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Beaverton, Oregon

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INSTRUCTION MANUAL

AM 503 CURRENT PROBE AMPLIFIER

Valuetronics International, Inc.
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MASTER COPY


PLEASE CHECK FOR CHANGE INFORMATION
AT THE REAR OF THIS MANUAL.

COMMITTED TO EXCELLENCE

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INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag,
or stamped on the chassis. The first number or letter
designates the country of manufacture. The last five digits
of the serial number are assigned sequentially and are
unique to each instrument. Those manufactured in the
United States have six unique digits. The country of
manufacture is identified as follows:

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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OPERATOR'S SAFETY SUMMARY

The following text contains a two-part summary of general safety precautions that must be observed during all phases of operation, service, and repair of this instrument.

OPERATORS SAFETY SUMMARY

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

TERMS

In This Manual

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

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


As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.


DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS

In This Manual

 This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment

 **DANGER** — High voltage.


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Power Source

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

Grounding the Product

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

 Protective ground (earth) terminal.

 **ATTENTION** — refer to manual.

Danger Arising From Loss of Ground

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

Use the Proper Power Cord

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

Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse of correct type, voltage rating and current rating as specified in the parts list for your product.

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

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

Do Not Remove Covers or Panels

To avoid personal injury, do not remove the product

covers or panels. Do not operate the product without the covers and panels properly installed.

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

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

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

Use Care When Servicing With Power On

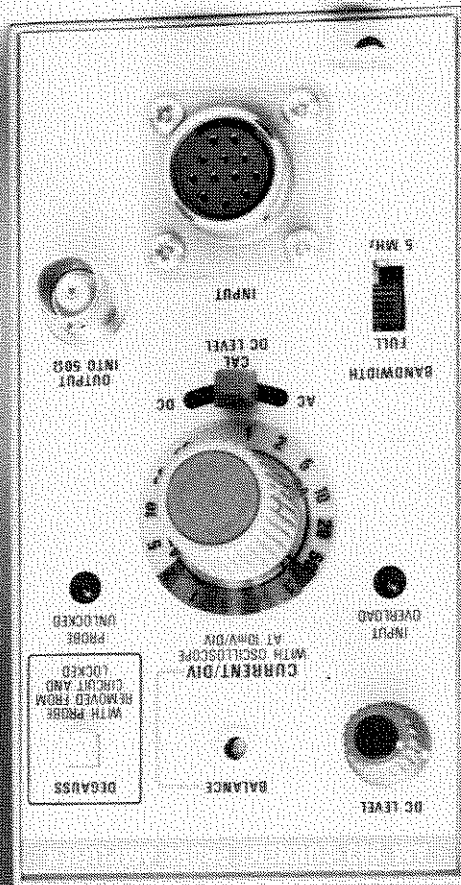
Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Power Source

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

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

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OPERATING INSTRUCTIONS

The AM 503 operates in TEKTRONIX TM 500-Series power modules only. It will operate in any compartment of a multiple-compartment power module.

Installation and Removal

CAUTION

Turn the power module off before inserting the plug-in; otherwise, damage may occur to the plug-in circuitry. It is also recommended that the power module be turned off before removing the AM 503. Refer to Fig. 1-1. Check to see that the plastic barriers on the interconnecting jack of the selected power module compartment match the cut-outs in the AM 503 circuit board edge connector.

Align the upper and lower groove of the AM 503 chassis with the upper and lower guides of the selected compartment. Push the module in and press firmly to seat the circuit board in the interconnecting jack.

