. Adapter	BNC male to dual binding post	Current/Division Accuracy	Tektronix 103-0035-00
11. Adapter	BNC female to dual banana	Current/Division Accuracy	Tektronix 103-0090-00
12. 10X Attenuator (3 required)	Impedance, 50 Ω; connectors, BNC	Noise	Tektronix 011-0059-02
13. Calibration Fixture (Current Loop)	Impedance, 50 Ω.	Droop, Dynamic Range, Tangential Noise, Rise-time, Bandwidth	Tektronix 067-0559-00

Detailed operating instructions for the test equipment are not given in this procedure. Refer to test equipment instruction manuals if more information is needed.

Test Equipment Alternatives

The test equipment listed in the "Examples" column, Table 5-1, is required to check the instrument.

The Performance Check is based on the first item in the example. If other equipment is substituted, control settings or setup may need to be altered. If the exact equipment item given as an example is not available, refer to "Minimum Specifications" column to determine if other equipment can be substituted. Check the "Usage" column.

INDEX TO PERFORMANCE CHECK

PRELIMINARY PROCEDURE

Page

A. INDICATORS

B. PROBE DEGAUSS

C. DC REPEATABILITY AND PROBE VOLTAGE INJECTION

D. DC LEVEL AND BALANCE RANGES

E. SQUARE-WAVE RESPONSE/DROOP

F. CURRENT/DIVISION ACCURACY

G. AC DYNAMIC RANGE

H. TANGENTIAL NOISE

I. RANDOM TRACE SHIFT

J. RISETIME-BANDWIDTH

PRELIMINARY PROCEDURE

Perform the following steps before preceeding with the Performance Check Procedure.

1. Plug the AM 503 into the TM 500-Series Power Module.

2. Plug the TM 500-Series Power Module into suitable ac line voltage. Ensure that Line Selector on TM 500-Series Power Module is within range of the ac line voltage.

3. Pull the TM 500-Series Power Module PWR switch on (out position).

All steps in the Performance Check require the following setup, (see Fig. 5-1) unless otherwise noted. With each of the more complex steps, an equipment setup is provided.

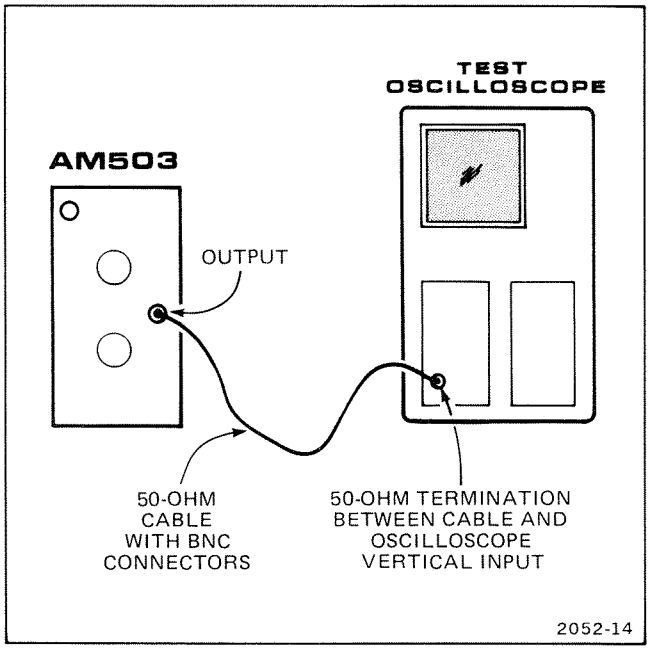


Fig. 5-1. Setup for Preliminary Procedure.

@

The equipment required information preceding each major step does not inlcude the equipment listed in this preliminary setup.

NOTE

Titles for external (front panel) AM 503 controls and connectors are capitalized in this procedure (e.g., CURRENT/DIV, BALANCE, etc.).

4. Set test oscilloscope vertical Volts/Div to 10 mV.

5. With test oscilloscope Input Coupling switch at Gnd, position trace vertically to graticule center. Switch Input Coupling to DC.

6. Connect P6302 Current Probe to AM 503 INPUT connector.

7. With AM 503 Coupling set to CAL DC LEVEL, adjust DC LEVEL control (on AM 503) for zero output (trace centered on test oscilloscope graticule).

8. Set CURRENT/DIV fully clockwise.

9. Press and release DEGAUSS button on AM 503.

10. Set AM 503 Coupling switch to DC.

11. Set BALANCE (screwdriver control on AM 503 front panel) for zero output.

A. INDICATORS

A1. Check AM 503 Indicators

a. With no probe connected to AM 503 INPUT, press DEGAUSS button.

b. CHECK—that INPUT OVERLOAD indicator is lit.

c. Connect pin L to pin K (ground) on INPUT connector. See Fig. 5-2.

d. CHECK—that CURRENT/DIV indication (behind knob skirt) switches from left to right. Remove wire jumper from INPUT connector.

e. Connect current probe to AM 503 INPUT connector.

f. Move slider to OPEN position (do not slide to fully open position).

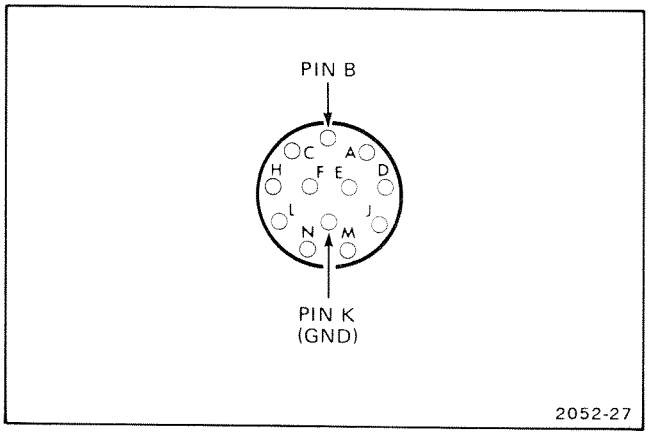


Fig. 5-2. INPUT connector pin designation.

g. CHECK—that PROBE UNLOCKED indicator on AM 503 is lit.

h. Move slider to CLOSED position.

i. CHECK—that PROBE UNLOCKED indicator is not lit.

B. PROBE DEGAUSS

B1. Check Degauss Operation

Set controls:

AM 503

CURRENT/DIV	5 A

Test Oscilloscope

Time/Div	2 ms

a. Be sure that probe slider is in CLOSED position.

b. Hold DEGAUSS button (on AM 503 front panel) in.

c. CHECK—for about 160 Hz sine-wave display of 21 A ±5 A on test oscilloscope.

B2. Check Degauss Decay Time

Set controls:

Test Oscilloscope

Time/Div	.2 s

a. Press and hold DEGAUSS button. When sweep reaches the second graticule line, release the DEGAUSS button and time the decay to zero amplitude.

b. CHECK—for decay time of 0.4 to 0.7 second (2 to 3.5 divisions).

C. DC REPEATABILITY AND PROBE VOLTAGE INJECTION

Equipment Required

1. 1X Passive Voltage Probe with ground lead (for voltage injection test).

C1. Check DC Measurement Repeatability

Set Controls:

AM 503

Coupling	CAL DC LEVEL
CURRENT/DIV	1 mA

Test Oscilloscope

Time/Div	10 μs
Input Coupling	Gnd

a. Be sure slider is in CLOSED position.

b. Position trace vertically to graticule center on test oscilloscope.

c. Switch test oscilloscope Input Coupling to DC.

d. Vertically center trace on test oscilloscope using AM 503 DC LEVEL control.

e. Set AM 503 Coupling to DC.

f. Press and release DEGAUSS button.

g. Adjust AM 503 BALANCE control to set trace on test oscilloscope to graticule center.

h. Press and release DEGAUSS button.

i. CHECK—for trace to return to graticule center (re-zero with BALANCE control, if necessary).

j. Open, close, and relock probe slider.

k. CHECK—that trace returns to within ±1 mA (1 division) of graticule center.

C2. Check Probe Voltage Injection

See Fig. 5-3 for test setup.

a. Press and hold DEGAUSS button and measure voltage on test oscilloscope display.

b. CHECK—for 40 mV maximum, peak-to-peak display amplitude.

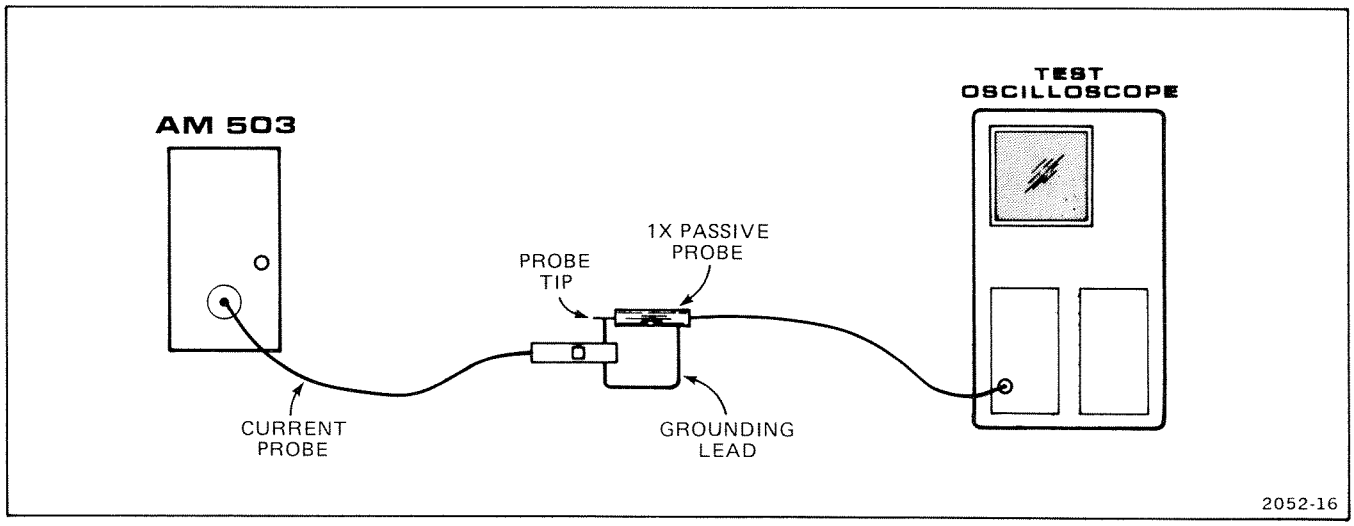


Fig. 5-3. Equipment setup for probe voltage injection check.

D. DC LEVEL AND BALANCE RANGES

D1. Check DC Level Range

Set Controls:

AM 503

Coupling	CAL DC LEVEL
CURRENT/DIV	5 mA

Test Oscilloscope

Coupling	Gnd

a. Position trace to graticule center using test oscilloscope Vertical Position control. Set test oscilloscope Volts/Div to 50 mV and Input Coupling to DC.

b. Rotate AM 503 DC LEVEL throughout its range.

c. CHECK—for ±100 mV minimum deflection on test oscilloscope.

d. Turn DC LEVEL control to position trace to graticule center.

e. Return AM 503 Coupling to DC.

D2. Check Balance Range

Set Controls:

AM 503

CURRENT/DIV	20 mA

Test Oscilloscope

Volts/Div	10 mV

a. Rotate BALANCE control (screwdriver control on AM 503 front panel) throughout its range.

b. CHECK—for 80 mA (4 divisions at 20 mA/Div), minimum.

E. SQUARE-WAVE RESPONSE/DROOP

Equipment Required

1. Calibration Generator
2. BNC male to GR Adapter
3. Current Probe Calibration Fixture (50-ohm loop)

E1. Check Square-Wave Droop

See Fig. 5-4 for test setup.

Set Controls:

AM 503

CURRENT/DIV 5 mA

a. Set Calibration Generator for 2 volt output.

b. Adjust test oscilloscope vertical for six-division display (uncalibrated).

c. CHECK—display flat within 3% on test oscilloscope.

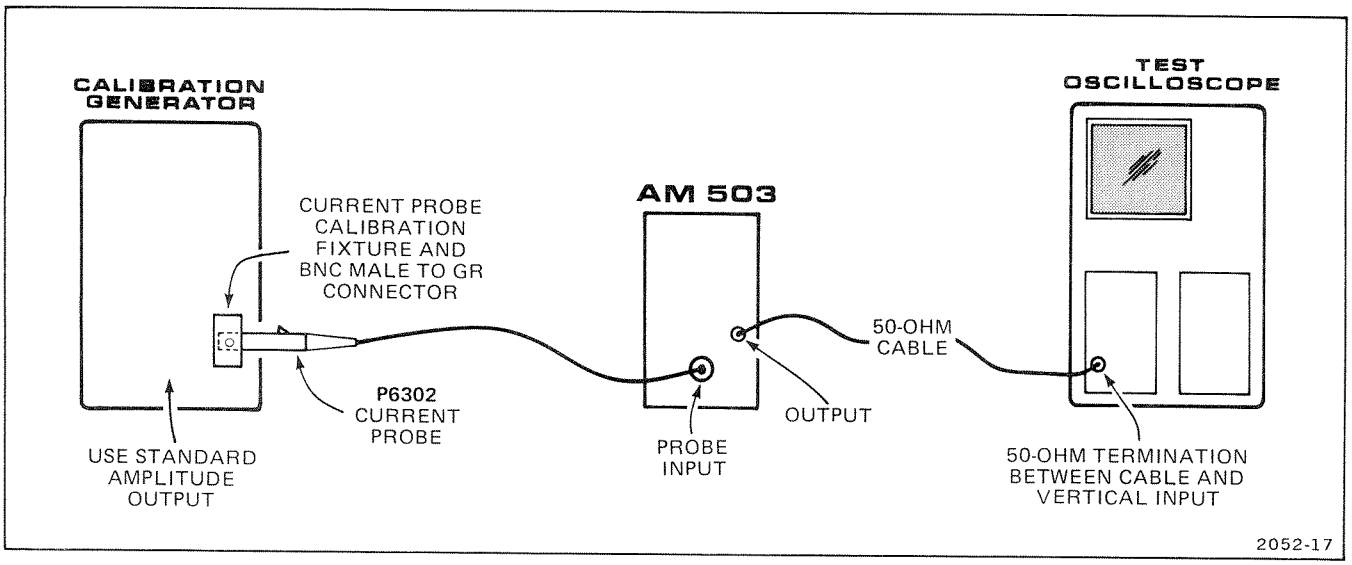


Fig. 5-4. Test setup for droop check.

F. CURRENT/DIVISION ACCURACY

Equipment Required

1. Calibration Generator
2. Test Oscilloscope
3. 50-Turn Current Loop (See Fig. 5-5)

See Fig. 5-5 for test setup.

F1. Check Current/Division Accuracy

Set Controls:

AM 503

CURRENT/DIV	5 A
Coupling	CAL DC LEVEL

Test Oscilloscope

Volts/Div	5 mV
Time/Div	.2 ms
Input Coupling	Gnd
Calibration Generators (Step Amplitude Output)	
Step Amplitude	10 V (5 V into 50 Ω)

a. Position test oscilloscope trace vertically to graticule center (with Position control).

b. Switch test oscilloscope Input Coupling to DC.

c. Adjust AM 503 DC LEVEL control to center test oscilloscope trace to graticule center.

d. Set AM 503 Coupling to DC.

e. Close P6302 probe core around the 50-turn current loop.

f. Adjust AM 503 DC LEVEL control to center displayed square wave on test oscilloscope graticule.

g. CHECK—that signal amplitude is 2 divisions.

h. Set the test oscilloscope, calibration generator AM 503 (CURRENT/DIV) and P6302 for each step in Table 5-2. Center the display as necessary with the AM503 DC LEVEL control.

i. CHECK—that displayed square wave amplitude in each step is 5 divisions ±3%.

TABLE 5-2
Current/Div Accuracy

AM 503 CURRENT/DIV	Current Loop Number of Turns	Calibration Generators Amplitude	Test Oscilloscope Volts/Div
2 A	50	10 V	5 mV
1 A	50	10 V	10 mV
.5 A	50	5 V	10 mV
.2 A	50	2 V	10 mV
.1 A	50	1 V	10 mV
50 mA	50	.5 V	10 mV
20 mA	50	.2 V	10 mV
10 mA	1	10 V	20 mV
5 mA	1	5 V	20 mV
2 mA	1	2 V	20 mV
1 mA	1	1 V	20 mV

G. AC DYNAMIC RANGE

Equipment Required

1. Low Frequency Sine Wave Generator
2. RMS reading DVM
3. Adapter, BNC to Dual Binding Post
4. Adaptor, Dual Banana Plug to BNC
5. Current Probe Calibration Fixture
6. Male BNC to GR Adaptor

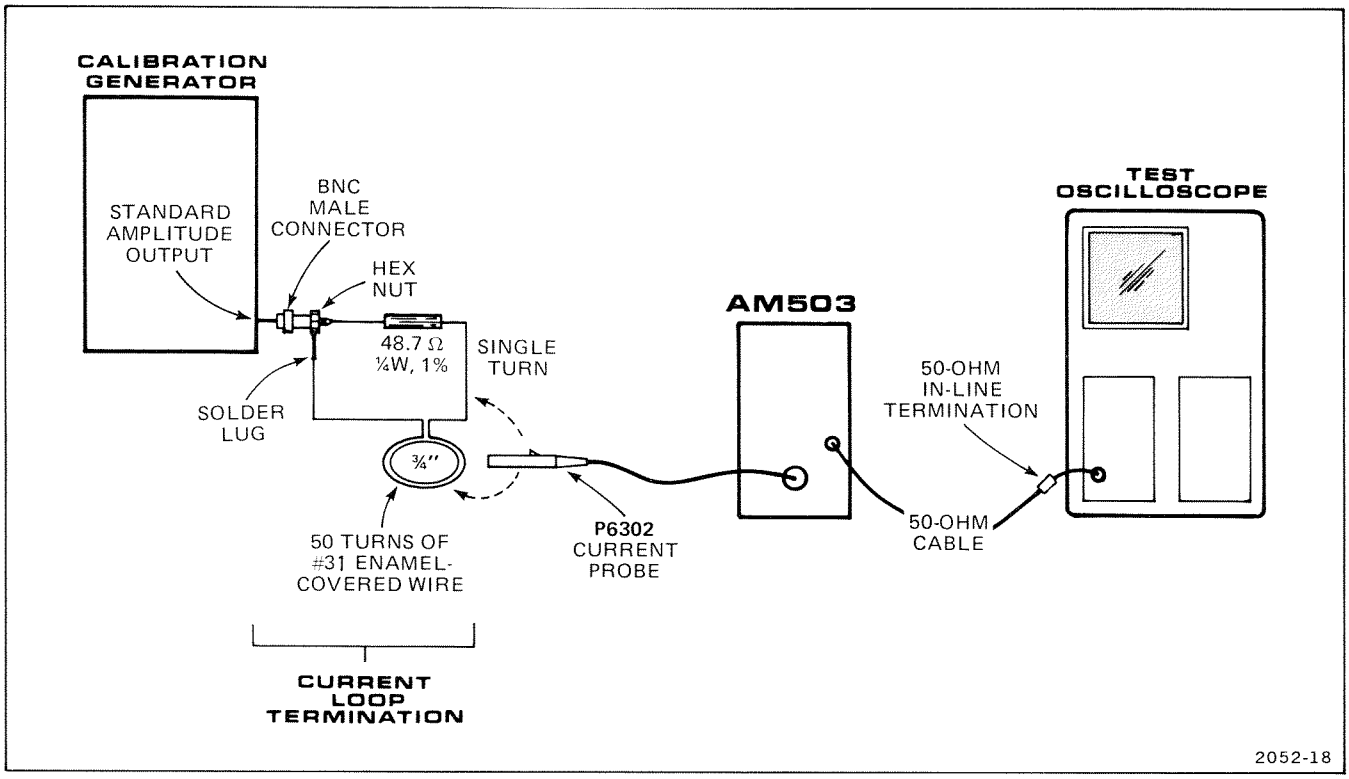


Fig. 5-5. Test setup for current/division check.

See Fig. 5-6 for test setup.

G1. Check AC Dynamic Range

Set Controls-

AM 503

CURRENT/DIV	5 mA
Coupling	DC

Test Oscilloscope

Volts/Div	20 mV
Input Coupling	DC
Sine Wave Gen Freq	100 Hz

a. Connect Current Probe around the Current Probe Calibration Fixture center conductor.

b. Set Sine-Wave Generator for 28.3 mV, RMS, out of AM 503 (test oscilloscope indicates 80 mV, peak-to-peak).

c. Set test oscilloscope Input Coupling to GND. Position trace vertically 4 divisions down from graticule center.

d. Reset test oscilloscope Input Coupling to DC.

e. Set AM 503 Coupling to CAL DC LEVEL.

f. Adjust AM 503 DC LEVEL to reposition trace 4 divisions down from graticule center.

g. Return AM 503 Coupling to DC.

h. Using AM 503 DC LEVEL control, position the signal peak (top of waveform) up 2 divisions.

i. CHECK—DVM should read 26.9 mV or greater (26.9 mV = 28.3 mV minus 5%).

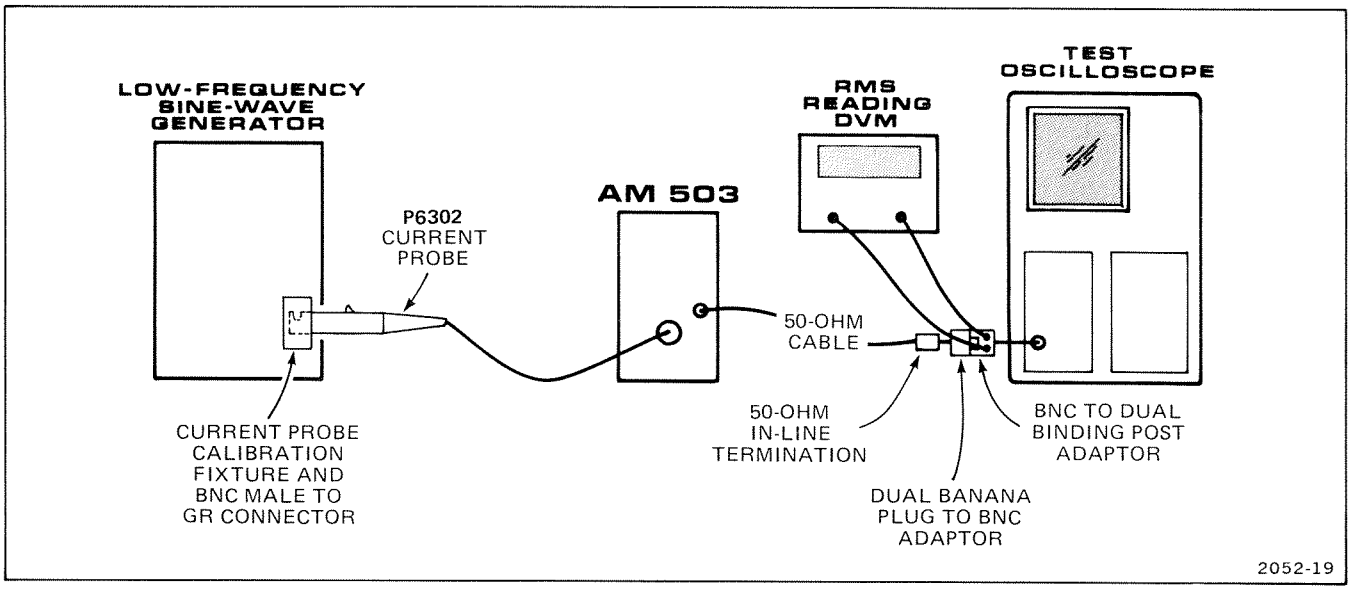


Fig. 5-6. Test setup for ac dynamic range check.

j. Switch test oscilloscope Input Coupling to Gnd.

k. Position trace vertically to 4 divisions above graticule center.

l. Switch test oscilloscope Input Coupling to DC.

m. Set AM 503 Coupling to CAL DC LEVEL.

n. Adjust DC LEVEL to reposition trace up 4 divisions from graticule center.

o. Set AM 503 Coupling to DC.

p. Using AM 503 DC LEVEL control, move bottom peak of signal down 2 divisions.

q. CHECK—DVM should read at least 26.9 V RMS.

H. TANGENTIAL NOISE

Equipment Required

1. Calibration Generator
2. 10X Attenuator (3)
3. 50-ohm In-line Termination
4. Adaptor, BNC male to Dual Binding Post
5. Current Probe Calibration Fixture (current loop)
6. Adaptor, BNC male to GR

Use test setup shown in Fig. 5-7.

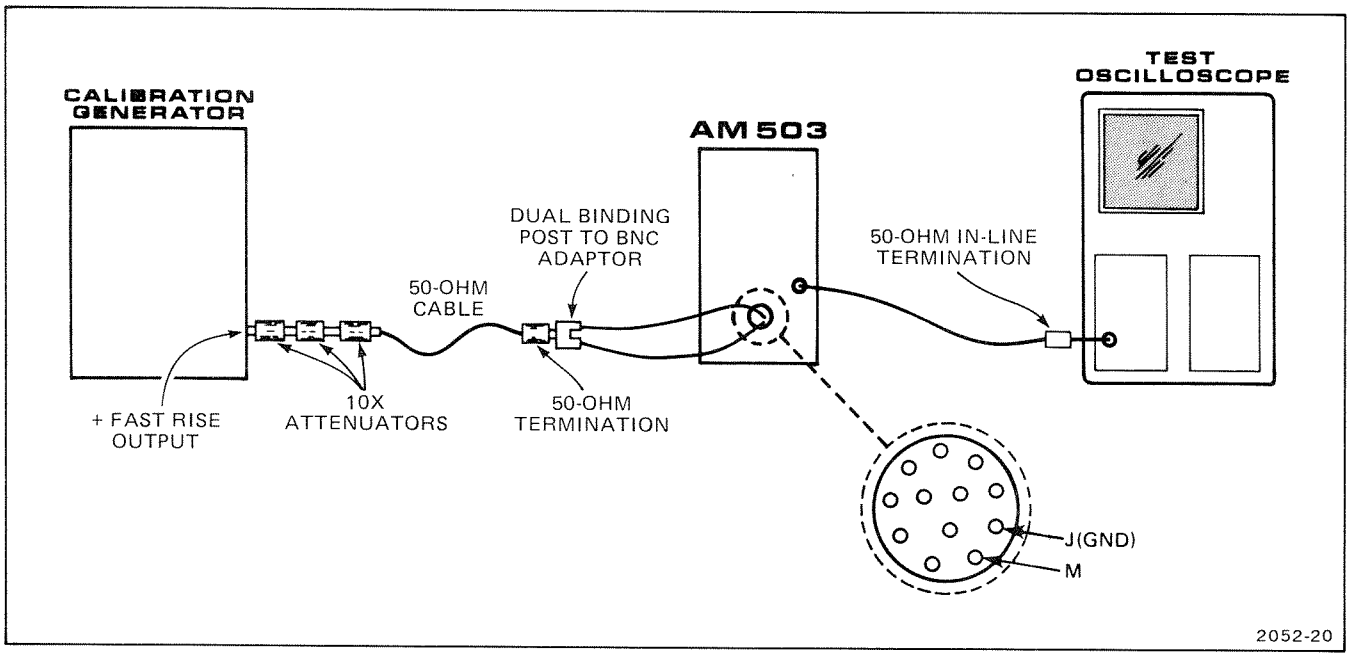


Fig. 5-7. Test setup for amplifier tangential noise check.

H1. Check Amplifier Noise Tangentially

Set Controls:

AM 503

BANDWIDTH	FULL
CURRENT/DIV	1 mA
Coupling	CAL DC LEVEL

Test Oscilloscope

Input Coupling	Gnd
Volts/Div	10 mV
Time/Div	10 μs

a. Set AM 503 Coupling to CAL DC LEVEL.

b. Set test oscilloscope Input Coupling to Gnd.

c. Using test oscilloscope Vertical Position control, position trace to graticule center.

d. Set test oscilloscope Input Coupling to DC.

e. Using AM 503 DC LEVEL control, position trace to graticule center.

f. Return AM 503 Coupling to DC.

g. Set Calibration Generator for approximately 1 kHz square wave.

h. Adjust Calibration Geenerator output for two traces (adjust test oscilloscope trigger to display free-running traces).

i. Decrease Calibration Generator output amplitude until the two traces just merge (no dark area between traces. See Fig. 5-8).

j. Remove one 10X attenuator.

k. Divide display amplitude by 10. Example: 1.9 divisions of display at 10 mV/Div. = 19 mV. Divide 19 mV by 10. The tangentially measured noise is 1.9 mV.

l. CHECK—for 4 mV of noise, maximum.

H2. Check Probe Noise Tangentially

Set Controls:

AM 503

CURRENT/DIV	1 mA
BANDWIDTH	5 MHz

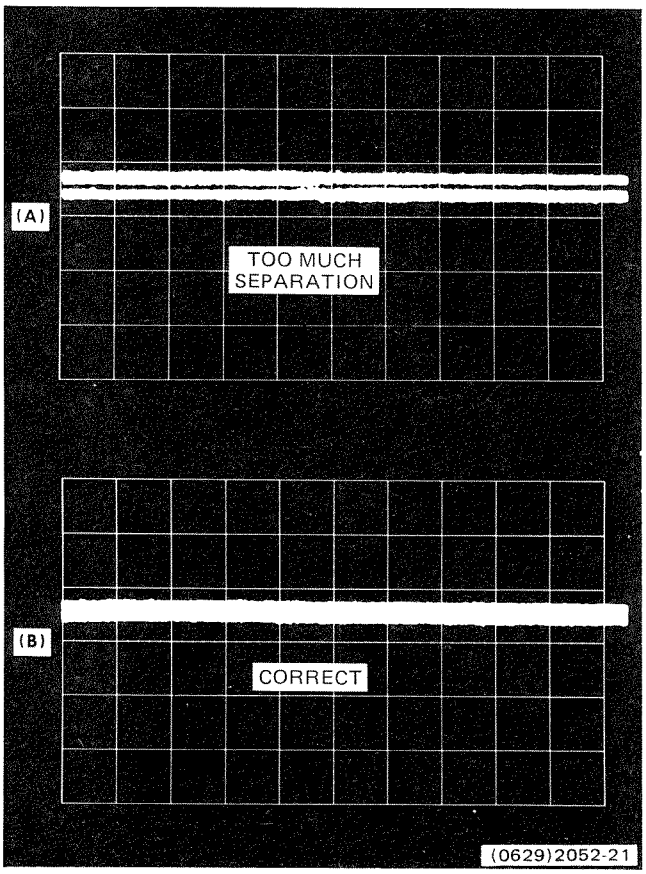


Fig. 5-8. Display of tangentially measured noise (A) incorrect; dark area showing between traces, (B) correct display.

Test Oscilloscope

Time/Div	100 μs
Volts/Div	10 mV
Calibration Generator	1 kHz Square Wave

Use test setup shown in Fig. 5-9.

a. Adjust Calibration Generator amplitude until two free-running traces just merge (no dark area between traces. See Fig. 5-8).

b. Remove 10X attenuator.

c. Divide displayed amplitude by 10. Example: 2 divisions of display at 10 mV/Div = 20 mV (equivalent to 2 mA), divided by 10 = 0.2 mA of noise.

d. CHECK—for 0.3 mA maximum tangentially measured noise.

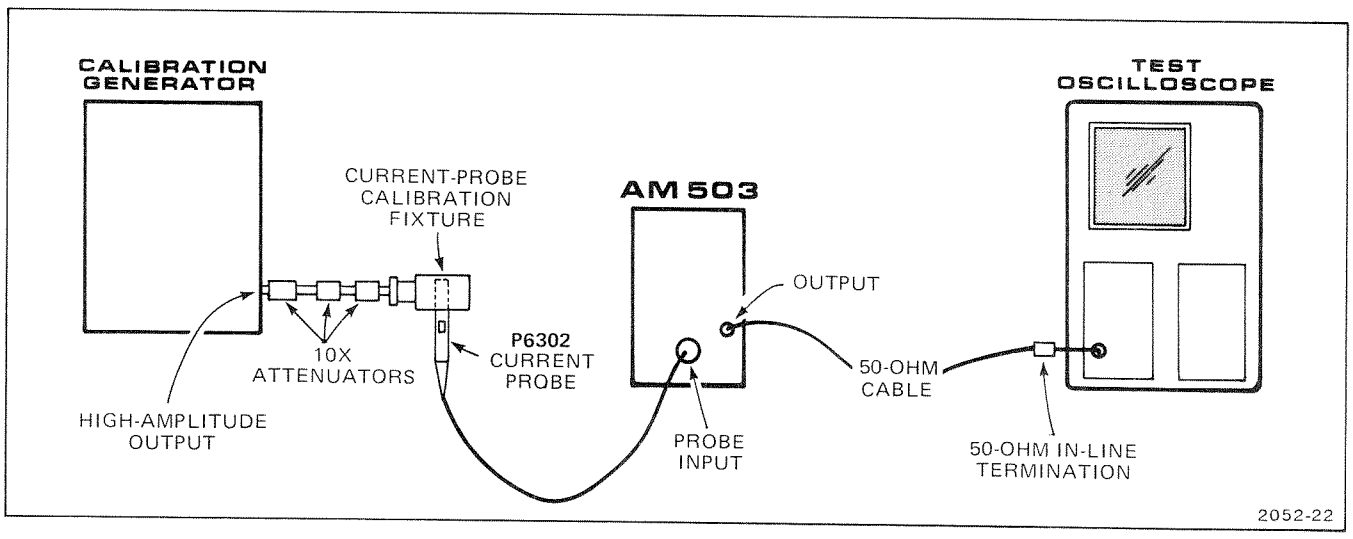


Fig. 5-9. Test setup for probe tangential noise check.

I. RANDOM TRACE SHIFT

1. Check Random Trace Shift

Set Controls:

AM 503

CURRENT/DIV	1 mA
BANDWIDTH	5 MHz

Test Oscilloscope

Time/Div	5 s
Volts/Div	10 mV

a. Connect current probe to AM 503 INPUT.

b. Watch test oscilloscope trace for abrupt vertical shift in the 50-second sweep.

c. CHECK—for maximum trace shift of 1.5 mA peak-to-peak (1.5 divisions).

J. RISETIME-BANDWIDTH

Equipment Required

1. Calibration Generator
2. Constant Amplitude Sine Wave Generator
3. Constant Amplitude, Low-Frequency Sine Wave Generator
4. Current Probe Calibration Fixture
5. Adapter, BNC male to GR

Set up test as shown in Fig. 5-10.

J1. Check Risetime

Set Controls:

AM 503

BANDWIDTH	FULL
CURRENT/DIV	2 mA
Calibration Generator Period	1 μs

Test Oscilloscope

Volts/Div	10 mV
Input Coupling	DC
Time/Div	20 ns

a. Adjust Calibration Generator output for 5-division vertical display on test oscilloscope.

b. Switch test oscilloscope Time/Div to 2 ns.

c. Measure risetime between 10 and 90% amplitude points.

d. CHECK—for 7 nanoseconds, maximum risetime.

J2. Check Bandwidth

Set up test as shown in Fig. 5-11.

Set Controls:

AM 503

BANDWIDTH	FULL
CURRENT/DIV	5 mA

Test Oscilloscope

Volts/Div	10 mV
Sine-Wave Gen Freq	50 kHz reference

a. Set Sine Wave Generator amplitude for six-division display on test oscilloscope.

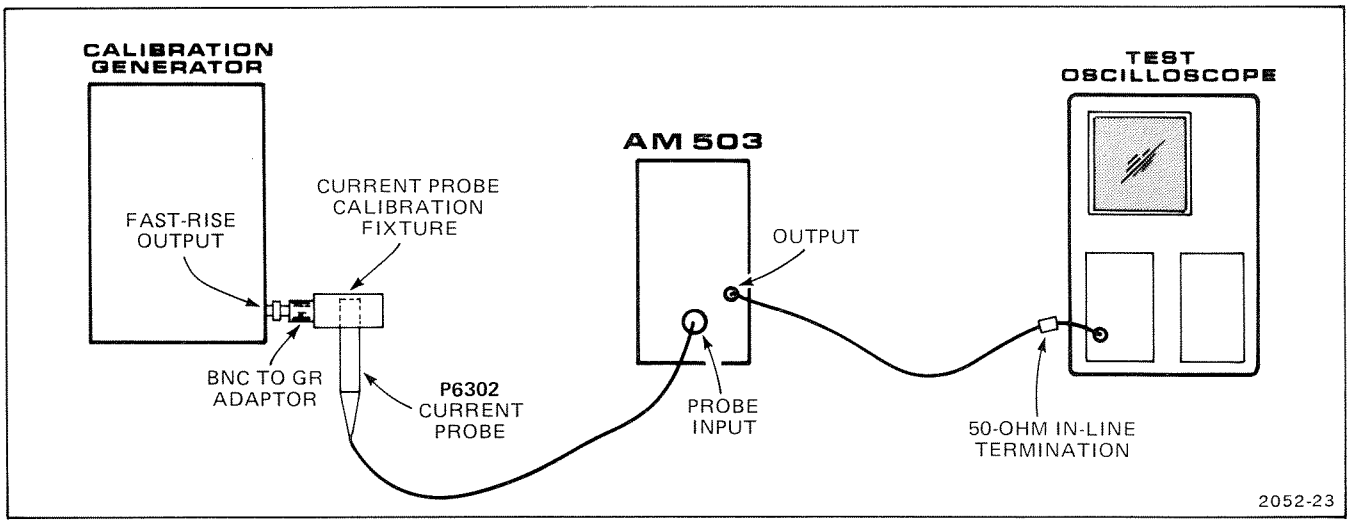


Fig. 5-10. Test setup for risetime check.

b. Increase Sine Wave Generator frequency until display amplitude reduces to 4.2 divisions.

c. CHECK—that Sine Wave Generator frequency is 50 MHz or greater.

J3. Check 5 MHz Bandwidth

Set Controls:

AM 503

BANDWIDTH	5 MHz
CURRENT/DIV	5 mA

Test Oscilloscope

Volts/Div	10 mV
Sine Wave Gen Freq	50 kHz reference

Use test setup shown in Fig. 5-11.

a. Set Sine Wave Generator amplitude for six-division display on test oscilloscope.

b. Increase Sine Wave Generator frequency until display amplitude reduces to 4.2 divisions.

c. CHECK—that Sine Wave Generator frequency is 5 MHz ±1 MHz.

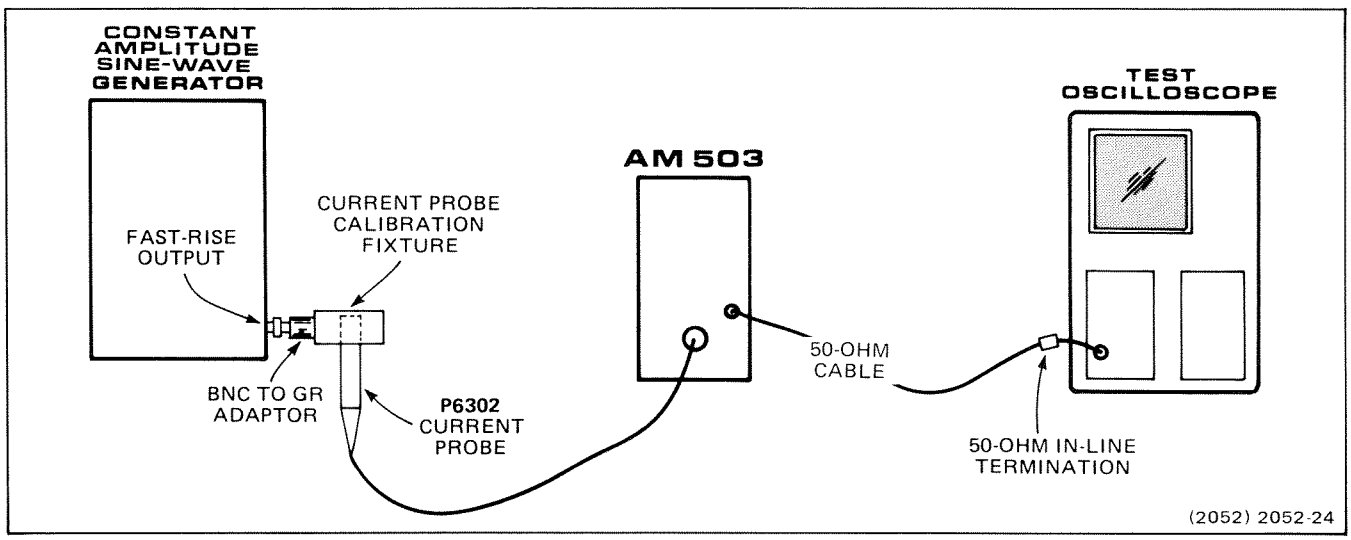


Fig. 5-11. Test setup for bandwidth check.

J4. Check AC Coupled –3 dB Point

Set Controls:

AM 503

CURRENT/DIV	5 mA
Low Frequency Sine Wave Generator Frequency	1 kHz

Test Oscilloscope

Volts/Div	10 mV

Use test setup shown in Fig. 5-11.

a. Set Sine Wave Generator amplitude for six-division display on test oscilloscope.

b. Decrease generator frequency until display amplitude decreases to 4.2 divisions.

c. CHECK—that Sine Wave Generator frequency is 7 Hz or less.

ADJUSTMENTS

This section contains information necessary to perform complete instrument adjustments. The adjustment procedure is not intended as a troubleshooting guide, and any trouble found during adjustment should be corrected before continuing. Refer to Maintenance section for further informations.

PRELIMINARY INFORMATION

Adjustment Interval

To maintain instrument accuracy, check the performance of the AM 503 every 1000 hours of operation, or every six months if used infrequently. Before complete adjustment, thoroughly clean and inspect the instrument as outlined in Section 4, Maintenance.

Tektronix Field Service

Tektronix Field Service Centers and the Factory Service Center provide instrument repair and adjustment service. Contact your Tektronix Field Office or representative for further information.

Using the Procedure

Completion of each step in this procedure ensures that the instrument is correctly adjusted and operating within specified limits. Refer to the following discussion for instructions on a complete or partial adjustment.

INDEX. An index precedes the adjustment procedure to aid in locating adjustment steps.

PARTIAL PROCEDURES. The following procedure is wirtten to completely adjust the instrument to the Performance Requirements listed in Section 1, Specification. If the applications for which the instrument is used do not require the full available performance, the procedure and the required equipment list can be shortened accordingly.

A partial adjustment may be desirable after replacing components, or to touch up the adjustment of a portion of the instrument. To adjust only part of the instrument, refer to the Equipment Required list that precedes that portion of the procedure to be performed.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 6-1 is required for complete adjustment of the instrument. The specification given in Table 6-1 for test equipmnet is the minimum required to meet the Performance Requirements listed in Section 1, Specification.

Detailed operating instructions for test equipment are not included in this procedure. Refer to the test equipment manual(s) if more information is required.

Special Fixtures

Special fixtures are used only where they facilitate instrument adjustment. These fixtures are available from Tektronix, Inc. Order by Tektronix part number from Tektronix Field Office or representative.

Test Equipment Alternatives

The test equipment listed in the "Example" column of Table 6-1 is recommended to adjust the instrument. The Adjustment Procedure is based on the first item of equipment given as an example. If other equipment is substituted, control settings or setup may need to be altered. If the exact item of equipment is not available, refer to the Minimum Specification column to determine what equipment may be substituted. Then check the Usage column. If you determine that your mesaurement requirement will not be affected, the item and corresponding step(s) can be deleted.

TABLE 6-1
Test Equipment Required

Description	Minimum Specification	Usage	Examples
1. Test Oscilloscope	Bandwidth, to 150 MHz; vertical deflection, 5 mV/Div; Time/Div, 2 ms.	Adjusting Calibration Generator output levels. Adjusting Compensation.	Tektronix 7704 with 7A16A Amplifier and 7B80 Time Base Tektronix 465
2. Calibration Generator	Fast Rise output: Period 0.1 ms; duty cycle, approx. 50% Amplitude, 200 mV p-p, into 50 ohms	Adjust Gain	Tektronix PG506[1] Pulse Generator Tektronix Type 106 Square Wave Generator
3. Digital Voltmeter	Range, 0-20 V dc; accuracy, ±0.25% ±1 count; input R, at least 10 MΩ.	Measuring power supply voltages.	DM 502[1] Digital Multimeter 7D13 Digital Multimeter
4. Flexible Extender Cable		All adjustments	Tektronix 067-0645-01
5. 1X Passive Probe		Adjust Gain	P6101 Probe
6. Adapter Cable BNC to Peltola		Signal to circuit board, Gain and Compensation adjustments	Tektronix 067-0709-00 Calibration Fixture
7. Cable	Impedance, 50 Ω; length, 42 inches; connectors, BNC	Adjust Compensation, AM 503 output to test oscilloscope	Tektronix 012-0057-01
8. Termination	Impedance, 50 Ω; connectors, BNC	Adjust Compensation, AM 503 output to test oscilloscope	Tektronix 011-0049-01
9. Current Probe	P6302 Current Probe. If current probe is not available, use 3.0 Ω, 3 W, 5% resistor.	Degauss Adjust	Tektronix 302-0441-00

[1] Requires TM 500-Series Power Module

A. POWER SUPPLIES

See TEST POINT AND ADJUSTMENT LOCATIONS pullout in Section 9.