To remove the AM 503, pull on the release latch

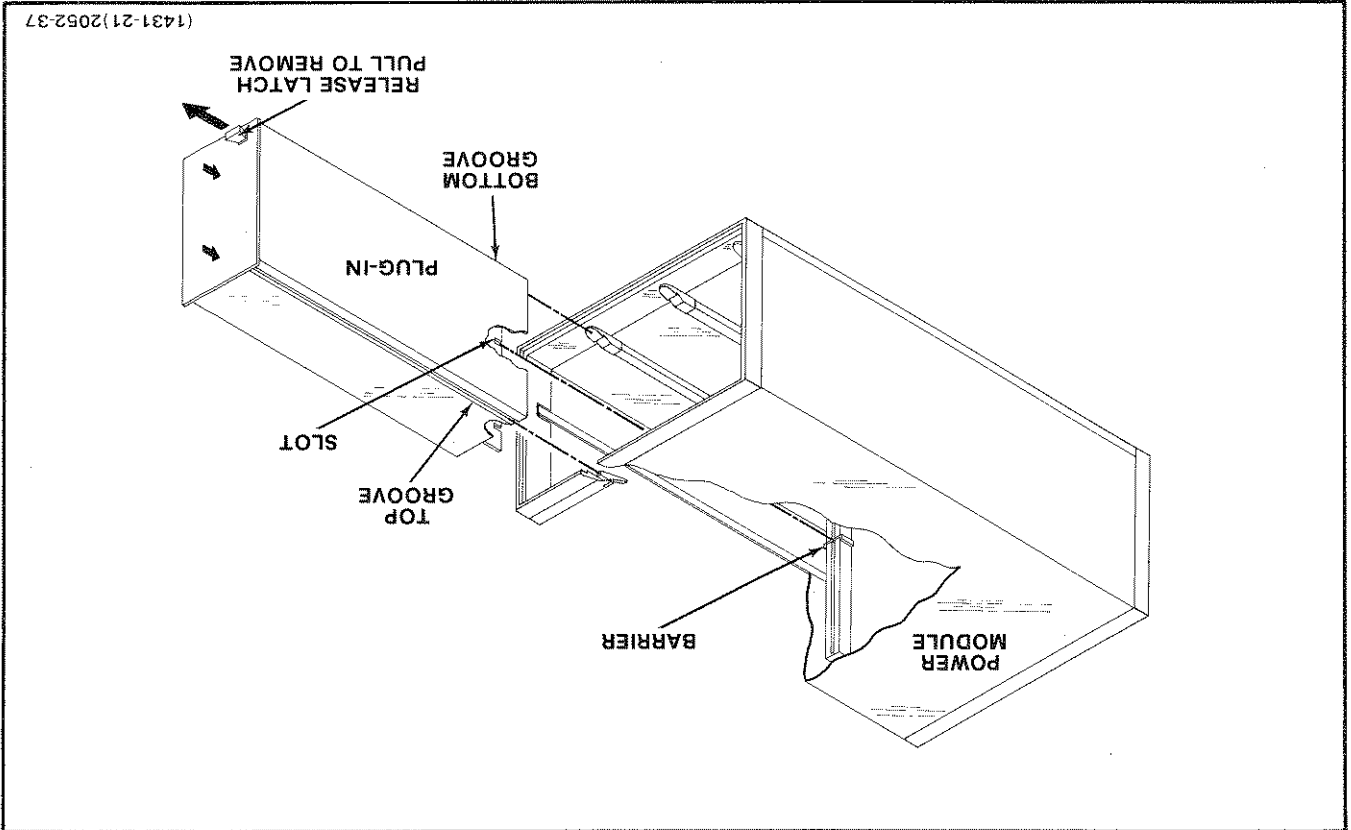


Fig. 1-1. Plug-in installation and removal.

Description

The AM 503 Current Probe Amplifier is designed for use with any of the compatible current probes (see Mechanical Parts list for accessories). The input attenuator is calibrated in a 1, 2, 5 sequence, and the knob-skirt illumination provides direct indication of current/division. An auto-scale switch changes the knob-skirt illumination automatically to match the sensitivity of the probe used.

Bandwidth is selectable for either FULL (limited by current probe in use) or 5 MHz. Input coupling is selectable (ac or dc); ac provides a means of measuring low amplitude ac signals on a high level dc current.

All references to the P6302 probe also apply to the A6302 probe.
All references to the P6303 probe also apply to the A6303 probe.

NOTE

(located in the lower left corner) until the interconnecting jack disengages and the AM 503 will slide out.

OPERATING CONSIDERATIONS

Introduction

The remainder of this section contains the operating information required to obtain the most effective performance from the instrument. This includes the function and actions of the controls and connectors, input connections, and a general description of the operating modes and procedures for making basic measurements.

Controls and Connectors

All of the major controls and connectors for operation of the AM 503 are located on the front panel of the unit. A brief functional description of each control and connector is included in Fig. 1-2.

Monitor Oscilloscope

The bandwidth required 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.

Deflection. 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 some current probes to ground the cable shield at the probe end. The ground lead is used to reduce high-frequency electrostatic voltages that could couple into the probe and cause errors in measuring. A ground lead is normally not used in the lower (1, 2, 5, and 10 mA) sensitivity positions of the attenuator switch because of undesirable chassis currents that may appear in these more sensitive positions.

When observing high-frequency signals, use the shortest practical ground-clip lead available.

Output Connection

Output connection can be accomplished through the OUTPUT INTO 50 Ω connector or the rear interconnecting jack at pin 28A. Pin 28A at the rear interconnecting jack is terminated in 50 Ω . Connector J480, located on the

right side upper-rear of the instrument, is where the output cable connects for rear interface output. With the output cable connected for rear interface output, a termination is not required because of the internal (factory wired) termination. The monitor oscilloscope input impedance should not be 50 Ω if the rear interface connection is used. It will cause an impedance mis-match and possible loading of the AM 503.

Changing output to rear interface. Remove the right side snap-in cover from the AM 503. Unplug the coaxial cable from the rear of the OUTPUT INTO 50 Ω connector. Carefully align the coaxial cable at the upper-rear coaxial connector, pressing firmly, insert the cable.

CAUTION

The coaxial cable connector center pin is easily bent and alignment is critical when making the connection for rear interface output.

With the output cable (internal) connected to the rear interconnecting jack output, the front-panel OUTPUT INTO 50 Ω connector will not have an output signal available.

Connecting the AM 503

Install the AM 503 into the TM 500-Series power module. Ensure that the power module into which the AM 503 will be installed is suitably adapted to the line voltage to be applied.

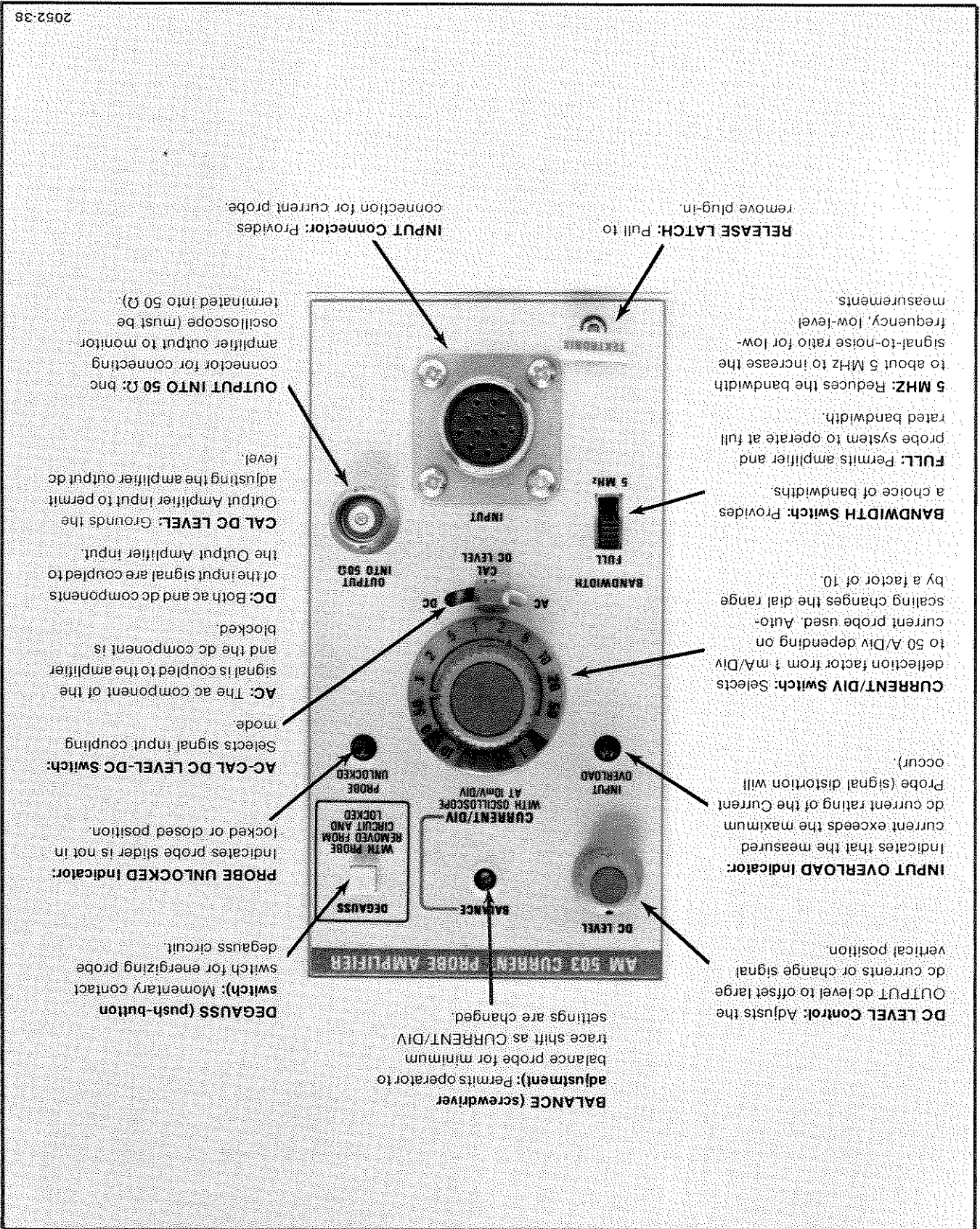
Connect a 50 Ω cable with bnc connectors (and if necessary, a 50 Ω termination for impedance matching) to the monitor oscilloscope vertical input.

Set the monitor oscilloscope vertical sensitivity for 10 mV/Div. The horizontal sweep speed should be consistent with the signal frequency to be examined.

Connect a current probe to the AM 503 INPUT connector.

Turn all equipment on and allow 20 minutes for the equipment to warm up and stabilize.

Fig. 1-2. AM 503 controls and connectors.



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Using the AM 503 with Probe

Set the monitor oscilloscope vertical input to ground and position the trace vertically to graticule center. Reset the monitor oscilloscope vertical input to dc coupling.

Set the AM 503 AC-CAL DC LEVEL-DC switch to the CAL DC LEVEL position. Rotate the DC LEVEL control to position the monitor oscilloscope trace to graticule center.

With the current probe slide in the closed position (not connected around a conductor) press and release the DEGAUSS button.

NOTE

Removal of any magnetic flux present in the probe transformer core always requires degaussing the probe. This is important after connecting or reconnecting the probe, or after making measurements in excess of the instrument range.

Set the AM 503 AC-CAL DC LEVEL-DC switch to DC. Set the CURRENT/DIV full clockwise. Adjust the screw-driver BALANCE control to position the monitor oscilloscope trace to graticule center.

The AM 503 and current probe are balanced, degaussed, and ready to measure current in a conductor. The CURRENT/DIV switch is calibrated for use at the 10 mV/Div monitor oscilloscope vertical sensitivity. However, for low amplitude currents (less than 2 mA), added resolution may be gained by changing the monitor oscilloscope sensitivity to 5 mV/Div. With the vertical sensitivity at 5 mV/Div, the AM 503 1 mA/Div sensitivity becomes 0.5 mA/Div.