Equipment Required

1. Digital Voltmeter
2. Variable Autotransformer
3. Flexible Extender

A1. Adjust −16 and +16 Volt Supplies (R405 and R415)

a. Remove the AM 503 side covers.

b. Connect the AM 503 to the TM 500-Series Power Module, using the flexible extender cable.

c. Be sure the Line Voltage Range Selector on the power module natches the power line voltage.

d. Connect DVM dc input between R422 (end toward front of AM 503) and chassis ground.

e. ADJUST—R405, Volts, for −16 volts.

f. Connect DVM dc input between R412 (end toward front of AM 503) and chassis ground.

g. ADJUST—R415, Balance, for +16 volts.

A2. Check +19.3 and −19.3 Volt Supplies

a. Connect DVM dc input between Q450 emitter and ground.

b. Check for +19.3 volts (+18 V to +21.5 V).

c. Connect DVM dc input between Q460 emitter and ground.

d. Check for −19.3 volts (−18 V to −21.5V).

B. GAIN

See TEST POINT AND ADJUSTMENT LOCATIONS pullout in Section 9.

Equipment Required

1. Adapter Cable, BNC to Peltola
2. Calibration Generator
3. Test Oscilloscope
4. 50-ohm Cable with BNC Connectors
5. 50-ohm In-line Termination
6. 1X Passive Voltage Probe

B1. Adjust Gain (R344-R346)

a. Disconnect probe from AM 503 INPUT connector.

b. Disconnect coaxial cable (white with orange stripe) from J202 on the Amplifier circuit board.

c. Connect the adapter cable between the Calibration Generator Fast Rise output and J202 on the Amplifier circuit board.

d. Connect the test oscilloscope probe tip to J202 (on back side of circuit board). Set test oscilloscope Volts/Div to 50 mV and Time/Div to .5 ms.

e. Set the Calibration Generator Fast Rise output for a 200 mV vertical display (at 1 kHz) after the first 10 μs.

f. Connect AM 503 OUTPUT connector via 50-ohm cable and 50-ohm termination to test oscilloscope vertical input.

g. Set AM 503 CURRENT/DIV to .1 A and Coupling to DC.

h. Set test oscilloscope Volts/Div to 10 mV.

i. ADJUST—R344, Gain, for 4-division display on test oscilloscope. Use DC LEVEL control as necessary to center display.

C. COMPENSATION

See TEST POINT AND ADJUSTMENT LOCATIONS pullout in Section 9.

Equipment Required

1. Calibration Generator
2. Adapter Cable BNC to Peltola
3. Test Oscilloscope
4. 50 ohm cable with BNC Connectors
5. 50 ohm, In-line Termination

C1. Adjust Low Frequency Compensation (R364)

a. Connect Calibration Generator High Amplitude Output via adapter cable to J202 on AM 503 circuit board.

b. Set Calibration Generator Period to .1 ms.

c. Set AM 503 CURRENT/DIV to .5 A.

d. Connect AM 503 OUTPUT via 50 ohm cable and 50 ohm termination to test oscilloscope vertical input.

e. Set test oscilloscope Volts/Div to 10 mV and Time/Div to 50 μs.

f. Adjust Calibration Generator Amplitude control for a six-division vertical display on test oscilloscope.

g. ADJUST—R364 (L. F. Comp) for best front corner on square wave. See Fig. 6-1. This adjustment is to be made with coil L202 disconnected. Be sure to reconnect coil L202.

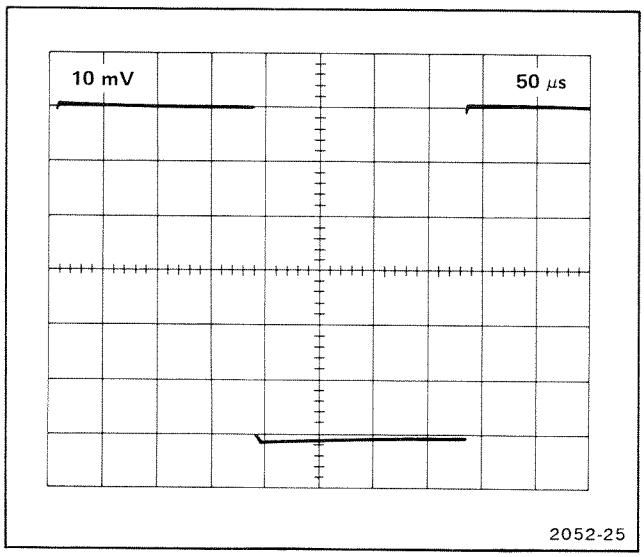


Fig. 6-1. Typical display of correct adjustment of R364, LF Comp.

C2. Adjust High Frequency Compensation (R345-R363)

a. Set test oscilloscope Time/Div to 10 ns.

b. ADJUST–R345, HF Comp, for flat top in the first 10 ns of the displayed square wave (see Fig. 6-2).

c. ADJUST–R363, HF Comp, for flat top in the first 20 ns of the displayed square wave (see Fig. 6-2).

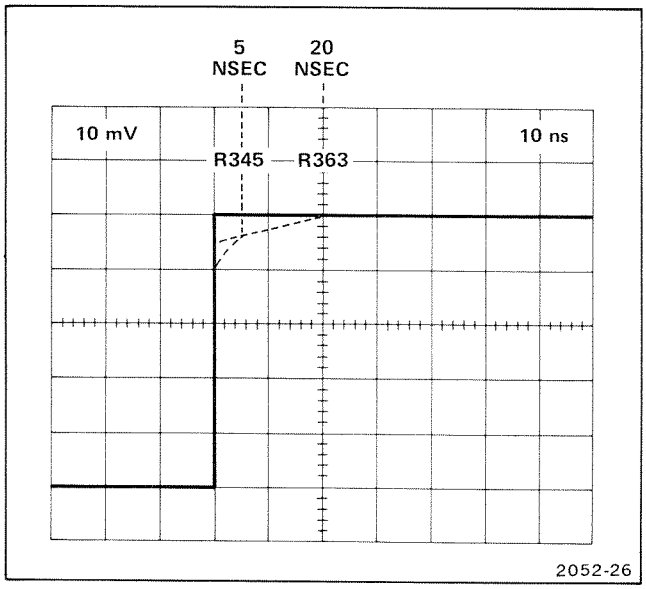


Fig. 6-2. Typical display of correct adjustment of HF Comp.

D. DEGAUSS

See TEST POINT AND ADJUSTMENT LOCATIONS pullout in Section 9.

Equipment Required

1. 50-ohm Coaxial Cable with BNC Connectors
2. 50-ohm In line Termination
3. Resistor, 3.0 Ohm, 3 W, 5%

D1. Adjust Degauss Offset

a. Connect AM 503 OUTPUT connector via 50-ohm coaxial cable and 50-ohm in-line termination to test oscilloscope vertical input.

b. Set test oscilloscope Volts/Div to 10 mV, Time/Div to 1 ms, and Input Coupling to Gnd. Position the free-running trace to graticule center with the test oscilloscope Vertical Position control. Switch test oscilloscope Input Coupling to DC.

c. Set AM 503 CURRENT/DIV fully clockwise.

d. Turn R136 fully counterclockwise.

e. Switch AM 503 Coupling to CAL DC LEVEL and center the test oscilloscope trace with the DC LEVEL control.

f. Switch AM 503 Coupling to DC.

g. Press and hold the DEGAUSS button (AM 503 front panel).

h. ADJUST–R152, Degauss Offset, for zero volts dc level (centered trace) on test oscilloscope.

D2. Adjust Degauss Signal Amplitude

a. Connect P6302 Current Probe to INPUT or connect a 3.0 ohm resistor between pins M and N on AM 503 INPUT connector (see Fig. 6-3).

b. Set AM 503 CURRENT/DIV fully counterclockwise (5A/DIV).

c. Press and hold DEGAUSS button.

d. ADJUST—R136, Degauss Level, for 22 A ±2 A (4.4 divisions ±0.4 division) display on test oscilloscope.

e. Remove 3.0 ohm resistor from INPUT connector.

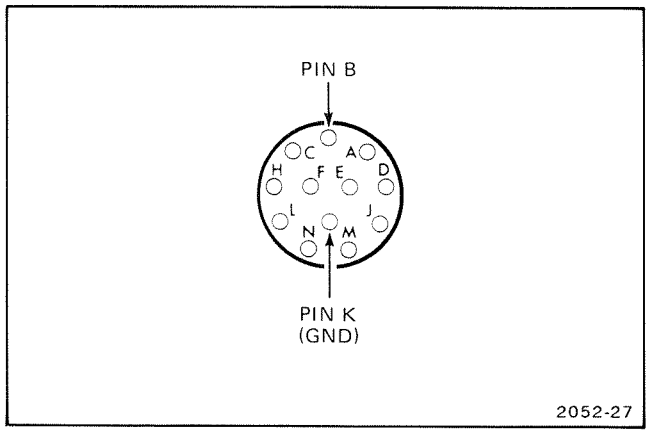


Fig. 6-3. Pins B and K on INPUT connector.

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	SEMICOND	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
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P O BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPARTMENT	NELA PARK	CLEVELAND, OH 44112
11237	CTS KEENE, INC.	3230 RIVERSIDE AVE.	PASO ROBLES, CA 93446
14193	CAL-R, INC.	1601 OLYMPIC BLVD.	SANTA MONICA, CA 90404
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
14936	GENERAL INSTRUMENT CORP., SEMICONDUCTOR PRODUCTS GROUP	P.O. BOX 600,600 W. JOHN ST.	HICKSVILLE, NY 11802
24931	SPECIALTY CONNECTOR CO., INC.	3560 MADISON AVE.	INDIANAPOLIS, IN 46227
28480	HEWLETT-PACKARD CO., CORPORATE HQ.	1501 PAGE MILL RD.	PALO ALTO, CA 94304
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
34333	SILICON GENERAL, INC.	7382 BOLSA AVE.	WESTMINSTER, CA 92683
34371	HARRIS SEMICONDUCTOR, DIV. OF HARRIS CORPORATION	P. O. BOX 883	MELBOURNE, FL 32901
50157	N. L. INDUSTRIES, INC., ELECTRONICS DEPT.	P. O. BOX 787	MUSKEGON, MI 49445
55210	GETTIG ENG. AND MFG. COMPANY	PO BOX 85, OFF ROUTE 45	SPRING MILLS, PA 16875
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73899	JFD ELECTRONICS COMPONENTS CORP.	PINETREE ROAD	OXFORD, NC 27565
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
79727	C-W INDUSTRIES	550 DAVISVILLE RD.,P O BOX 96	WARMINISTER, PA 18974
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
81483	INTERNATIONAL RECTIFIER CORP.	9220 SUNSET BLVD.	LOS ANGELES, CA 90069
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E WASHINGTON STREET P O BOX 372	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-4353-00	B010100	B029999	CIRCUIT BOARD ASSY:MAIN PLUG-IN	80009	670-4353-00
A1	670-4353-01	B030000		CIRCUIT BOARD ASSY:MAIN PLUG-IN	80009	670-4353-01
C100	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C101	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C103	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C108	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C110	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C112	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D151E700F0
C124	285-1097-00			CAP.,FXD,PLSTC:0.47UF,10%,100V	14752	230B1B474K
C125	283-0693-00			CAP.,FXD,MICA D:1730PF,1%,300V	00853	D19-3F1731F0
C126	290-0525-00			CAP.,FXD,ELCTLT:4.7UF,20%,50V	56289	196D475X0050KA1
C133	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039 E 105Z
C137	285-1050-00			CAP.,FXD,PLSTC:0.1UF,1%,200V	14752	230B1C104F
C138	283-0051-00			CAP.,FXD,CER DI:0.0033UF,5%,100V	72982	8131N145 A 332J
C140	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C146	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C148	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C153	283-0600-00	B010100	B019999	CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0
C153	283-0676-00	B020000		CAP.,FXD,MICA D:82PF,1%,500V	00853	D105E820F0
C155	290-0272-00			CAP.,FXD,ELCTLT:47UF,20%,50V	90201	TLS476M050B1B
C156	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C160	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C165	290-0272-00			CAP.,FXD,ELCTLT:47UF,20%,50V	90201	TLS476M050B1B
C168	283-0114-00			CAP.,FXD,CER DI:0.0015UF,5%,200V	72982	805-509B152J
C172	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C176	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C187	283-0204-00	B010100	B020286X	CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C218	283-0212-00			CAP.,FXD,CER DI:2UF,20%,50V	72982	8141N064Z5U0205M
C220	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C232	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C234	290-0134-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	150D226X0015B2
C242	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C244	290-0134-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	150D226X0015B2
C306	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C308	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C313	283-0077-00	B010100	B029999X	CAP.,FXD,CER DI:330PF,5%,500V	56289	40C94A3
C323	283-0077-00	B010100	B029999X	CAP.,FXD,CER DI:330PF,5%,500V	56289	40C94A3
C328	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C345	283-0600-00	B010100	B029999	CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0
C345	283-0615-00	B030000		CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C351	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C360	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C363	283-0615-00	B010100	B029999	CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C363	281-0158-00	B030000		CAP.,VAR,CER D1:7-45PF,50V	73899	DVJ-5006
C364	283-0210-00	B010100	B029999	CAP.,FXD,CER DI:5600PF,10%,100V	72982	8131N145W5R562M
C364	283-0639-00	B030000		CAP.,FXD,MICA D:56PF,1%,100V	00853	D151E560F0
C365	SELECTED	B010100	B029999			
C365	283-0212-00	B030000		CAP.,FXD,CER DI:2UF,20%,50V	72982	8141N064Z5U0205M
C366	283-0238-00	XB030000		CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N071W5R103K
C367	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C380	283-0625-00			CAP.,FXD,MICA D:220PF,1%,500V	00853	D105F221F0
C383	283-0600-00			CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C385	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C388	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C391	283-0615-00			CAP.,FXD,MICA D:33PF,5%,500V	00853	D155E330J0
C393	281-0593-00			CAP.,FXD,CER DI:3.9PF,10%,500V	72982	301-000C0J0399C
C394	281-0626-00			CAP.,FXD,CER DI:3.3PF,1%,500V	72982	301-000C0J0339B
C396	283-0629-00			CAP.,FXD,MICA D:62PF,1%,500V	00853	D105E620F0
C398	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C402	290-0334-00			CAP.,FXD,ELCTLT:1250UF,+75-10%,50V	56289	D46468
C406	290-0334-00			CAP.,FXD,ELCTLT:1250UF,+75-10%,50V	56289	D46468
C413	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C414	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039 E 105Z
C423	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C434	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C436	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C444	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C446	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075Z5U0103M
C452	290-0782-00	XB030000		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	56289	503D475G035AS
C462	290-0782-00	XB030000		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	56289	503D475G035AS
CR103	150-1001-00			LAMP,LED:RED,2V,100MA	28480	5082-4403
CR115	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR116	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR127	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR133	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR158	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR166	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR167	152-0585-00			SEMICOND DEVICE:SILICON,BRIDGE,75V,75MA	14936	W02M
CR168	150-1001-00			LAMP,LED:RED,2V,100MA	28480	5082-4403
CR175	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR226	152-0321-00			SEMICOND DEVICE:SILICON,35V,100MA	07263	FSA1480
CR320	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR380	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR383	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR386	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR402	152-0585-00			SEMICOND DEVICE:SILICON,BRIDGE,75V,75MA	14936	W02M
CR406	152-0585-00			SEMICOND DEVICE:SILICON,BRIDGE,75V,75MA	14936	W02M
CR452	152-0141-02	XB020000	B029999X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR462	152-0141-02	XB020000	B029999X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
DS190	150-0046-00			LAMP,INCAND:10V,0.04A	08806	2107D
DS192	150-0046-00			LAMP,INCAND:10V,0.04A	08806	2107D
F402	159-0064-00	B010100	B019999	FUSE,CARTRIDGE:1A,250V,10 SEC	75915	212001
F402	159-0107-00	B020000		FUSE,CARTRIDGE:2A,250V,10 SEC	75915	212002
F406	159-0064-00	B010100	B019999	FUSE,CARTRIDGE:1A,250V,10 SEC	75915	212001
F406	159-0107-00	B020000		FUSE,CARTRIDGE:2A,250V,10 SEC	75915	212002
J100	131-1315-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR235-1
J160	131-1003-00			CONNECTOR BODY,:CKT CD MT,3 PRONG	80009	131-1003-00
J202	131-1003-00			CONNECTOR BODY,:CKT CD MT,3 PRONG	80009	131-1003-00
J380	131-1003-00			CONNECTOR BODY,:CKT CD MT,3 PRONG	80009	131-1003-00
J480	131-1003-00			CONNECTOR BODY,:CKT CD MT,3 PRONG	80009	131-1003-00
L168	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L202	108-0853-00			COIL,RF:48.7UH,TOROIDAL	80009	108-0853-00
L380	108-0345-00			COIL,RF:1.9UF	80009	108-0345-00
L383	108-0345-00			COIL,RF:1.9UF	80009	108-0345-00

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Q115	151-1059-00			TRANSISTOR:SILICON,FE,N-CHANNEL	80009	151-1059-00
Q130	151-1059-00			TRANSISTOR:SILICON,FE,N-CHANNEL	80009	151-1059-00
Q155	151-0390-00			TRANSISTOR:SILICON,NPN	80009	151-0390-00
Q165	151-0391-00			TRANSISTOR:SILICON,PNP	04713	MPS-U95
Q180	151-0254-00			TRANSISTOR:SILICON,NPN	80009	151-0254-00
Q185	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q230A,B	151-1032-00			TRANSISTOR:SILICON,FET,DUAL	80009	151-1032-00
Q310	153-0609-00	B010100	B029999	SEMICOND DVC SE:SILICON,PNP	80009	153-0609-00
Q310A,B	151-0461-00	B030000		TRANSISTOR:SILICON,NPN,DUAL	80009	151-0461-00
Q315	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q320	153-0609-00	B010100	B029999X	SEMICOND DVC SE:SILICON,PNP	80009	153-0609-00
Q325	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q360	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q385	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q390	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q395	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q440	151-0347-00	XB020000		TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q450	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q460	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q470	151-0350-00	XB020000		TRANSISTOR:SILICON,PNP	80009	151-0350-00
R100	308-0243-00			RES.,FXD,WW:240 OHM,5%,3W	91637	CW2BB240R0J
R102	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R103	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R104	321-0162-00			RES.,FXD,FILM:475 OHM,1%,0.125W	91637	MFF1816G475R0F
R105	321-0162-00			RES.,FXD,FILM:475 OHM,1%,0.125W	91637	MFF1816G475R0F
R106	321-0354-00			RES.,FXD,FILM:47.5K OHM,1%,0.125W	91637	MFF1816G47501F
R108	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R110	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R112	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R113	321-0354-00			RES.,FXD,FILM:47.5K OHM,1%,0.125W	91637	MFF1816G47501F
R114	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R116	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R118	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R120	311-0580-00			RES.,VAR,NONWIR:50K OHM,20%,0.50W	11237	300SF-41695
R121	321-0200-00			RES.,FXD,FILM:1.18K OHM,1%,0.125W	91637	MFF1816G11800F
R122	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R123	321-0183-00			RES.,FXD,FILM:787 OHM,1%,0.125W	91637	MFF1816G787R0F
R124	315-0225-00			RES.,FXD,CMPSN:2.2M OHM,5%,0.25W	01121	CB2255
R126	315-0470-00	XB030000		RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R127	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R128	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R129	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	91637	MFF1816G499R0F
R130	315-0200-00	B010100	B019999	RES.,FXD,CMPSN:20 OHM,5%,0.25W	01121	CB2005
R130	315-0300-00	B020000		RES.,FXD,CMPSN:30 OHM,5%,0.25W	01121	CB3005
R132	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R133	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R134	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R136	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R137	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R138	321-0431-00			RES.,FXD,FILM:301K OHM,1%,0.125W	91637	MFF1816G30102F
R140	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R142	315-0241-00	B010100	B029999X	RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R145	321-0135-00	B010100	B019999	RES.,FXD,FILM:249 OHM,1%,0.125W	91637	MFF1816G249R0F