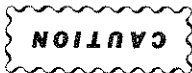
The AM 503 internal circuitry, in conjunction with a 10X probe, has a feature for automatically changing the amplifier gain. When the gain is changed for a 10X probe, the CURRENT/DIV knob-skirt illumination changes to display the corresponding switch range. If a 10X probe is used (e.g., P6303), the lowest range on the CURRENT/DIV switch becomes 10 mA/Div. Again, the monitor oscilloscope sensitivity can be changed to increase the monitor oscilloscope resolution for viewing lower amplitude signals.

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 to minimize loading. Consult the instruction sheet for the probe in use to find the relationship of frequency to insertion impedance deviation.

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 disconnected (terminated), the high voltage developed in the secondary winding of the transformer may damage the current probe.



Maximum Currents

The maximum peak-to-peak currents (approximate) in amperes vs. signal frequency derating curve is listed in the appropriate instruction sheet for the current probe in use. Current is derated for a continuous signal to prevent excessive heating in the probe head.

INPUT OVERLOAD indicator light. The front panel indicator lights when the measured current exceeds the maximum dc current rating of the probe in use. The monitor oscilloscope display (regardless of input coupling) may be inaccurate with the INPUT OVERLOAD lamp lit.

SPECIFICATION AND PERFORMANCE CHECK

Performance Conditions

The electrical characteristics are valid only if the AM 503 has been calibrated at an ambient temperature between +20°C and +30°C and is operating at an ambient temperature between 0°C and +50°C, unless otherwise stated.

Items listed in the Performance Characteristics column of the Electrical Characteristics are verified by completing the Performance Check in this section of the manual. Items listed in the Supplemental Information column are not verified in this manual. The items are either explanatory notes or performance characteristics for which no limits are specified.

Table 2-1
ELECTRICAL CHARACTERISTICS

Characteristics	Performance Characteristics	Supplemental Information
Bandwidth (−3 dB) Full	Amplifier Only	OUTPUT terminated into 50 Ω, DC function
	with P6303	
	with P6302	
	5 MHz	
	5 MHz, ±1 MHz	
ac coupled, lower limit	≤7 Hz	
Rise time (full bandwidth)	≤3.5 ns	
Noise	Amplifier random (1st two cw positions of CURRENT/DIV switch)	BANDWIDTH Full, function in CAL DC LEVEL; dc level adjusted for zero dc out
	≤4 mV	
	Amplifier random (CURRENT/DIV switch ranges except 1st two cw positions)	
	≤0.8 mV	
	Random (typical probes)	
	P6302	
	≤0.3 mA (Tangentially measured)	BANDWIDTH Full, function in DC; CURRENT/DIV full cw; DC LEVEL adjusted for zero dc out
	P6303	
	≤3 mA (Tangentially measured)	
Attenuator Accuracy	Within 3% of indicated Current/Division	

Table 2-1 (cont)

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Characteristics	Supplemental Information
Deflection Factor (typical probes) P6302	1 mA to 5 A/div in a 1, 2, 5 sequence	In first two cw positions; 2 mV/°C or less at OUTPUT (from +15°C to +35°C ambient) In all but first two cw positions: ≤ 0.4 mV/°C at OUTPUT (from +15°C to +35°C ambient)
	10 mA to 50 A/div in a 1, 2, 5 sequence	
Thermal Drift Amplifier Only		
OUTPUT dynamic range	+80 mV and -80 mV with less than 5% compression (into 50 Ω)	CURRENT/DIV set to 5 mA/Div. Monitor oscilloscope set for 20 mV/div
POWER CONSUMPTION		
Standard Instrument		≈ 17 W

Table 2-2
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Information
Temperature	Test to procedures of MIL-STD-810C Methods 502.1 and 501.1 using Procedure I as specified in MIL-T-28800B paragraph 4.5.5.1.3 and 4.5.5.1.4. 0°C to +50°C. Non-operating
Humidity	Operating +50°C to 95% relative humidity. Non-operating +60°C to 95% relative humidity.
Altitude	Test to MIL-STD-810C Method 507.1 Procedure IV, modified as specified in MIL-T-28800B paragraph 4.5.5.1.1.2. Test to MIL-STD-810C Method 500.1 Procedure I as specified in MIL-T-28800B paragraph 4.5.5.2. To 15,000 feet Non-operating To 50,000 feet

Table 2-2 (cont)

ENVIRONMENTAL CHARACTERISTICS

Characteristics	Information
Vibration	Operating and Non-operating
Shock	Non-operating
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.

With the instrument operating, the vibration frequency is swept from 10 to 55 to 10 Hz. Vibrate 15 minutes in each of the three major axes at 0.015" total displacement. Hold 10 minutes at any major resonance, or if none, at 55 Hz. Total time, 75 minutes.

30 g's 1/2 sine, 11 ms duration, 3 shocks in each direction along 3 major axes, for a total of 18 shocks.

PERFORMANCE CHECK

Introduction

This procedure checks the electrical characteristics of the AM 503 that appear in the Specification section of this manual. If the instrument fails to meet the requirements given in this performance check, the adjustment procedure should be performed. This procedure can also be used by an incoming inspection facility to determine acceptability of performance.

The electrical characteristics in Section 2 are valid only if the AM 503 is calibrated at an ambient temperature of +20°C to +30°C and operated at an ambient temperature of 0°C to +50°C.

Tolerances that are specified in this Performance Check procedure apply to the instrument under test and do not include test equipment error.