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R145	315-0241-00	B020000		RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R146	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R148	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R150	315-0243-00	B010100	B029999	RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R150	315-0123-00	B030000		RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R151	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R152	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R153	315-0243-00	B010100	B029999	RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
R153	315-0123-00	B030000		RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
R156	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R158	308-0441-00			RES.,FXD,WW:3 OHM,5%,3W	91637	RS2B-D3R000J
R159	322-0292-00			RES.,FXD,FILM:10.7K OHM,0.25%,0.25W	91637	MFF1421G10701F
R160	321-0181-00			RES.,FXD,FILM:750 OHM,1%,0.125W	91637	MFF1816G750R0F
R162	322-0292-00			RES.,FXD,FILM:10.7K OHM,0.25%,0.25W	91637	MFF1816G10701F
R166	308-0441-00			RES.,FXD,WW:3 OHM,5%,3W	91637	RS2B-D3R000J
R168	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R169	315-0620-00			RES.,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
R172	308-0243-00			RES.,FXD,WW:240 OHM,5%,3W	91637	CW2BB240R0J
R174	315-0822-00	B010100	B020286X	RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R175	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R176	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
R181	302-0271-00			RES.,FXD,CMPSN:270 OHM,10%,0.50W	01121	EB2711
R182	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R183	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R185	315-0512-00	B010100	B020286X	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R187	315-0512-00	B010100	B020286X	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R189	302-0271-00			RES.,FXD,CMPSN:270 OHM,10%,0.50W	01121	EB2711
R202	321-0040-00			RES.,FXD,FILM:25.5 OHM,1%,0.125W	91637	MFF1816G25R50F
R204	307-1040-00			TERM,THK FILM:50 OHM	80009	307-1040-00
R206	307-1020-00			ATTENUATOR,FXD:50 OHM,2X	80009	307-1020-00
R208	307-1020-00			ATTENUATOR,FXD:50 OHM,2X	80009	307-1020-00
R210	307-1023-00			ATTENUATOR,FXD:50 OHM,5X	80009	307-1023-00
R212	307-1024-00			ATTENUATOR,FXD:50 OHM,10X	80009	307-1024-00
R214	307-1024-00			ATTENUATOR,FXD:50 OHM,10X	80009	307-1024-00
R216	307-1040-00			TERM,THK FILM:50 OHM	80009	307-1040-00
R220	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R222	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R224	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R232	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R234	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
R236	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	91637	MFF1816G20R00F
R242	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R244	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
R246	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	91637	MFF1816G20R00F
R300	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R302	311-0546-00			RES.,VAR,NONWIR:10K OHM,20%,0.75W	80009	311-0546-00
R304	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R306	321-0243-00	B010100	B029999	RES.,FXD,FILM:3.32K OHM,1%,0.125W	91637	MFF1816G33200F
R306	321-0279-00	B030000		RES.,FXD,FILM:7.87K OHM,1%,0.125W	91637	MFF1816G78700F
R308	321-0032-00	B010100	B029999	RES.,FXD,FILM:21 OHM,1%,0.125W	91637	MFF1816G21R00F
R308	321-0068-00	B030000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R311	322-0172-00	XB030000		RES.,FXD,FILM:604 OHM,1%,0.25W	75042	CEBT0-6040F
R312	321-0111-00			RES.,FXD,FILM:140 OHM,1%,0.125W	91637	MFF1816G140R0F

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R313	315-0151-00	B010100	B029999	RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R313	321-0068-00	B030000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R314	321-0111-00			RES.,FXD,FILM:140 OHM,1%,0.125W	91637	MFF1816G140R0F
R315	308-0553-00			RES.,FXD,W:680 OHM,1%,3W	14193	SA30-0680F
R317	321-0010-00	B010100	B029999	RES.,FXD,FILM:12.4 OHM,1%,0.125W	91637	MFF1816G12R40F
R317	321-0068-00	B030000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R321	322-0172-00	XB030000		RES.,FXD,FILM:604 OHM,1%,0.25W	75042	CEBT0-6040F
R323	315-0151-00	B010100	B029999	RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R323	321-0068-00	B030000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R326	321-0216-00	B010100	B029999	RES.,FXD,FILM:1.74K OHM,1%,0.125W	91637	MFF1816G17400F
R326	315-0821-00	B030000		RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
R327	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	91637	MFF1816G32400F
R328	317-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.125W	01121	BB6805
R330	322-0662-00	B010100	B029999	RES.,FXD,FILM:334 OHM,1%,0.25W	75042	CEBT0-3340F
R330	321-0140-00	B030000		RES.,FXD,FILM:280 OHM,1%,0.125W	91637	MFF1816G280R0F
R332	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R332	321-0097-00	B030000		RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R334	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R334	321-0097-00	B030000		RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R335	322-0109-00			RES.,FXD,FILM:133 OHM,1%,0.25W	91637	MFF1421G133R0F
R336	321-0111-00			RES.,FXD,FILM:140 OHM,1%,0.125W	91637	MFF1816G140R0F
R338	321-0111-00			RES.,FXD,FILM:140 OHM,1%,0.125W	91637	MFF1816G140R0F
R340	315-0121-00			RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R344	311-1260-00			RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R345	311-1259-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3329P-L58-101
R346	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R347	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R349	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R351	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R352	321-0173-00			RES.,FXD,FILM:619 OHM,1%,0.125W	91637	MFF1816G619R0F
R353	322-0167-00			RES.,FXD,FILM:536 OHM,1%,0.25W	91637	MFF1421G536R0F
R354	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R355	322-0109-00			RES.,FXD,FILM:133 OHM,1%,0.25W	91637	MFF1421G133R0F
R356	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R357	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R358	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R360	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R361	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R362	301-0131-00			RES.,FXD,CMPSN:130 OHM,5%,0.50W	01121	EB1315
R363	311-1263-00	B010100	B029999	RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R363	311-1260-00	B030000		RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R364	311-1265-00			RES.,VAR,NONWIR:2K OHM,10%,0.50W	32997	3329P-L58-202
R365	315-0222-00	XB030000		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R366	315-0911-00	XB030000		RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R367	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R368	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R370	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R372	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	91637	MFF1816G665R0F
R373	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R374	321-0176-00			RES.,FXD,FILM:665 OHM,1%,0.125W	91637	MFF1816G665R0F
R376	321-0130-00			RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
R377	323-0185-00			RES.,FXD,FILM:825 OHM,1%,0.50W	75042	CECT0-8250F
R380	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F

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R382	301-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.50W	01121	EB6815
R383	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	91637	MFF1816G100R0F
R384	301-0681-00			RES.,FXD,CMPSN:680 OHM,5%,0.50W	01121	EB6815
R386	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R387	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R388	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	01121	CB8225
R390	322-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.25W	75042	CEBT0-1581F
R391	321-0068-00	B010100	B020286	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	MFF1816G49R90F
R391	321-0066-00	B020287		RES.,FXD,FILM:47.5 OHM,1%,0.125W	91637	MFF1816G47R50F
R392	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R393	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R394	321-0135-00			RES.,FXD,FILM:249 OHM,1%,0.125W	91637	MFF1816G249R0F
R395	323-0183-00			RES.,FXD,FILM:787 OHM,1%,0.50W	75042	CECT0-7870F
R396	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R397	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R398	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R399	321-0078-01			RES.,FXD,FILM:63.4 OHM,0.5%,0.125W	91637	MFF1816G63R40D
R403	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R404	321-0380-00			RES.,FXD,FILM:88.7K OHM,1%,0.125W	91637	MFF1816G88701F
R405	311-1271-00			RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R406	321-0377-00			RES.,FXD,FILM:82.5K OHM,1%,0.125W	91637	MFF1816G82501F
R407	317-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.125W	01121	BB1015
R412	308-0755-00	B010100	B019999	RES.,FXD,WW:0.75 OHM,5%,2W	75042	BWH-R7500J
R412	308-0679-00	B020000		RES.,FXD,WW:0.51 OHM,5%,2W	75042	BWH-R5100J
R414	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
R415	311-1268-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R416	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
R422	308-0755-00	B010100	B019999	RES.,FXD,WW:0.75 OHM,5%,2W	75042	BWH-R7500J
R422	308-0679-00	B020000		RES.,FXD,WW:0.51 OHM,5%,2W	75042	BWH-R5100J
R432	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R436	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R442	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R446	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
R452	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R454	315-0471-00	B010100	B019999	RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R454	315-0430-02	B020000		RES.,FXD,CMPSN:43 OHM,5%,0.25W	01121	CB4305
R462	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R464	315-0471-00	B010100	B019999	RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R464	315-0430-02	B020000		RES.,FXD,CMPSN:43 OHM,5%,0.25W	01121	CB4305
R480	323-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.50W	75042	CECT0-49R90F
RT135	307-0122-00			RES.,THERMAL:50 OHM,10%	50157	3D1515
RT156	307-0126-00			RES.,THERMAL:100 OHM,10%	14193	2D21-101K
RT160	307-0126-00			RES.,THERMAL:100 OHM,10%	14193	2D21-101K
RT342	307-0126-00			RES.,THERMAL:100 OHM,10%	14193	2D21-101K
S125	260-1421-00			SWITCH,PUSH:1 STA,MOMENTARY,NON-SHORT	80009	260-1421-00
S200A	263-1111-00			DRUM ASSY,CAM S:ATTENUATOR DRUM TYPE	80009	263-1111-00
S200B	105-0243-00			ACTUATOR,SWITCH:	80009	105-0243-00
S370	260-0816-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF-126-0012A
U110	156-0317-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFLIER	34371	HA2-2625-5
U135	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U145	156-0317-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFLIER	34371	HA2-2625-5
U350	155-0078-11			MICROCIRCUIT,LI:VERTICAL AMPL	80009	155-0078-11
U370	155-0078-11			MICROCIRCUIT,LI:VERTICAL AMPL	80009	155-0078-11

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U410	156-0208-00			MICROCIRCUIT,LI:DUAL TRACKING VOLTAGE REG	34333	SG8195
VR100	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	07910	1N4372A
VR103	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	07910	1N4372A
VR166	152-0306-00			SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	81483	1N960B
VR167	152-0306-00			SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	81483	1N960B
VR172	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	07910	1N4372A
VR187	152-0226-00	B010100	B020286X	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR380	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	07910	1N4372A
VR452	152-0304-00	B010100	B029999	SEMICOND DEVICE:ZENER,0.4W,20V,5%	04713	1N968B
VR452	152-0680-00	B030000		SEMICOND DEVICE:ZENER,0.4W,19.3V.1%	80009	152-0680-00
VR462	152-0304-00	B010100	B029999	SEMICOND DEVICE:ZENER,0.4W,20V,5%	04713	1N968B
VR462	152-0680-00	B030000		SEMICOND DEVICE:ZENER,0.4W,19.3V.1%	80009	152-0680-00
W452	131-0566-00	XB030000		LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	L-2007-1
W462	131-0566-00	XB030000		LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	L-2007-1

OPTIONS

No options were available for this instrument at the time of this printing.

Information on any subsequent options may be found in the CHANGE INFORMATION section in the back of this manual.

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

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

Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μs).

Resistors = Ohms (Ω).

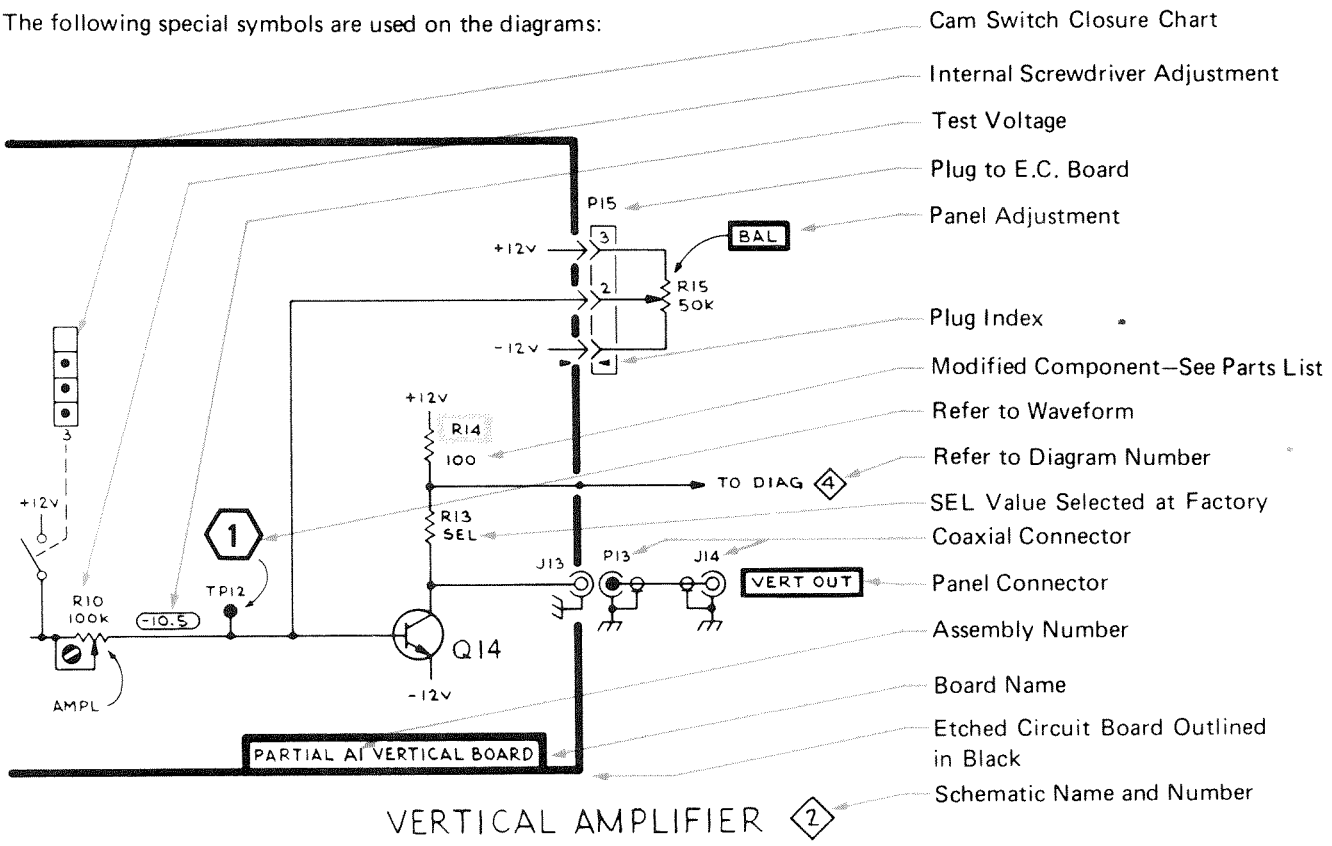
Symbols used on the diagrams are based on ANSI Standard Y32.2-1975.

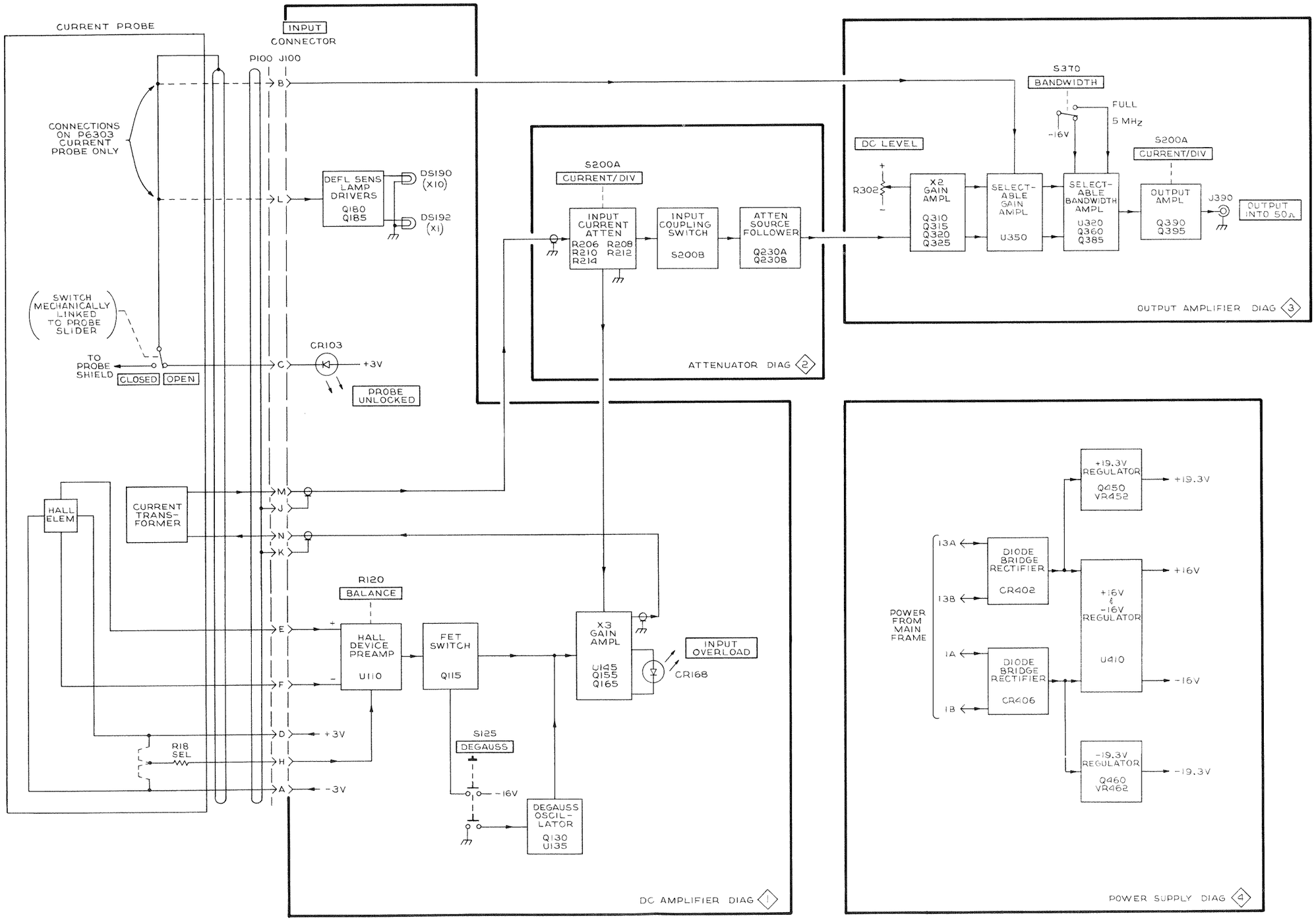
Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

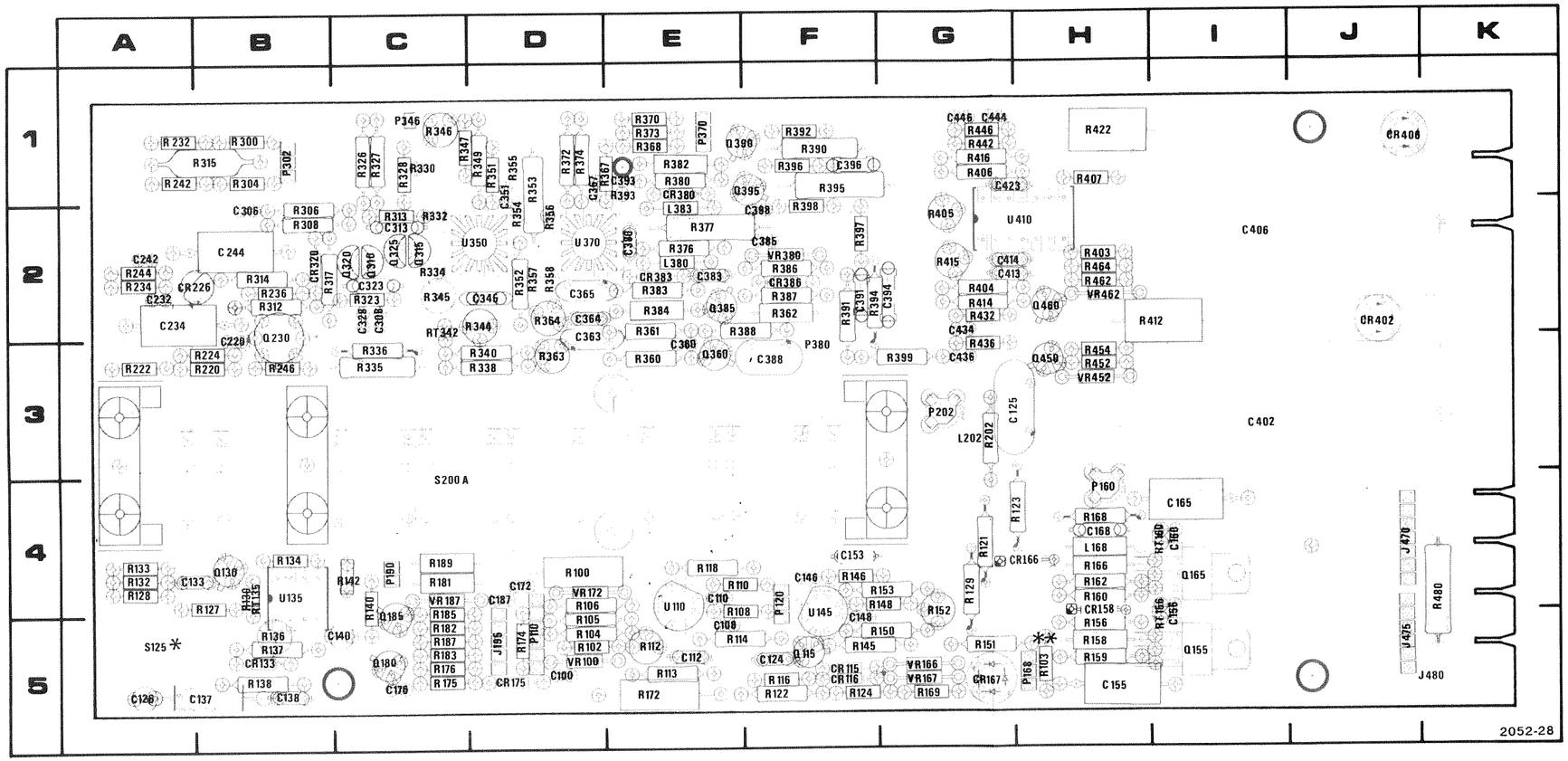
A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	RT	Thermistor
AT	Attenuator, fixed or variable	HR	Heater	S	Switch
B	Motor	HY	Hybrid circuit	T	Transformer
BT	Battery	J	Connector, stationary portion	TC	Thermocouple
C	Capacitor, fixed or variable	K	Relay	TP	Test point
CB	Circuit breaker	L	Inductor, fixed or variable	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	V	Electron tube
DL	Delay line	M	Meter	VR	Voltage regulator (zener diode, etc.)
DS	Indicating device (lamp)	P	Connector, movable portion	Y	Crystal
E	Spark Gap	Q	Transistor or silicon-controlled rectifier	Z	Phase shifter
F	Fuse	R	Resistor, fixed or variable		
FL	Filter				

The following special symbols are used on the diagrams:





AM503 @ BLOCK DIAGRAM



CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C100	5D	P110	5D	R128	4A	R182	5C
C108	5E	P120	4F	R129	4G	R183	5C
C110	4E	P160	4H	R130	4B	R185	5C
C112	5E	P168	5H	R132	4A	R187	5C
C124	5F	P190	4C	R133	4A	R189	4C
C125	3G			R134	4B		
C126	5A	Q115	5F	R136	5B	RT135	4B
C133	4A	Q130	4B	R137	5B	RT156	5I
C137	5B	Q155	5I	R138	5B	RT160	4I
C138	5B	Q165	4I	R140	4G		
C140	5C	Q180	5C	R142	4C	S125	5A
C146	4F	Q185	5C	R145	5F		
C148	5F			R146	4F	U110	4E
C153*	4G	R100	4D	R148	4F	U135	4B
C155	5H	R102	5D	R150	5G	U145	5F
C156	5I	R103	5H	R151	5G		
C160	4I	R104	5D	R152	5G	VR100	5D
C165	4I	R105	5D	R153	4G	VR166	5G
C168	4H	R106	4D	R156	5H	VR167	5G
C172	4D	R108	5E	R158	5H	VR172	4D
C176	5C	R110	4E	R159	5H	VR187	4C
C187	4D	R112	5E	R160	4H		
CR115	5F	R113	5E	R162	4H		
CR116	5F	R114	5E	R166	4H		
CR133	5B	R116	5F	R168	4H		
CR158*	4H	R118	4E	R169	5G		
CR166*	4H	R121	4G	R172	5E		
CR167	5G	R122	5F	R174	5D		
CR175	5D	R123	4G	R175	5C		
J195	5D	R124	5F	R176	5C		
L168	4H	R127	4B	R181	4C		

*CR127 is located on back of board.