Test Equipment Required

The following test equipment, or equivalent, is required to perform the performance check. Test equipment characteristics listed are the minimum required to verify the performance of the equipment under test. Substitute equipment must meet or exceed the stated requirements. All test equipment is assumed to be operating within tolerances.

Special test devices are used where necessary to facilitate the procedure. Most of these are available from Tektronix, Inc., and can be ordered through your local Tektronix Field Office or representative.

Table 2-4

LIST OF TEST EQUIPMENT REQUIREMENTS

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	AM 503 and test	Provide power to equipment	TEKTRONIX TM 503 or TM 506 or TM 515
3. Digital Voltmeter	Ranges (ac rms), 0—200 mV, 0—2 V; Accuracy, $\pm 0.5\%$ ± 1 count at 1 kHz.	Dynamic range	TEKTRONIX DM 502
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 μ s 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 μ s to 10 ms; duty cycle, approx. 50%; amplitude range, 100 mV or less to at least 1.0 V into 50 Ω . Rise time (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.	Noise, Rise Time Bandwidth	TEKTRONIX PG 506 [†] 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; flat- ness, output amplitude does not	Bandwidth Checks	TEKTRONIX SG 503 [†] Leveled Sine- Wave Generator

Table 2-4 (cont)

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Minimum Specifications	Usage	Examples
5. Constant Amplitude Sine-Wave Generator (cont)	vary more than 3% from actual amplitude of 50 kHz reference to 50 MHz.		
6. Function Generator	Output frequency, approx. 5 Hz to 1 kHz; amplitude, (into 50 Ω), or 5 V p-p; ±1.5 dB throughout required frequency range.	Ac low frequency —3 dB point check. Dynamic range	TEKTRONIX FG 502*
7. Cable (3 required)	Impedance, 50 Ω; length, 42 inches; connectors, bnc	Used in all test setups.	Tektronix Part No. 012-0057-01
8. Termination (2 required)	Impedance, 50 Ω, in-line; connectors, bnc	Used in all test setups	Tektronix Part No. 011-0049-01
9. Special Adapter	Impedance, 25 Ω, in-line; connectors, bnc	Used in all test setups	See Fig. 3-1
10. Adapter	bnc 'T'	AC Dynamic Range	Tektronix Part No. 103-0030-00
11. 10X Attenuator (3 required)	Impedance, 50 Ω; connectors, bnc	Noise; Dynamic range	Tektronix Part No. 011-0059-02

* Requires TM 500-Series Power Module.

Preliminary Procedure

1. Ensure that all power switches are off.
2. Ensure that all test equipment and the power module into which the AM 503 under test will be installed are suitably adapted to the line voltage to be applied.
3. Install the AM 503 into the power module, and if applicable, install all other TM 500-Series test equipment into the power module.
4. Connect the power module(s) and test equipment to a suitable line voltage source. Turn all equipment on and allow at least 20 minutes for the equipment to warm up and stabilize.

AM 503

Set the following controls as indicated:

CURRENT/DIV	5 A
Coupling	DC
BANDWIDTH	FULL

Calibration Generator

Amplitude	10 V
Mode	std ampl

Monitor Oscilloscope

Volts/Div	5 mV
Time/Div	50 μs
Input Coupling	dc
Triggering	ext

Specification and Performance Check—AM 503

a. Connect the OUTPUT of the AM 503 to the input of the monitor oscilloscope using a 50 Ω cable and a 50 Ω terminator.

b. Connect the Ampl Output of the calibration generator to the AM 503 INPUT using the special adapter (see Fig. 3-1) and a 50 Ω cable.

c. Using the AM 503 DC LEVEL control and the monitor oscilloscope vertical position control, center the display.

d. Check—that the signal amplitude is two divisions.

e. Set the AM 503, calibration generator, and monitor oscilloscope as indicated in Table 2-2.

f. Check—that the signal amplitude in each step is five divisions ± 0.15 division.

Table 2-2

CURRENT/DIVISION ACCURACY CONTROL SETTINGS

AM 503	Calibration Generator	Monitor Oscilloscope VOLTS/DIV
2.0 A	10.0 V	5 mV
1.0 A	10.0 V	10 mV
0.5 A	5.0 V	10 mV
0.2 A	2.0 V	10 mV
0.1 A	1.0 V	10 mV
50 mA	0.5 V	10 mV
20 mA	0.2 V	10 mV
10 mA	0.1 V	10 mV
5 mA	50 mV	10 mV
2 mA	20 mV	10 mV
1 mA	20 mV	20 mV

g. Remove test connections.

2. Check AC Dynamic Range

Set the following controls as indicated:

AM 503
CURRENT/DIV 5 mA
Coupling DC
BANDWIDTH FULL

m. Set the AM 503 coupling to CAL DC LEVEL.

l. Reset the monitor oscilloscope input coupling to dc.

k. Position the trace vertically four divisions above the center graticule line.

j. Set monitor oscilloscope input coupling to gnd.

i. Check—DVM should read at least 26.9 mV rms or greater.

h. Using the AM 503 DC LEVEL control, center the signal on the center graticule line.

g. Reset the AM 503 coupling to DC.

f. Adjust AM 503 DC LEVEL to position trace vertically four divisions below the center graticule line.

e. Set AM 503 coupling to CAL DC LEVEL.

d. Reset monitor oscilloscope input coupling to dc.

c. Set monitor oscilloscope input coupling to gnd. Position trace vertically four divisions below the center graticule line.

b. Set the sine-wave generator for 28.3 mV, rms out of the AM 503 (monitor oscilloscope indicates 80 mV, peak-to-peak).

a. See Fig. 2-1 for test setup.