**VR103 is located on back of board.

Figure 9-1. A1—Amplifier circuit board with locations of components on schematic 1.

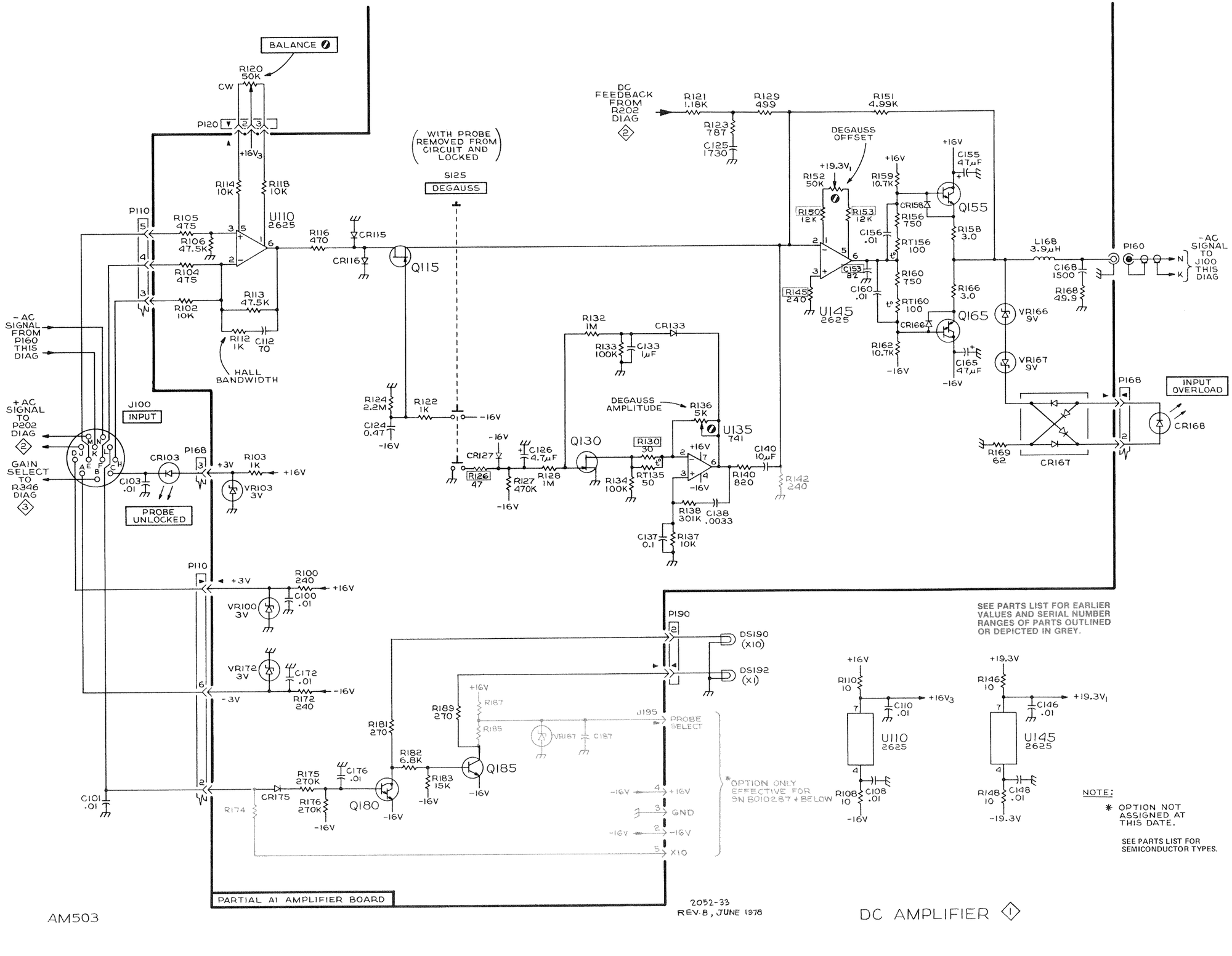
CONDITIONS USED TO MEASURE DC VOLTAGES ON SCHEMATICS

Probe not connected to input.

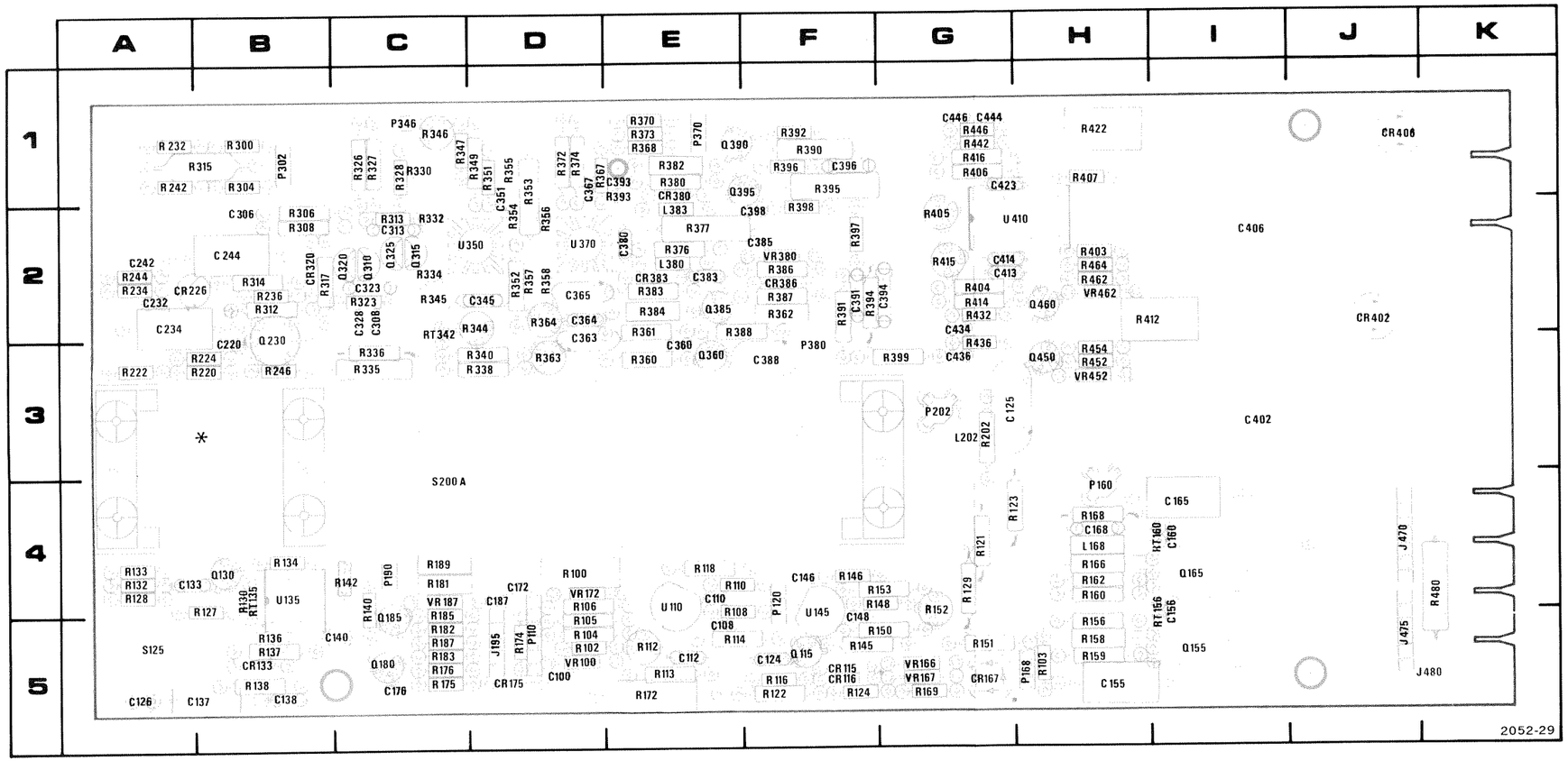
Bandwidth set to full.

AC-CAL DC Level—DC set to CAL DC LEVEL.

Set voltage at output to zero volts (into 50 ohms) with DC Level control.


BALANCE
R120 50K
CW
P120
+16V3
R114 10K
R118 10K
P110
R105 475
R106 47.5K
R104 475
R102 10K
U110 2625
R116 470
CR115
CR116
Q115
R113 47.5K
R112 1K
C112 70
HALL BANDWIDTH
WITH PROBE REMOVED FROM CIRCUIT AND LOCKED
S125
DEGAUSS
DC FEEDBACK FROM R202 DIAG 2
R121 1.18K
R123 787
C125 1730
R129 499
R151 4.99K
DEGAUSS OFFSET
+19.3V1
R152 50K
R150 12K
R153 12K
U145 2625
R145 240
C153 82
C156 .01
C160 .01
+16V
R159 10.7K
CR158
R156 750
RT156 100
R160 750
RT160 100
CR166
R162 10.7K
-16V
C155 47µF
Q155
R158 3.0
R166 3.0
Q165
C165 47µF
L168 3.9µH
C168 1500
R168 49.9
P160
-AC SIGNAL TO J100 THIS DIAG
N
K
VR166 9V
VR167 9V
P168
INPUT OVERLOAD
CR168
R169 62
CR167
-AC SIGNAL FROM P160 THIS DIAG
+AC SIGNAL TO P202 DIAG 2
GAIN SELECT TO R346 DIAG 3
J100
INPUT
CR103
C103 .01
P168
+3V
R103 1K
+16V
VR103 3V
PROBE UNLOCKED
R124 2.2M
C124 0.47
-16V
R122 1K
R132 1M
R133 100K
C133 1µF
CR133
DEGAUSS AMPLITUDE
R136 5K
U135 741
Q130
R130 30
RT135 50
R134 100K
C126 4.7µF
CR127
R126 47
R127 470K
R128 1M
R138 301K
C138 .0033
C137 0.1
R137 10K
C140 10µF
R140 820
R142 240
P110
+3V
R100 240
+16V
VR100 3V
C100 .01
VR172 3V
C172 .01
-3V
R172 240
-16V
P190
DS190 (X10)
DS192 (X1)
+16V
R187
R189 270
R185
VR187
C187
R181 270
R182 6.8K
R183 15K
Q185
J195
PROBE SELECT
C101 .01
R175 270K
C176 .01
CR175
R176 270K
Q180
R174
-16V
+16V
GND
-16V
X10
*OPTION ONLY EFFECTIVE FOR SN B010287 + BELOW
R110 10
C110 .01
U110 2625
R108 10
C108 .01
+19.3V
R146 10
C146 .01
+19.3V1
U145 2625
R148 10
C148 .01
-19.3V
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
NOTE:
* OPTION NOT ASSIGNED AT THIS DATE.
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.
PARTIAL A1 AMPLIFIER BOARD
2052-33
REV.B, JUNE 1978
AM503
DC AMPLIFIER 1
DC AMPLIFIER 1

COMPONENT LOCATIONS ◇2



CKT NO	GRID COORD	CKT NO	GRID COORD
C220	3B	R202	3G
C232	2A	R220	3B
C234	2A	R222	3A
C242	2A	R224	3B
C244	2B	R232	1A
		R234	2A
CR226	2A	R236	2B
		R242	1A
L202	3G	R244	2A
P202	3G	S200A	4C
		S200B	4C
Q230	2B		

*C218 is located on back of board.

Figure 9-2. A1—Amplifier circuit board with locations of components on schematic ◇2.

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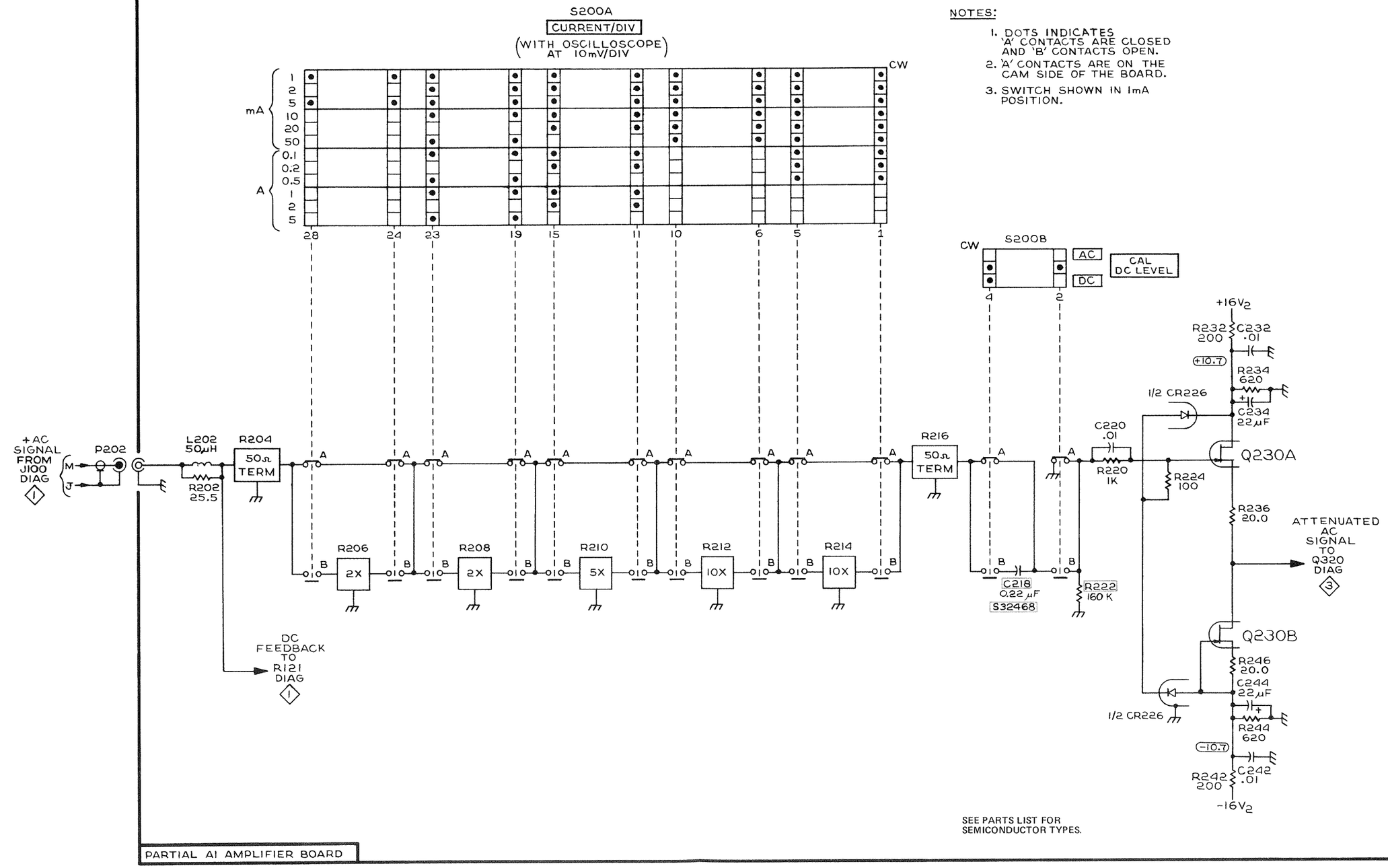
VOLTAGE & WAVEFORM CONDITIONS



NOTES:

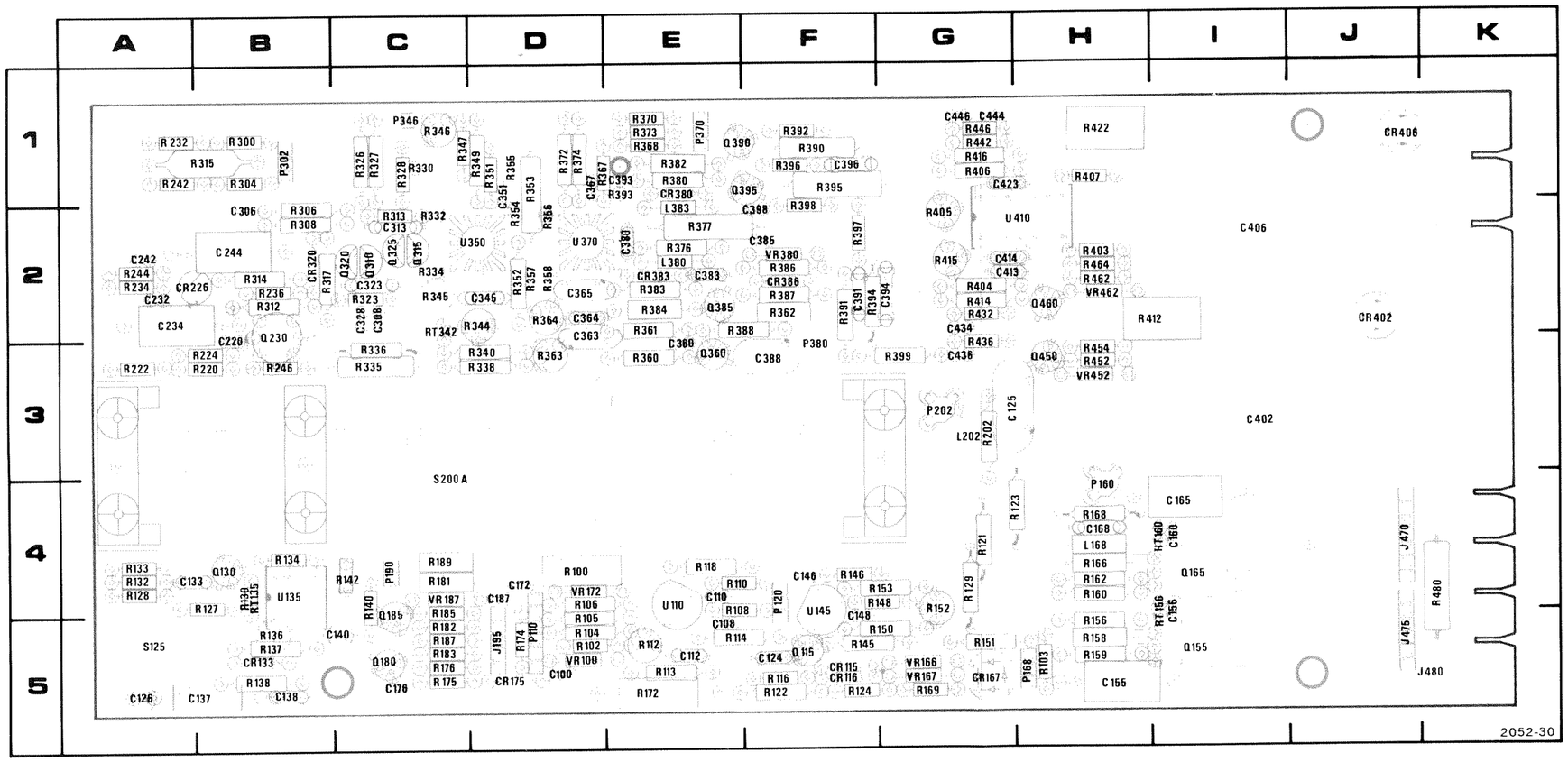
1. DOTS INDICATES 'A' CONTACTS ARE CLOSED AND 'B' CONTACTS OPEN.
2. 'A' CONTACTS ARE ON THE CAM SIDE OF THE BOARD.
3. SWITCH SHOWN IN 1mA POSITION.

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

PARTIAL A1 AMPLIFIER BOARD

ATTENUATOR 2

LIC	
B16	P1



COMPONENT LOCATIONS ◇3

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C306	2B	Q395	1F	R368	1E
C308	2C			R370	1E
C313	2C	R300	1B	R372	1D
C323	2C	R304	1B	R373	1E
C328	2C	R306	2B	R374	1D
C345	2D	R308	2B	R376	2E
C351	1D	R312	2B	R377	2E
C360	3E	R313	2C	R380	1E
C363	2D	R314	2B	R382	1E
C364	2D	R315	1B	R383	2E
C365	2D	R317	2B	R384	2E
C367	1D	R323	2C	R386	2F
C380	2E	R326	1C	R387	2F
C383	2E	R327	1C	R388	2F
C385	2F	R328	1C	R390	1F
C388	3F	R330	1C	R391	2F
C391	2F	R332	2C	R392	1F
C393	1E	R334	2C	R393	1E
C394	2G	R335	3C	R394	2F
C396	1F	R336	3C	R395	1F
C398	2F	R338	3D	R396	1F
		R340	3D	R397	2F
CR320	2B	R344	2D	R398	2F
CR380	1E	R345	2C	R399	3G
CR383	2E	R346	1C		
CR386	2F	R347	1C	RT342	2C
		R349	1D		
L380	2E	R351	1D	U350	2D
L383	2E	R352	2D	U370	2D
		R353	1D		
P346	1C	R354	2D	VR380	2F
P370	1E	R355	1D		
P380	3F	R356	2D		
		R357	2D		
Q310	2C	R358	2D		
Q315	2C	R360	3E		
Q320	2C	R361	2E		
Q325	2C	R362	2F		
Q360	3E	R363	3D		
Q385	2E	R364	2D		
Q390	1E	R367	1D		

Figure 9-3. A1—Amplifier circuit board with locations of components on schematic ◇3.

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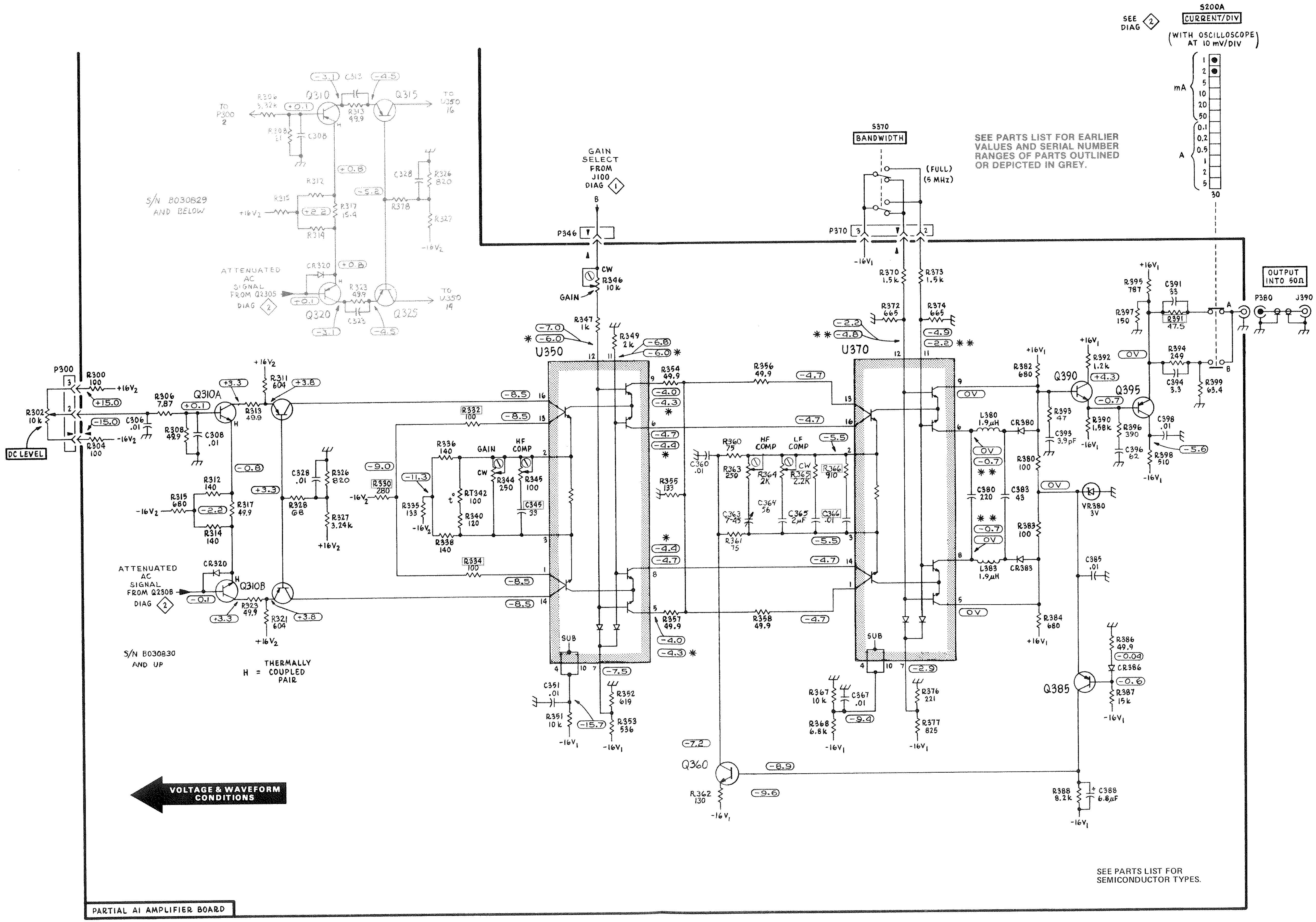


2052-35
REV. B, JUL 1978

OUTPUT AMPLIFIER 3

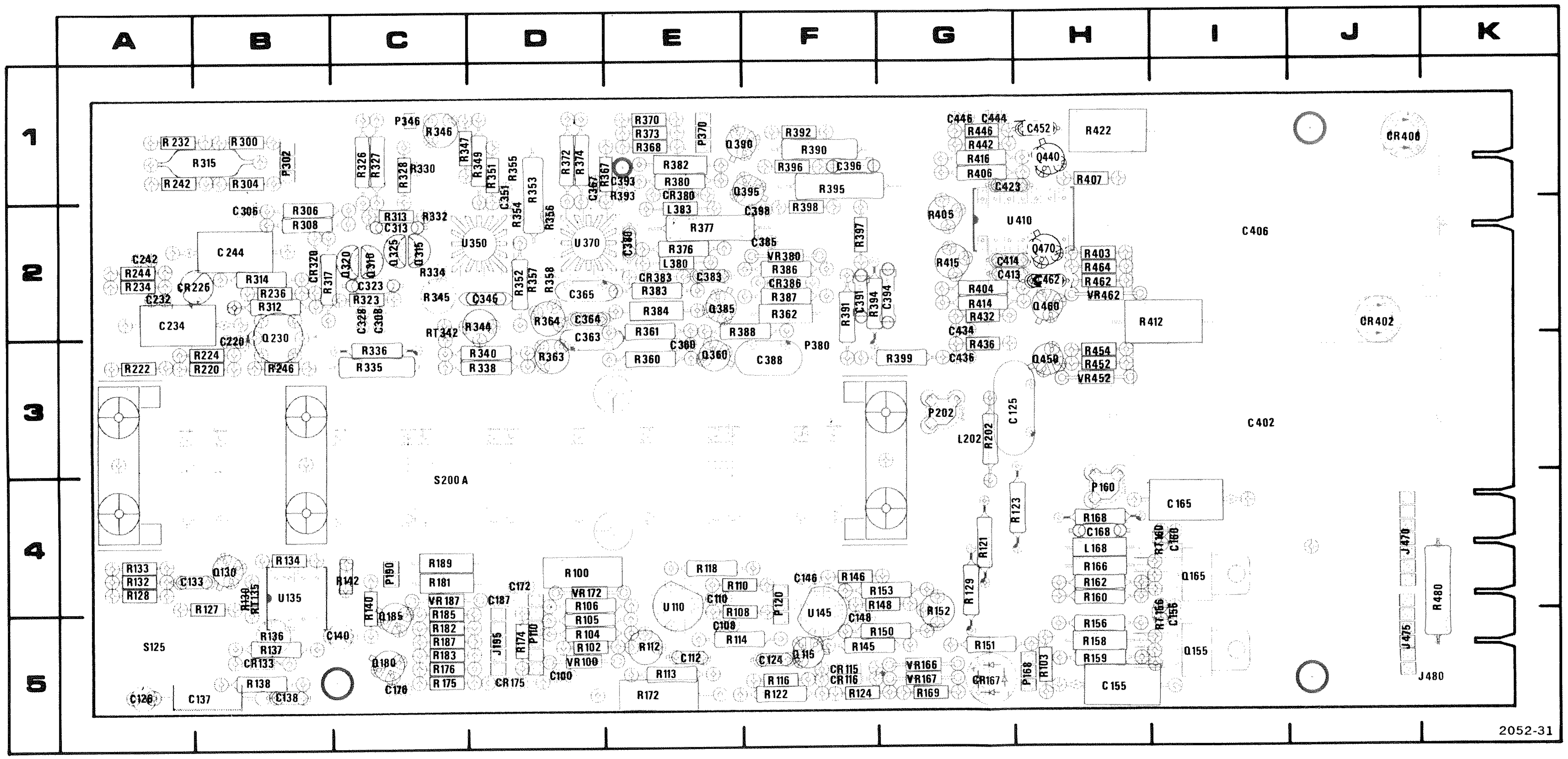
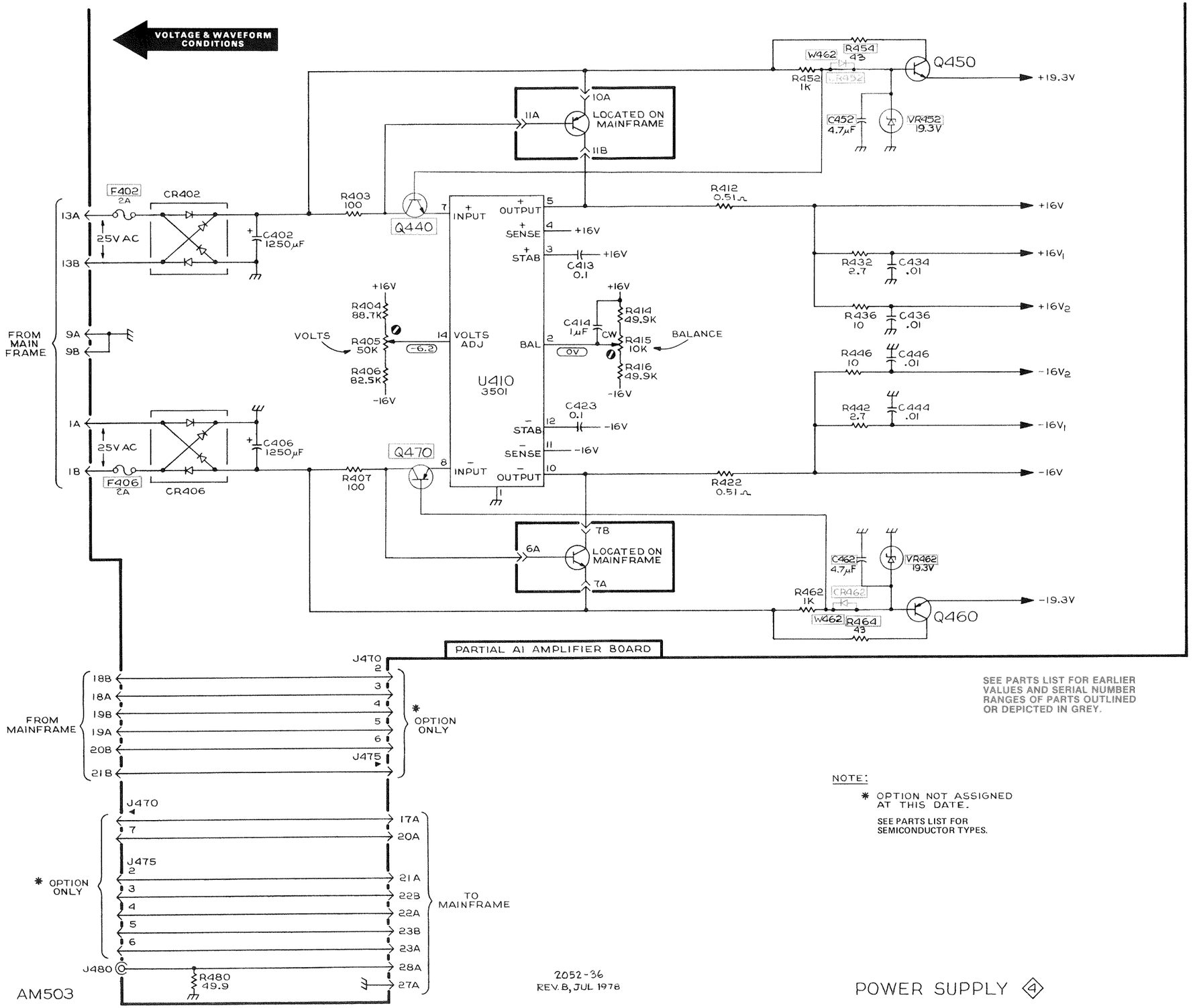


Figure 9-4. A1—Amplifier circuit board with locations of components on schematic ⟨4⟩.

CKT NO	GRID COORD	CKT NO	GRID COORD	CKT NO	GRID COORD
C402	3I	R403	2H	R480	4K
C406	2I	R404	2G		
C413	2G	R405	2G	U410	2H
C414	2G	R406	1G		
C423	1G	R407	1H	VR452	3H
C434	2G	R412	2I	VR462	2H
C436	3G	R414	2G		
C444	1G	R415	2G		
C446	1G	R415	2G		
C452*	1H	R416	1G		
C462*	2H	R422	1H		
		R432	2G		
CR402	2J	R436	3G		
CR406	1J	R442	1G		
		R446	1G		
J470	4J	R452	3H		
J475	5J	R454	3H		
J480	5K	R462	2H		
Q440*	1H	R464	2H		
Q450	3H				
Q460	2H				
Q470*	2H				



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

NOTE:

* OPTION NOT ASSIGNED AT THIS DATE.

SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

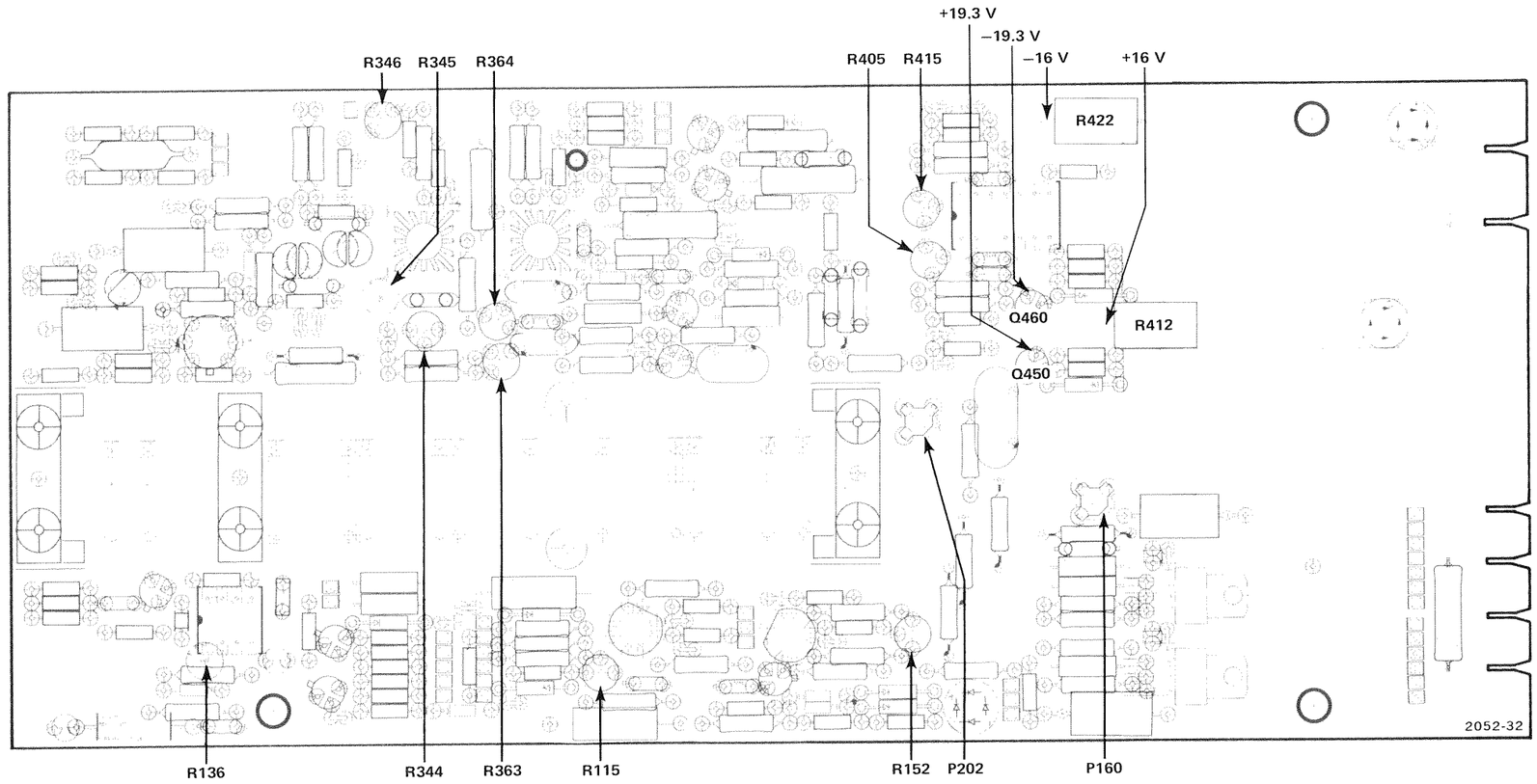


Figure 9-5. Adjustment & test point locations.

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.

SPECIAL NOTES AND SYMBOLS

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

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.

ABBREVIATIONS

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

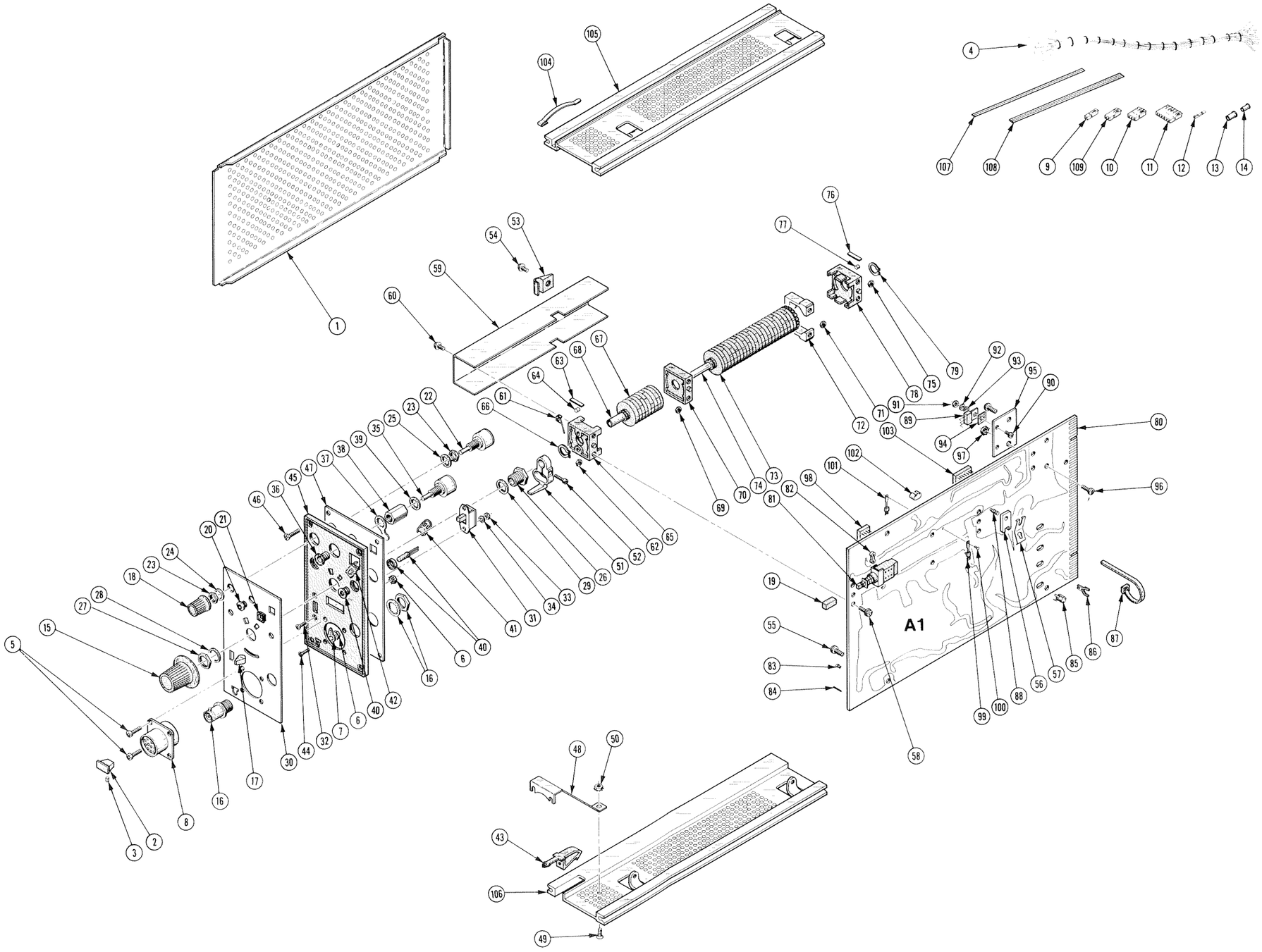
CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02660	BUNKER RAMO CORP., CONNECTOR DIVISION	2801 S 25TH AVENUE	BROADVIEW, IL 60153
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
18203	ENGELMANN MICROWAVE CO.	SKYLINE DR.	MONTVILLE, NJ 07045
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
42838	NATIONAL RIVET AND MFG. CO.	1-21 EAST JEFFERSON ST.	WAUPUN, WI 53963
45722	USM CORP., PARKER-KALON FASTENER DIV.		CAMPBELLSVILLE, KY 42718
55210	GETTIG ENG. AND MFG. COMPANY	PO BOX 85, OFF ROUTE 45	SPRING MILLS, PA 16875
70278	ALLIED STEEL AND CONVEYORS, DIV. OF SPARTON CORP.	17333 HEALY	DETROIT, MI 48212
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
78471	TILLEY MFG. CO.	900 INDUSTRIAL RD.	SAN CARLOS, CA 94070
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
86928	SEASTROM MFG. COMPANY, INC.	701 SONORA AVENUE	GLENDALE, CA 91201
95987	WECKESSER CO., INC.	4444 WEST IRVING PARK RD.	CHICAGO, IL 60641