Low Frequency Sine-Wave Generator
Frequency 100 Hz
Amplitude Minimum
Offset Off (in)

Monitor Oscilloscope

Volts/Div 20 mV
Coupling dc
Time/Div 5 ms

Adjust DC level so signal is on scope

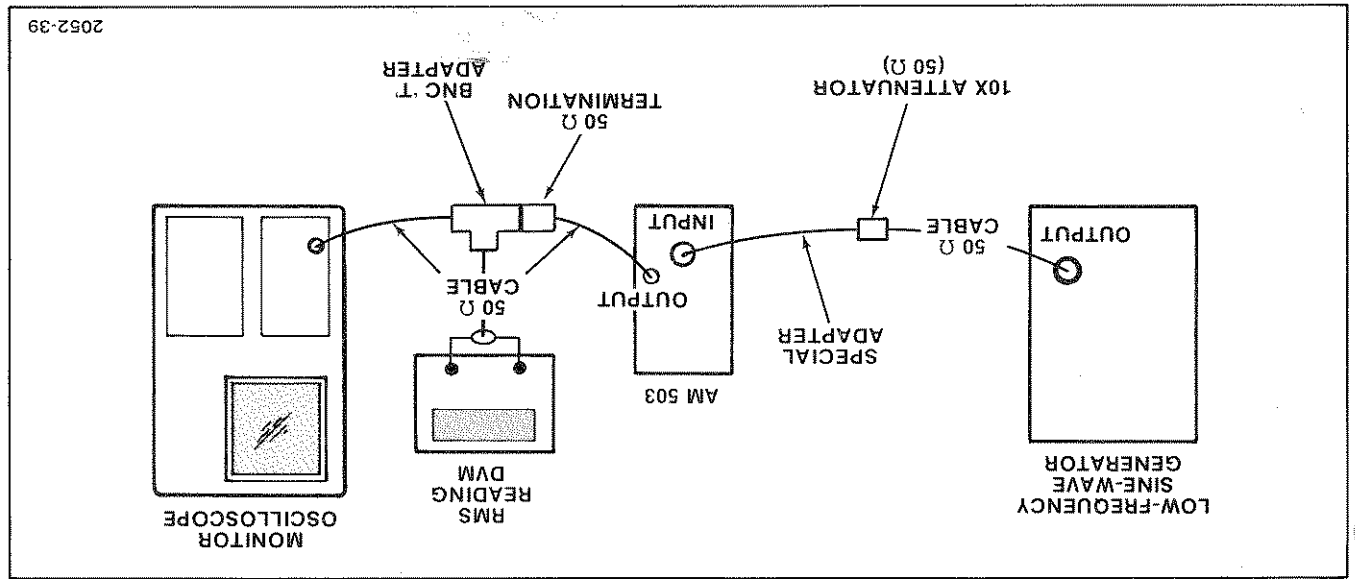


Fig. 2-1. Test setup for AC Dynamic Range Check.

Monitor Oscilloscope

Volts/Div 10 mV
 Time/Div 10 μ s
 Input Coupling gnd
 Triggering ext

n. Adjust the AM 503 DC LEVEL control to position the trace four divisions above the center graticule line.

o. Set the AM 503 coupling to DC.

p. Using the AM 503 DC LEVEL control, center the signal on the center graticule line.

q. Check—DVM should read at least 26.9 mV rms or greater.

r. Remove test connections.

3. Check Amplifier Noise

Set the following controls as indicated:

AM 503
 CURRENT/DIV 1 mA
 BANDWIDTH FULL
 COUPLING CAL DC LEVEL

Calibration Generator

Mode Fast Rise
 Period 1 ms
 Pulse Amplitude midrange

(Use short cables.)

t. Set the AM 503 coupling to DC.

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

d. Set the monitor oscilloscope input coupling to dc.

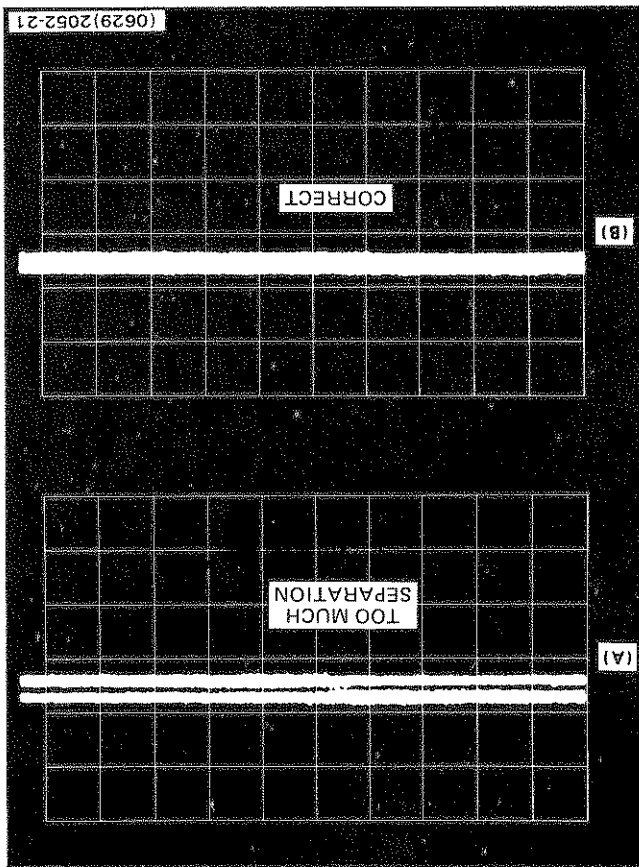
c. Set the monitor oscilloscope vertical Position control so that the trace is on the center graticule line.

b. Attach the three 10X attenuators to the +Fast Rise Output of the calibration generator. Using a 50 Ω cable and the special adapter, connect the AM 503 INPUT to the attenuators.

a. Using a 50 Ω cable and a 50 Ω termination, connect the AM 503 OUTPUT to the input of the monitor oscilloscope.

g. Decrease the calibration generator output amplitude until the two traces just merge (no dark area between the traces, see Fig. 2-2).

Fig. 2-2. Display of tangentially measured noise (A) incorrect; dark area showing between traces, (B) correct display.



- h. Remove one 10X attenuator.
- i. Divide display amplitude by 10. Example: 1.9 divisions of display at 10 mV/Div = 19 mV. Divide 19 mV by 10; then the noise = 1.9 mV.
- j. Check—for a maximum of 4 mV of noise.
- k. Set the AM 503 CURRENT/DIV to 2 mA.
- l. Check—using the procedure in part i, for a maximum of 4 mV of noise.
- m. Set AM 503 CURRENT/DIV to 5 mA.

- a. Using the 50 Ω cable and 50 Ω termination, connect the AM 503 OUTPUT to the input of the monitor oscilloscope.
- b. Using the special adapter and a 50 Ω cable, connect the calibration generator Fast Rise Output to the AM 503 INPUT.
- c. Set the display amplitude to five divisions using the calibration generator Pulse Amplitude control.
- d. Set the test oscilloscope to Internal Triggering and, using the Triggering Level and horizontal Position controls, obtain a display of the waveform leading edge.
- e. Measure the rise time (10%—90% point).
- f. Check—that the rise time is 3.5 ns or less.

At 20 mV/Div with monitor oscilloscope, go to High Amplitude Output on Calibration generator. Remove 10X attenuator on 0.1 A setting. Remove last 10X attenuator on 1.0 A setting.

NOTE

- 4. Check Rise Time/Bandwidth
- Set the following controls as indicated:

AM 503		Calibration Generator		Monitor Oscilloscope	
CURRENT/DIV	20 mA	Mode	Fast Rise	Volts/Div	10 mV
BANDWIDTH	FULL	Period	1 μs	Bandwidth	Full
Coupling	DC	Amplitude	Minimum	Time/Div	.02 μs
				Magnifier	X10
				Triggering	ext

- o. Check—for a maximum of 0.8 mV of noise.
- p. Repeat parts n and o for all remaining settings of the AM 503 CURRENT/DIV control.

Specification and Performance Check—AM 503

- p. Check—that the sine-wave generator frequency is at least 4 MHz and not more than 6 MHz.
- q. Disconnect the cable from the Output of the sine-wave generator and connect to the Output of the function generator.

r. Set the following controls as indicated:

AM 503	CURRENT/DIV	20 mA
	BANDWIDTH	5 MHz
	Coupling	AC
Function Generator	Frequency	1 kHz
	Amplitude	Minimum

Monitor Oscilloscope

50 mV	Volts/Div
10 μ s	Time/Div
ext	Triggering

- s. Set the function generator Amplitude control for a six-division display.
- t. Decrease the frequency of the function generator until the display is reduced to 4.2 divisions.
- u. Check—that the function generator frequency is not more than 7 Hz.

5. DC Level and Balance

Set the following controls as indicated:

AM 503	Current/Div	1 mA
	Bandwidth	Full
	Coupling	Cal DC

Monitor Oscilloscope

10 mV	Volts/Div
10 μ s	Time/Div
ext	Triggering

- g. Disconnect the calibration generator from the special adapter.

- h. Connect the sine-wave generator Output to the special adapter.

i. Set the following controls as indicated:

AM 503	CURRENT/DIV	5 mA
	BANDWIDTH	FULL
	Coupling	DC
Levelled Sine-Wave Generator	Frequency Range (MHz)	REF 350 kHz
	Amplitude Multiplier	X .01
	Output Amplitude	3.0

Monitor Oscilloscope

10 mV	Volts/Div
50 μ s	Time/Div
ext	Triggering

- j. Adjust the Output Amplitude control of the sine-wave generator for a six-division display.

- k. Increase the frequency of the sine-wave generator until the display is reduced to 4.2 divisions.

- l. Check—that the sine-wave generator frequency is at least 100 MHz.

m. Change the following controls as indicated:

AM 503	BANDWIDTH	5 MHz
	Frequency Range	Ref 350 kHz

Sine-Wave Generator

- n. Adjust Output Amplitude of the sine-wave generator for a six-division display.

- o. Increase the frequency of the sine-wave generator until the display amplitude is reduced to 4.2 divisions.