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	337-1399-04			2		SHIELD,ELEC:SIDE	80009	337-1399-04
-2	366-1286-04			1		KNOB:LATCH	80009	366-1286-04
						(ATTACHING PARTS)		
-3	214-1840-00			1		PIN,KNOB SECRG:0.094 OD X 0.120 INCH LONG	80009	214-1840-00
						- - - * - - -		
-4	179-2415-00			1		WIRING HARNESS,:PROBE SIGNAL AND BIAS	80009	179-2415-00
						(ATTACHING PARTS)		
-5	211-0012-00			4		SCREW,MACHINE:4-40 X 0.375 INCH,PNH STL	83385	OBD
-6	210-0586-00			4		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
-7	210-0261-00			1		TERMINAL,LUG:0.270 INCH DIA,SE	80009	210-0261-00
						- - - * - - -		
	----- -----			-		. HARNESS ASSEMBLY INCLUDES:		
-8	131-1855-00			1		. CONN,RCPT,ELEC:165 SERIES,12 FEMALE CONT	02660	165-12
-9	352-0171-00			1		. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
-10	352-0161-00			1		. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
-11	352-0164-00			1		. CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0164-00
-12	131-0707-00			10		. CONTACT,ELEC:0.48" L,22-26 AWG WIRE	22526	75691-005
-13	210-0774-00			2		. EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
-14	210-0775-00			2		. EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00
-15	366-1669-00			1		KNOB:GRAY,0.189 IDX 0.72 OD,0.79H	80009	366-1669-00
	213-0153-00			2		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-16	----- -----			1		CONNECTOR,RCPT:(SEE J100 EPL)		
-17	366-0215-05			1		KNOB:LEVER SWITCH	80009	366-0215-05
-18	366-0494-05			1		KNOB:GRAY,0.127 IDX 0.5 OD,0.531H	80009	366-0494-05
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-19	366-1559-00			1		PUSH BUTTON:GRAY	80009	366-1559-00
-20	358-0301-02			1		BUSHING,SLEEVE:GRAY PLASTIC	80009	358-0301-02
-21	426-1072-00			1		FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-22	----- -----			1		RESISTOR,VAR:(SEE R302 EPL)		
						(ATTACHING PARTS)		
-23	210-0583-00			2		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-24	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
-25	210-0046-00			1		WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
						- - - * - - -		
-26	358-0029-05			1		BSHG,MACH THD:0.274 ID X 0.438"L,NP BRS	80009	358-0029-05
						(ATTACHING PARTS)		
-27	220-0495-00			1		NUT,PLAIN,HEX.:0.375-32 X 0.438 INCH BRS	73743	OBD
-28	210-0978-00			1		WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
-29	210-0012-00			1		WASHER,LOCK:INTL,0.375 ID X 0.50" OD STL	78189	1220-02-00-0541C
						- - - * - - -		
-30	333-2131-00			1		PANEL,FRONT:	80009	333-2131-00
-31	----- -----			1		SWITCH,SLIDE:(SEE S370 EPL)		
						(ATTACHING PARTS)		
-32	211-0030-00			2		SCREW,MACHINE:2-56 X 0.25"82 DEG,FLH STL	83385	OBD
-33	220-0627-00			2		NUT,PLAIN,HEX.:2-56 X 0.156 INCH,BRS	73743	10002-56-101
-34	210-0001-00			2		WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL	78189	1202-00-00-0541C
						- - - * - - -		
-35	----- -----			1		RESISTOR,VAR:(SEE R120 EPL)		
						(ATTACHING PARTS)		
-36	358-0409-00			1		BSHG,MACH.THD:0.25-32 X 0.159 ID X 0.24	80009	358-0409-00
-37	210-0223-00			1		TERMINAL,LUG:0.25 INCH DIA,SE	86928	A313-136
-38	210-0471-00			1		NUT,SLEEVE:HEX.,0.312 X 0.594 INCH LONG	80009	210-0471-00
-39	210-0046-00			1		WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
						- - - * - - -		
-40	----- -----			2		LAMP,LED:(SEE CR168,CR103 EPL)		
-41	337-1430-00			2		SHIELD,LIGHT:LAMP	80009	337-1430-00
-42	378-0703-00			2		LENS,LIGHT:HOLDER,CLEAR	80009	378-0703-00
-43	214-1513-01			1		LCH,PLUG-IN RET:	80009	214-1513-01
						(ATTACHING PARTS)		
-44	213-0254-00			1		SCR,TPG,THD CTG:2-32 X 0.250,100 DEG,FLH	45722	OBD
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-45	386-3501-00			1		SUBPANEL,FRONT:AM503	80009	386-3501-00
						(ATTACHING PARTS)		
-46	213-0229-00			4		SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH STL	83385	OBD
						- - - * - - -		
-47	337-2292-00			1		SHIELD,ELEC:FRONT PANEL	80009	337-2292-00
-48	337-2369-00			1		SHIELD,ELEC:CONNECTOR	80009	337-2369-00
						(ATTACHING PARTS)		
-49	211-0101-00			1		SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
-50	210-0586-00			1		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-51	105-0243-00			1		ACTUATOR,SWITCH:	80009	105-0243-00
						(ATTACHING PARTS)		
-52	213-0214-00			1		SCREW,CAP SCH:2-56 X 0.375"HEX HD STL	70278	OBD
						- - - * - - -		
-53	343-0081-00			2		STRAP,RETAINING:	95987	3-16H
						(ATTACHING PARTS FOR EACH)		
-54	211-0207-00			1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
	672-0574-00			1		CKT CARD ASSY:ATTENUATOR,W/CAM SWITCH	80009	672-0574-00
						(ATTACHING PARTS)		
-55	213-0146-00			4		SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
	210-0801-01			3		WASHER,FLAT:0.140 ID X 0.281" OD,STL	12327	OBD
						- - - * - - -		
	131-0963-00			1		CONTACT,ELEC:GROUNDING	80009	131-0963-00
	----- -----			-		. CKT CARD ASSY INCLUDES:		
-56	----- -----			6		. ATTENUATOR,FXD:(SEE R206,R208,R210,R212,		
	----- -----			-		. R214 AND R216 EPL)		
-57	344-0248-00			7		. CLIP,ATTENUATOR:	80009	344-0248-00
	263-1111-00			1		. DRUM ASSY,CAM S:ATTENUATOR(SEE S200A EPL)		
						(ATTACHING PARTS)		
-58	211-0116-00			8		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
						- - - * - - -		
	----- -----			-		. . DRUM ASSEMBLY INCLUDES:		
-59	200-1950-00			1		. . COVER,CAM SW:5.625 L X 0.876 H,AL	80009	200-1950-00
						(ATTACHING PARTS)		
-60	211-0207-00			6		. . SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-61	131-0963-00			1		. . CONTACT,ELEC:GROUNDING	80009	131-0963-00
-62	210-0406-00			3		. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-63	214-1139-03			2		. . SPRING,FLAT:RED COLORED	80009	214-1139-03
-64	214-1752-00			2		. . ROLLER,DETENT:	80009	214-1752-00
-65	401-0180-00			1		. . BEARING,CAM SW:FRONT	80009	401-0180-00
						(ATTACHING PARTS)		
-66	354-0390-00			1		. . RING,RETAINING:0.338 ID X 0.025" THK,STL	79136	5100-37MD
						- - - * - - -		
-67	105-0716-00			1		. . DRUM ASSY,CAM S:AC-DC DRUM TYPE	80009	105-0716-00
-68	384-0878-01			1		. . SHAFT,CAM SW:FRONT	80009	384-0878-01
-69	210-0406-00			4		. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-70	401-0178-01			1		. . BEARING,CAM SW:CENTER/REAR	80009	401-0178-01
-71	210-0406-00			4		. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-72	407-1199-00			1		. . BRACKET,COVER:	80009	407-1199-00
-73	105-0651-00			1		. . DRUM ASSY,CAM S:ATTENUATOR	80009	105-0651-00
-74	384-1424-01			1		. . SHAFT,CAM SW:7.4 L X 0.188DIA	80009	384-1424-01
-75	210-0406-00			4		. . NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
-76	214-1139-02			2		. . SPRING,FLAT:GREEN COLORED	80009	214-1139-02
-77	214-1752-00			2		. . ROLLER,DETENT:	80009	214-1752-00
-78	401-0180-00			1		. . BEARING,CAM SW:FRONT	80009	401-0180-00
						(ATTACHING PARTS)		
-79	354-0390-00			1		. . RING,RETAINING:0.338 ID X 0.025" THK,STL	79136	5100-37MD
						- - - * - - -		
-80	----- -----			1		. CKT CARD ASSY:MAIN PLUG-IN(SEE A1 EPL)		
-81	----- -----			1		. . SWITCH,PUSH:(SEE S125 EPL)		
-82	361-0385-00			2		. . SPACER,PB SW:0.164 INCH LONG	80009	361-0385-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-83	136-0252-04			108	. . SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
-84	131-0608-00			39	. . CONTACT,ELEC:0.365 L X 0.25 PH BRZ GOLD PL	22526	47357
-85	131-1003-00			4	. . CONNECTOR BODY,:CKT CD MT,3 PRONG	80009	131-1003-00
-86	344-0255-00			4	. . CLIP,ELECTRICAL:FUSE MOUNT	80009	344-0255-00
-87	343-0149-00			2	. . CLAMP,LOOP:NYLON	80009	343-0149-00
-88	214-1797-00			14	. . PIN,ATTEN CLIP:	80009	214-1797-00
-89	----- -----			2	. . TRANSISTOR:(SEE Q155 AND Q165 EPL)		
					(ATTACHING PARTS)		
-90	211-0001-00			2	. . SCREW,MACHINE:2-56 X 0.25 INCH,PNH STL	83385	OBD
-91	220-0627-00			2	. . NUT,PLAIN,HEX.:2-56 X 0.156 INCH,BRS	73743	10002-56-101
	210-0801-01			1	. . WASHER,FLAT:0.140 ID X 0.281" OD,STL	12327	OBD
-92	210-0001-00			2	. . WASHER,LOCK:INTL,0.092 ID X 0.18"OD,STL	78189	1202-00-00-0541C
-93	210-1156-00			2	. . WASHER,NONMETAL:0.09 ID X 0.121" OD,NYLON	80009	210-1156-00
					- - - * - - -		
-94	342-0166-00			2	. . INSULATOR,PLATE:TRANSISTOR	80009	342-0166-00
-95	214-2407-00			1	. . HEAT SINK,XSTR:	80009	214-2407-00
					(ATTACHING PARTS)		
-96	211-0097-00			1	. . SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
-97	210-0586-00			1	. . NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
					- - - * - - -		
-98	136-0514-00			1	. . SOCKET,PLUG IN:MICROCIRCUIT,8 CONTACT	73803	C9308-02
-99	131-1030-00			13	. . CONTACT ASSY,EL:CAM SWITCH,BOTTOM	80009	131-1030-00
					(ATTACHING PARTS)		
-100	210-0779-00			13	. . RIVET,TUBULAR:0.051 OD X 0.115 INCH LONG	42838	RA-29952715
					- - - * - - -		
-101	131-1031-00			13	. . CONTACT ASSY,EL:CAM SWITCH,TOP	80009	131-1031-00
-102	214-0973-00	B010100	B029999X	1	. . HEAT SINK,ELEC:0.28 X 0.18 OVAL X 0.187"H	80009	214-0973-00
-103	136-0269-02			1	. . SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C931402
	131-0566-00	XB030000		2	. . LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	L-2007-1
-104	214-1061-00			1	SPRING,GROUND:FLAT	80009	214-1061-00
-105	426-0725-05			1	FR SECT,PLUG-IN:TOP	80009	426-0725-05
-106	426-0724-14			1	FR SECT,PLUG-IN:BOTTOM	80009	426-0724-14
	198-0001-00			1	WIRE SET,ELEC:	80009	198-0001-00
	131-0707-00			11	. CONTACT,ELEC:0.48" L,22-26 AWG WIRE	22526	75691-005
-107	175-0825-00			FT	. WIRE,ELECTRICAL:2 WIRE RIBBON	08261	OBD
-108	175-0826-00			FT	. WIRE,ELECTRICAL:3 WIRE RIBBON	80009	175-0826-00
-109	352-0169-02			1	. CONN BODY,PL,EL:2 WIRE RED	80009	352-0169-00
	352-0161-00			1	. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
	352-0161-03			1	. CONN BODY,PL,EL:3 WIRE ORANGE	80009	352-0161-03
	352-0161-04			1	. CONN BODY,PL,EL:3 WIRE YELLOW	80009	352-0161-04
	210-0774-00			1	. EYELET,METALLIC:0.152 OD X 0.245 INCH L,BRS	80009	210-0774-00
	210-0775-00			1	. EYELET,METALLIC:0.126 OD X 0.23 INCH L,BRS	80009	210-0775-00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ACCESSORIES

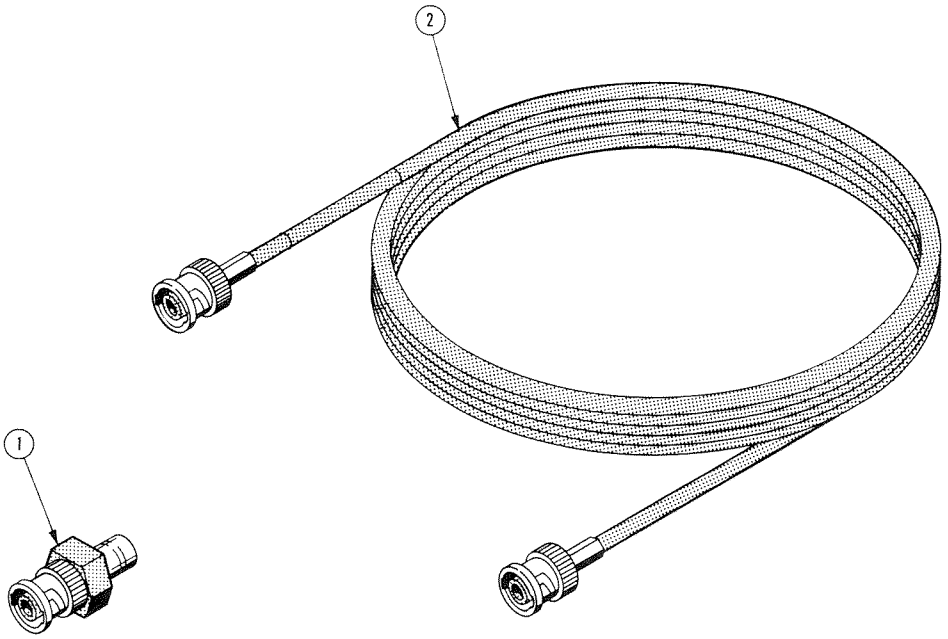


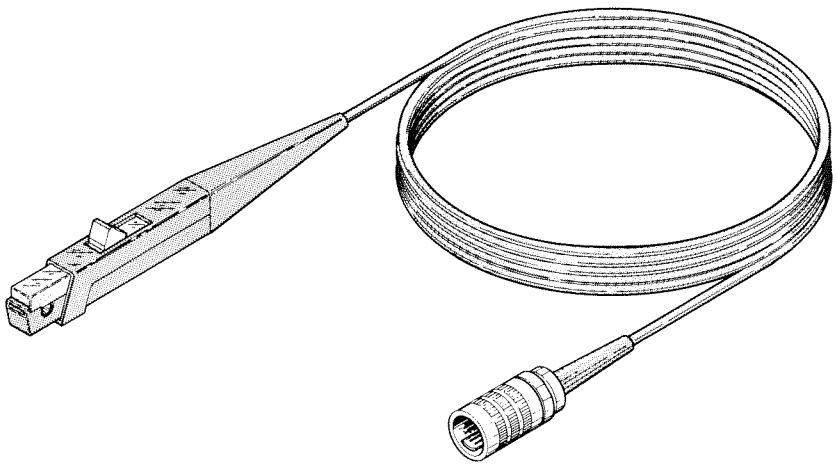
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
						STANDARD ACCESSORIES		
-1	011-0049-01			1		TERMN,COAX:50 OHM,2W,BNC	18203	011-049-01-A
-2	012-0057-01			1		CABLE ASSY,RF:50 OHM COAX W/BNC	80009	012-0057-01
	070-2052-00			1		MANUAL,TECH:INSTRUCTION	80009	070-2052-00
						OPTIONAL ACCESSORIES		
	010-6302-01			1		PROBE,CURRENT:20 AMP,2 METER L,W ACCESS	80009	010-6302-01

Tektronix®
COMMITTED TO EXCELLENCE

data sheet

CSG PUBLICATIONS/RESEARCH

P6302 CURRENT PROBE



The P6302 is a dc to 50 MHz probe capable of measuring currents to 20 A dc (or dc plus peak ac), and up to 50 A peak current, not to exceed the amp-second rating. The P6302 is designed for use with the AM 503 Current Probe Amplifier.

A Hall generator device is used in the probe to provide dc and low-frequency current information. Low-frequency (from the Hall device) and high-frequency (from the current transformer) information are combined in the AM 503 to produce an accurate representation of the current being measured.

A spring-loaded slider permits the current transformer core to open and close around a conductor. The slider is pushed forward into the CLOSED position to measure the current in a conductor. A multi-pin connector is provided to permit the operator to disconnect the probe from the AM 503.

NO. 062-2322-00
DATE Oct. 1976 (R)

SPECIFICATION

The performance limits in the specification apply only when used with the AM 503 Current Probe Amplifier, after a 20-minute warmup.

Electrical

Maximum Input Current

DC + Peak AC: 20 A (see current vs. frequency derating curves, Fig. 1).

Peak Pulse: 50 A (do not exceed 100 x 10^{-6}, amp-second product).

Maximum Voltage

Bare Conductor Under Test: 500 V (dc + peak ac).

NOTE

Do not let the probe transformer core touch the bare conductor under test. The core is not insulated.

Random Noise

0.3 mA or less (measured tangentially) with AM 503 BANDWIDTH set to 5 MHz.

Bandwidth (–3 dB)

AM 503 BANDWIDTH set to FULL: DC to at least 50 MHz.

Insertion Impedance

See Fig. 2.

Environmental

Temperature

Operating: 0° to +50°C.

Altitude

Operating: to 15,000 feet

Physical

Dimensions, Probe Head

Length: 7 7/8 inches

Height: 1 1/4 inches

Width: 7/16 inch

Jaw Size: 0.15 inch

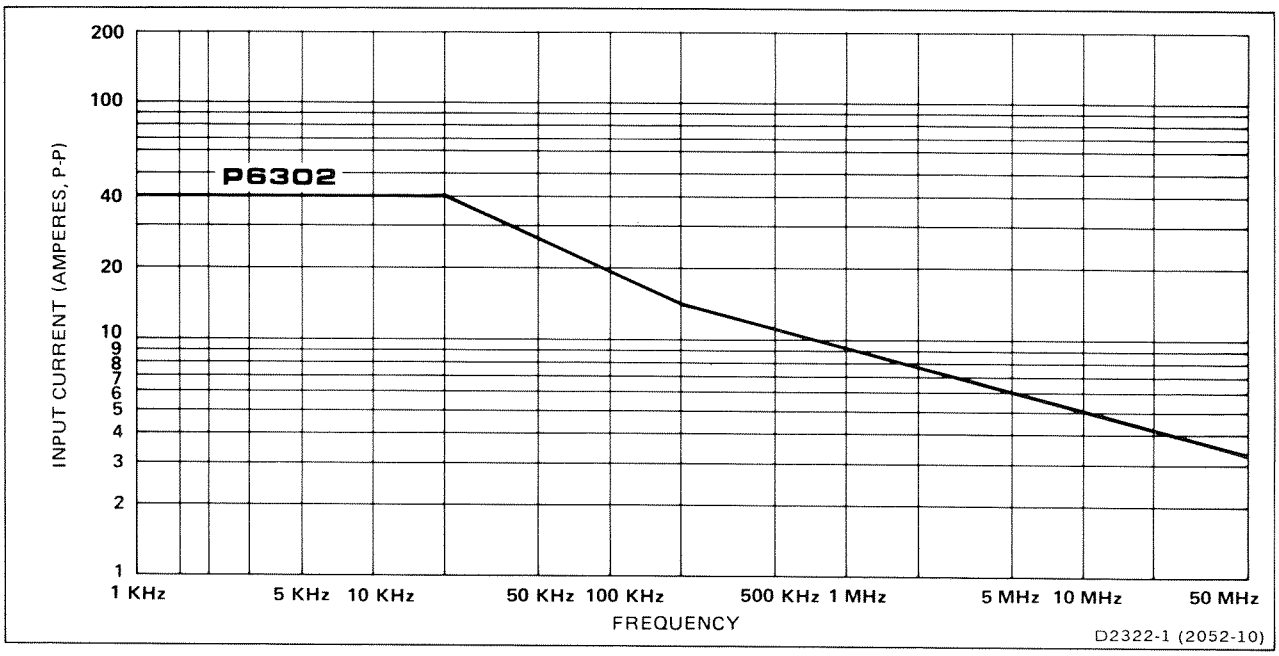

200
100
40
20
10
9
8
7
6
5
4
3
2
1
P6302
INPUT CURRENT (AMPERES, P-P)
1 KHz
5 KHz
10 KHz
50 KHz
100 KHz
500 KHz
1 MHz
5 MHz
10 MHz
50 MHz
FREQUENCY
D2322-1 (2052-10)

Fig. 1

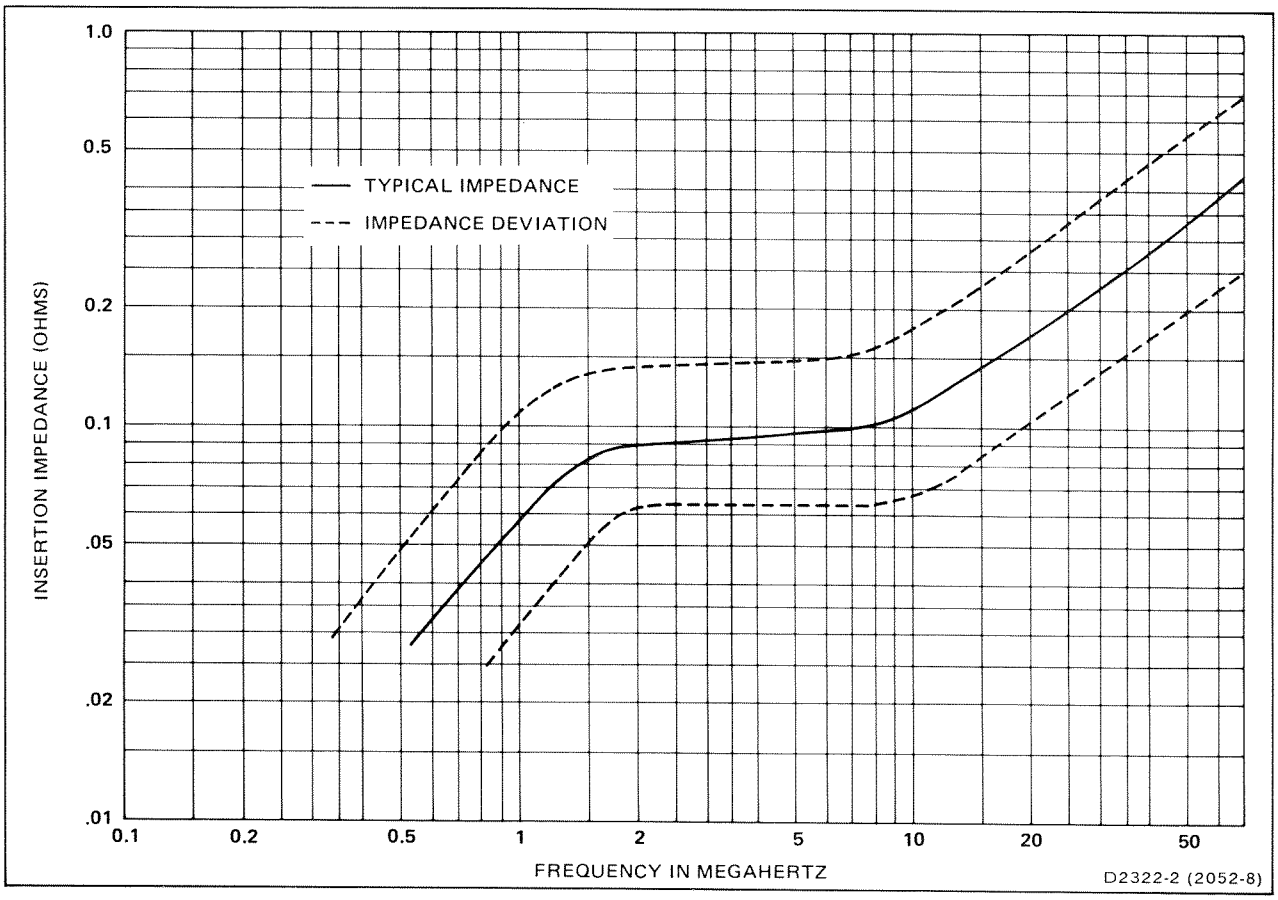

1.0
0.5
0.2
0.1
.05
.02
.01
TYPICAL IMPEDANCE
IMPEDANCE DEVIATION
INSERTION IMPEDANCE (OHMS)
0.1
0.2
0.5
1
2
5
10
20
50
FREQUENCY IN MEGAHERTZ
D2322-2 (2052-8)

Fig. 2

OPERATING CONSIDERATIONS

Ground Clip Leads

Two ground-clip leads are supplied with each probe. These leads are provided to ground the probe shield at the probe head to reduce high-freqeuncy electrostatic voltages that could be coupled to the current transformer. Normally, the ground lead is not used in the 1, 2, 5, and 10 mA positions of the AM 503 CURRENT/DIV switch due to undesirable currents that may appear in these more sensitive positions. When observing high-frequency signals, use the short ground lead.

Circuit Loading

To minimize loading of critical circuits, clamp the probe at the low or ground end of a component lead whenever possible.

NOTE

The P6302 Current Probe measures magnetic flux around a conductor, caused by current in the conductor. Keep this in mind when reading dc current in ferrous leads (such as transistor leads) that may be magnetized. This lead flux causes erroneous readings in the more sensitive AM 503 CURRENT/DIV settings.

Direction of Current Flow

To display correct polarity, the probe should be clamped around a conductor with the probe arrow pointing in the direction of conventional current flow (plus to minus).

MAINTENANCE

Cleaning (Outside Surfaces)

Use a soft-bristle brush to dislodge the dirt and dust, then wipe clean with a lint-free cloth. If a persistent coating of dirt remains, use a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

CAUTION

Avoid the use of chemical cleaning agents that might damage the plastics used in the probe. In particular, avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Recommended cleaning agents are isopropyl alcohol (isopropanol) or ethyl alcohol (Fotocol or ethanol).

Servicing

Only qualified service personnel should use the following service instructions.

The P6302 Current Probe is designed to withstand normal operation and handling. However, if the probe fails or breaks, replacement parts are available. See Replaceable Parts list for part numbers.

LUBRICATION. Do not lubricate the gap between the stationary and movable transformer core pieces. Any lubricant between the core pieces should be removed with a recommended cleaning agent.

Slide Switch. This switch is lubricated before leaving the factory. Should the switch become noisy, clean and lubricate with No Noise.

Movable Plastic Parts. Should the plastic slide assembly require lubrication, apply Versilube silicone grease sparingly to the plastic.

Probe Disassembly Procedure (See Fig. 3)

1. Move the probe slider assembly to the OPEN position.

2. Remove the two screws from the bottom of the probe body and pull the strain relief boot back on the cable.

3. While holding the probe in a horizontal position with the slide assembly up, lift the top half of the body and slide the top half off the end of the probe.

NOTE

Don't let the metal ball, in the top of the slide assembly, fall out. The ball may be easily lost.

4. Remove the metal ball.

5. Lift the spring retainer and spring out of the spring holder. Remove the spring and retainer (lift the back of the slide assembly)

6. Lay the probe on its side and remove the slide assembly. When removing the movable portion of the transformer core and the contact for the slide assembly, note the position of the contact spring. Switch contacts are not removable from the slide assembly.

7. Remove the spring holder from the bottom half of the probe body.

8. To remove the stationary transformer core, first lift out the transformer-circuit board assembly, then carefully grip the stationary transformer core and pull it out of its socket. If necessary, unsolder the cable connection to the bottom half of the probe body.

Probe Assembly Procedure (See Fig. 3)

1. If unsoldered, resolder the cable connection to the bottom half of the probe body.

2. Plug the stationary transformer core into the 8-pin connector.

3. Place the circuit board and transformer core into the bottom half of the probe body and replace the spring holder.

4. Replace the contact spring and movable core in the slide assembly. Place the spring and spring retainer in the spring guide on the slide assembly.

5. With both halves of the probe body held upside down, insert the slide assembly tip into the slot at the front of the probe body and bring the two pieces together. Be sure that the slide assembly switch contacts go on the inside (toward the center) of the stationary contacts. As the two pieces are brought together, push the spring retainer into the spring holder.

6. Hold the probe with the slide assembly up and place the metal ball into the hole in the slide assembly.

7. Replace the top half of the probe body, the strain relief boot, and the two screws.

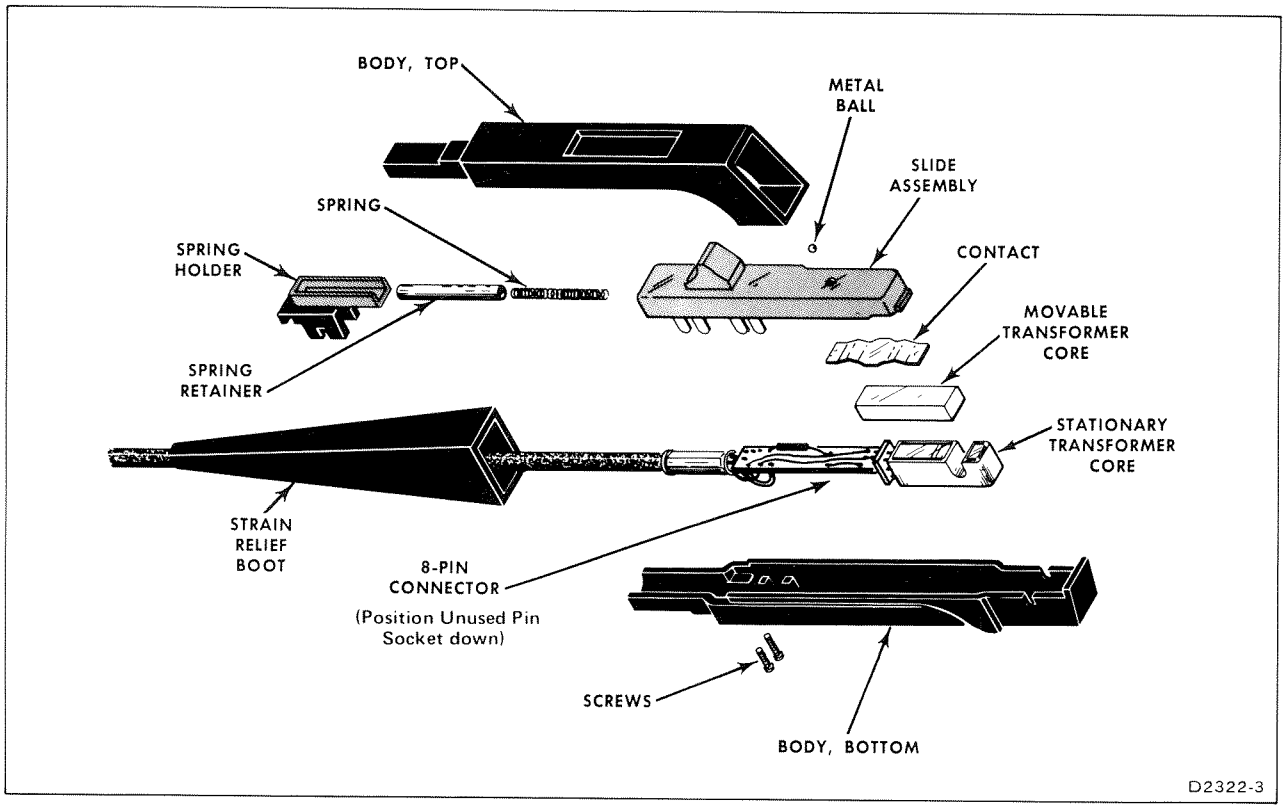
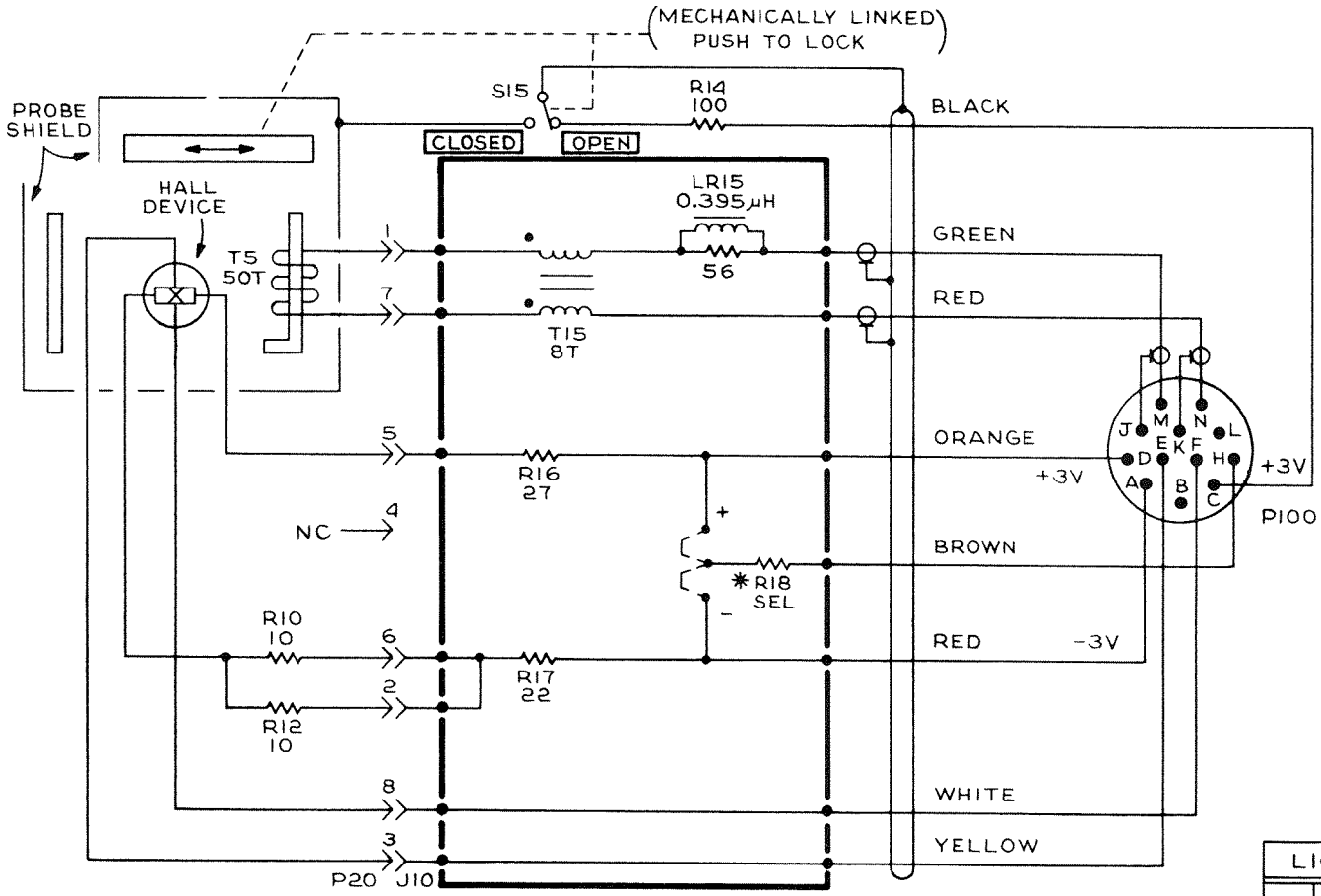


Fig. 3

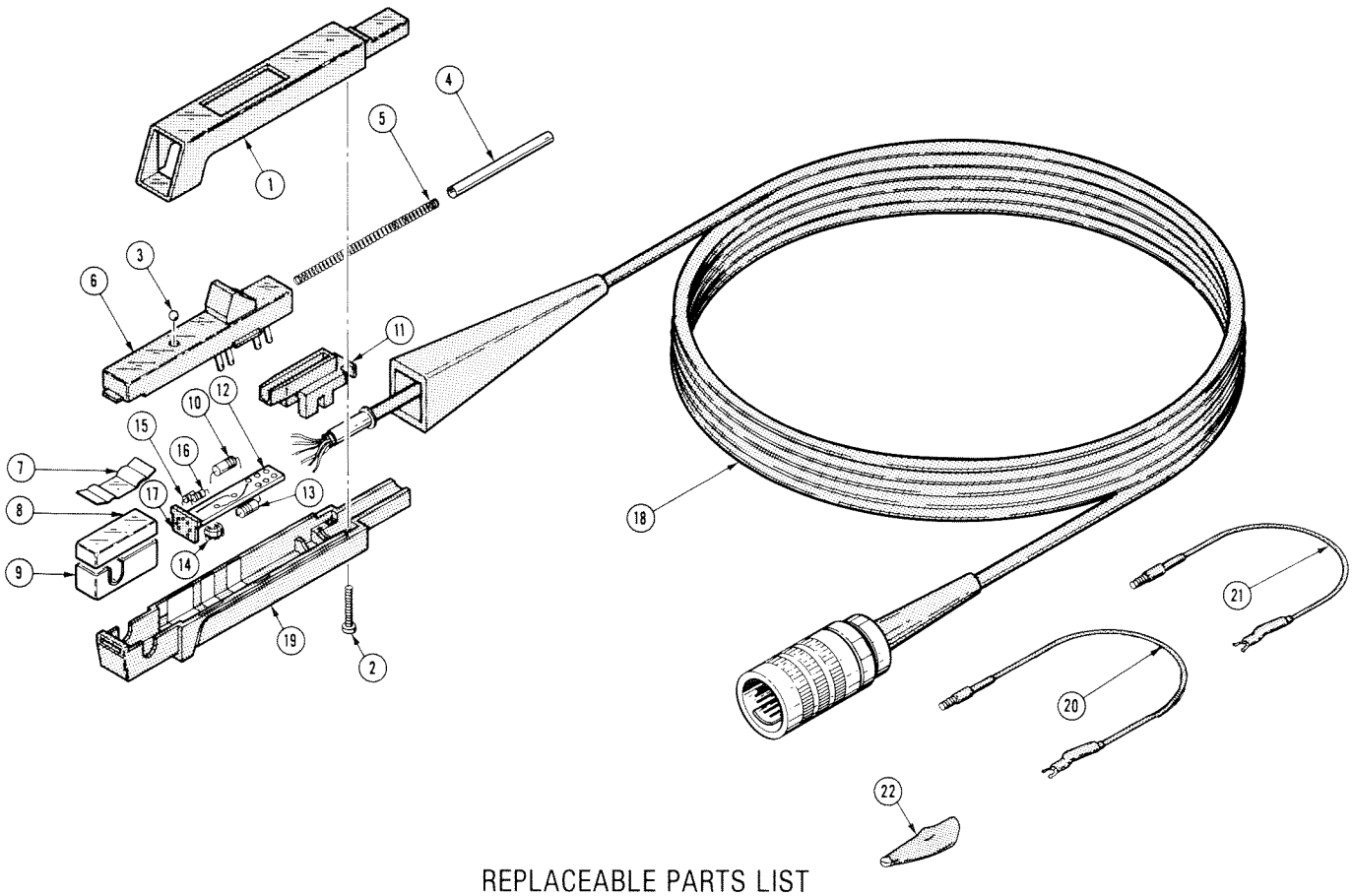


NOTES:

1. * R18 IS SELECTED WITH THE STRAP EITHER TO THE ORANGE OR RED LEAD.
2. P10 IS COUNTED IN A CW DIRECTION STARTING AT THE KEY.

P10

P6302 @



REPLACEABLE PARTS LIST

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
	010-6302-01			1	PROBE,CURRENT:20 AMP,2 METER L,W/ACCESS	80009	010-6302-01
	----- -----			1	. PROBE,CURRENT:20 AMP,2 METER LONG		
-1	204-0288-00			1	. . BODY HALF,PROBE:TOP	80009	204-0288-00
					(ATTACHING PARTS)		
-2	213-0087-00			2	. . SCREW,TPG,TC:2-32 X 0.500 L,PNH STL	83385	OBD
					- - - * - - -		
-3	214-0997-00			1	. . BALL,BEARING:0.094 OD,SST	80009	214-0997-00
-4	214-0849-00			1	. . RTNR,RTN SPR:0.132ID X 0.160OD X 1.770 L,BR		
-5	214-0835-00			1	. . SPRING,HLCPS:0.12 OD X 2.625 L	80009	214-0835-00
-6	351-0121-00			1	. . CONT ASSY,ELEC:LIGHT GRAY,PLASTIC	80009	351-0121-00
-7	214-0854-00			1	. . CONTACT,ELEC:0.340 W X 1.0 L	80009	214-0854-00
	120-0464-02			1	. . TRANSFORMER,CUR:UPPER AND LOWER	80009	120-0464-02
-8	----- -----[1]			1	. . . XFMR SUBASSY,CU:UPPER		
-9	----- -----[1]			1	. . . XFMR SUBASSY,CU:LOW		
	----- -----[1]			1	. . . . RES,FXD,CMPSN:10 OHM,5%,0.125W(R10,R12)		
-10	----- -----[1]			1	. . . RESISTOR SELECTED:(R18)		
-11	352-0106-00			1	. . HOLDER,SPR TRNR:BLACK,ACETAL RESIN	80009	352-0106-00
	317-0101-00			1	. . RES.,FXD,CMPSN:100 OHM,5%,0.125W(R14)	01121	BB1015
	175-1836-01			1	. . CA ASSY,SP,ELEC:W/CIRCUIT CARD	80009	175-1836-01
-12	670-4647-00			1	. . . CKT CARD ASSY:	80009	670-4647-00
-13	108-0330-00			1	. . . . COIL,RF:0.4UH(LR15)	80009	108-0330-00
-14	120-0741-00			1	. . . . XFMR,TOROID:8 TURNS(T15)	80009	120-0741-00
	136-0252-00			7	. . . . CONTACT,ELEC:0.145 INCH LONG	00779	2-330808-7
-15	317-0220-00			1	. . . . RES.,FXD,CMPSN:22 OHM,5%,0.125W(R17)	01121	BB2205
-16	317-0270-00			1	. . . . RES.,FXD,CMPSN:27 OHM,5%,0.125W(R16)	01121	BB2705
-17	352-0287-00			1	. . . . HOLDER,CKT CARD:	80009	352-0287-00
-18	175-1836-00			1	. . . CA ASSY,SP,ELEC:6.30 AWG/2,50 OHM COAX	80009	175-1836-00
-19	204-0714-00			1	. . BODY HALF,PROBE:W/CONTACTS,GROUND,BOTTOM	80009	204-0714-00

[1]Available under 120-0464-02 only.

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
						STANDARD ACCESSORIES		
	062-2322-00			1		DATA SHEET:P6302		
-20	175-0124-01			1		LEAD,ELECTRICAL:PROBE GND,5 INCHES LONG	80009	175-0124-01
-21	175-0263-01			1		LEAD,ELECTRICAL:PROBE GND,3 INCHES LONG	80009	175-0263-01
-22	344-0046-00			2		CLIP,ELECTRICAL:ALLIGATOR TYPE,W/COVER	80009	344-0046-00

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
80009	TEKTRONIX, INC.	P. O. BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 Ω.	107 - Risetime less than 3.0 ns into 50 Ω.
108	PG 501 - 5 V output pulse; 3.5 ns Risetime.	108 - 10 V output pulse; 1 ns Risetime.
111	PG 501 - Risetime less than 3.5 ns; 8 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger Pulse delay.
114	PG 501 - ±5 V output.	114 - ±10 V output. Short proof output.
115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode; ±5 V dc Offset. Has ±5 V output.	115 - Paired, Burst, Gated, and Delayed pulse mode; ±10 V output. Short-proof output.
PG 502 replaces 107		
108	PG 502 - 5 V output	108 - 10 V output.
111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay.
114	PG 502 - ±5 V output	114 - ±10 V output. Short proof output.
115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode; Has ±5 V output.	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode; ±10 V output. Short-proof output.
2101	PG 502 - Does not have Paired or Delayed pulse. Has ±5 V output.	2101 - Paired and Delayed pulse; 10 V output.
PG 506 replaces 106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
191	SG 503 - Frequency range 250 kHz to 250 MHz.	191 - Frequency range 350 kHz to 100 MHz.
067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180, 180A	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Marker outputs, 5 sec to 1 μs. Sinewave available at 20, 10, and 2 ns. Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns.	181 - Marker outputs, 1, 10, 100, 1000, and 10,000 μs, plus 10 ns sinewave.
184	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Marker outputs, 5 sec to 2 ns. Sinewave available at 50, 20, 10, 5, and 2 ns. Separate trigger pulses of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs. Marker amplifier provides positive or negative time marks of 25 V min. Marker intervals of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 μs.
2901	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	2901 - Marker outputs, 5 sec to 0.1 μs. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 μs. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

REV. A, OCT 1975

TEKTRONIX®
committed to technical excellence

MANUAL CHANGE INFORMATION

PRODUCT AM 503
070-2052-00

CHANGE REFERENCE S32468
DATE 12-7-77

CHANGE:	DESCRIPTION

EFF SN B032320

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

C218	283-0339-00	CAP.,FXD,CER DI:0.22UF,10%,50V
R222	315-0164-00	RES.,FXD,CMPSN:160K OHM,5%,0.25W

C218 and R222 are located on the AMPLIFIER circuit board and shown on diagram 2 ATTENUATOR.