Specification and Performance Check—AM 503

a. Set monitor oscilloscope input coupling to gnd. Position trace vertically at the center of the CRT.

b. Reset monitor oscilloscope input coupling to DC.

NOTE

If the trace has moved from the gnd setting, there is an offset problem with the monitor oscilloscope.

c. Using a 50 Ω cable and a 50 Ω feed-through terminator, connect the AM 503 OUTPUT to the input of the monitor oscilloscope.

This complete the performance check.

f. Remove test set-up.

e. Adjust the front panel balance so there is a minimal shift on monitor oscilloscope trace between the Cal DC level position and the DC position on the AM 503.

d. Reset the AM 503 coupling to DC.

Description	Performance Requirements	Applications	Examples
Oscilloscope	Bandwidth, to 150 MHz; vertical sensitivity, 10 mV/Div; sweep rate, 2 ms.	Gain, Compensation, and Degauss adjustment.	TEKTRONIX 7704A main-frame and 7A16A/7B80 plug-ins.

LIST OF TEST EQUIPMENT REQUIREMENTS

Table 3-1

A flexible plug-in extender, Tektronix Part No. 067-0645-02, is useful for troubleshooting or adjusting the AM 503; however, the complete Adjustment Procedure can be performed without use of the extender.

If other test equipment is substituted, control settings or calibration setup may be altered to meet the requirements of the equipment used.

The test equipment listed in Table 3-1, or equivalent, is required for adjustment of the AM 503. Specifications given for the test equipment are the minimum necessary for accurate adjustment and measurement. All test equipment is assumed to be correctly calibrated and operating within specification.

Test Equipment Required

Tektronix, Inc. provides complete instrument repair and adjustment at local Field Service Centers and at the Factory Service Center. Contact your local Tektronix Field Office or representative for further information.

Services Available

To maintain instrument accuracy, check the performance of the Current Probe Amplifier every 1,000 hours of operation, or every six months if used infrequently.

Adjustment Interval

that no adjustment is necessary.

the desired result. We recommend that adjustments not be made if a previous Check or Examine instruction indicates

2. Examine—usually precedes an Adjust instruction and describes how to determine whether the adjustment is necessary. Measurement limits following the word Examine are not to be interpreted as performance limits derived from the instrument specifications. They are provided as indicators of a properly functioning instrument and to aid in the adjustment process.

3. Adjust—describes which adjustment to use to make

1. Check—indicates that the instruction accomplishes a performance requirement check. Each performance requirement is derived from the instrument specification as listed in Table 2-1, Electrical Characteristics.

The alphabetical instructions under each step (a, b, c, etc.) may contain Check, Examine, or Adjust as the first word of the instruction. These terms are defined as follows:

Adjustment Instructions

Completion of all adjustment steps in this procedure ensures that the instrument will meet the performance requirements listed in the Specification section. However, to fully ensure satisfactory performance, it is recommended that the Performance Check be performed after any adjustment is made.

This adjustment procedure is to be used to restore the AM 503 to original performance specifications. Adjustment need not be performed unless the instrument fails to meet the Performance Requirements of the Electrical Characteristics listed in the Specification section, or the Performance Check cannot be completed satisfactorily.

Introduction

ADJUSTMENT

LIST OF TEST EQUIPMENT REQUIREMENTS

Table 3-1 (cont)

Description	Performance Requirements	Applications	Examples
Calibration Generator	Pulse Output: period 1 μ s to 10 ms; duty cycle, \approx 50%; amplitude range, 0.5 V or less to at least 5 V. Leading edge aberrations \leq 2% into 50 Ω . Rise time (terminated into 50 Ω) \leq 10 ns.	Gain and Compensation adjustment.	TEKTRONIX PG 506 ^a Pulse Generator.
Digital Voltmeter	Range, 0 to 20 V; accuracy within 0.2%.	Power supply voltage check.	TEKTRONIX DM 502A ^a Digital Multimeter.
Probe	1X	Gain adjustment.	TEKTRONIX P6101.
Termination	Impedance, 50 Ω ; connector, bnc.	All measurements.	Tektronix Part No. 011-0049-01.
Cable (2 required)	Impedance, 50 Ω ; length, 42 inches; connectors, bnc.	All measurements.	Tektronix Part No. 012-0057-01.
Resistor	Fixed wire-wound, 3 Ω , 3 W, 5%.	Degauss adjustment.	Tektronix Part No. 308-0441-00.
Special Adapter		Used for all inputs to AM 503.	See Fig. 3-1.

^a Requires TM 500-Series Power Module.

Preparation

- a. Construct Special Adapter as shown in Fig. 3-1.
 - b. Remove the left side cover of the AM 503 to gain access to the adjustments. Pull the rear end of the side cover outward from the side of the instrument (the cover snaps into place).
 - c. Be sure that the power switch is off. Set the power module for the line voltage to be applied and connect it to the line voltage source.
 - d. Install the other TM 500-Series equipment into the power module.
- e. Turn on all test equipment and allow 20 minutes for warm up and stabilization.
- 1. Adjust Power Supply Voltages**
- a. Connect the DVM between each voltage test point and ground for the supplies listed in Table 3-2. See Fig. 3-2 for test point and adjustment locations.
 - b. Examine—each supply voltage to determine if it is within the range given.
 - c. Adjust—each supply voltage with the indicated adjustment.

Fig. 3-2. Power supply test point and adjustment locations.

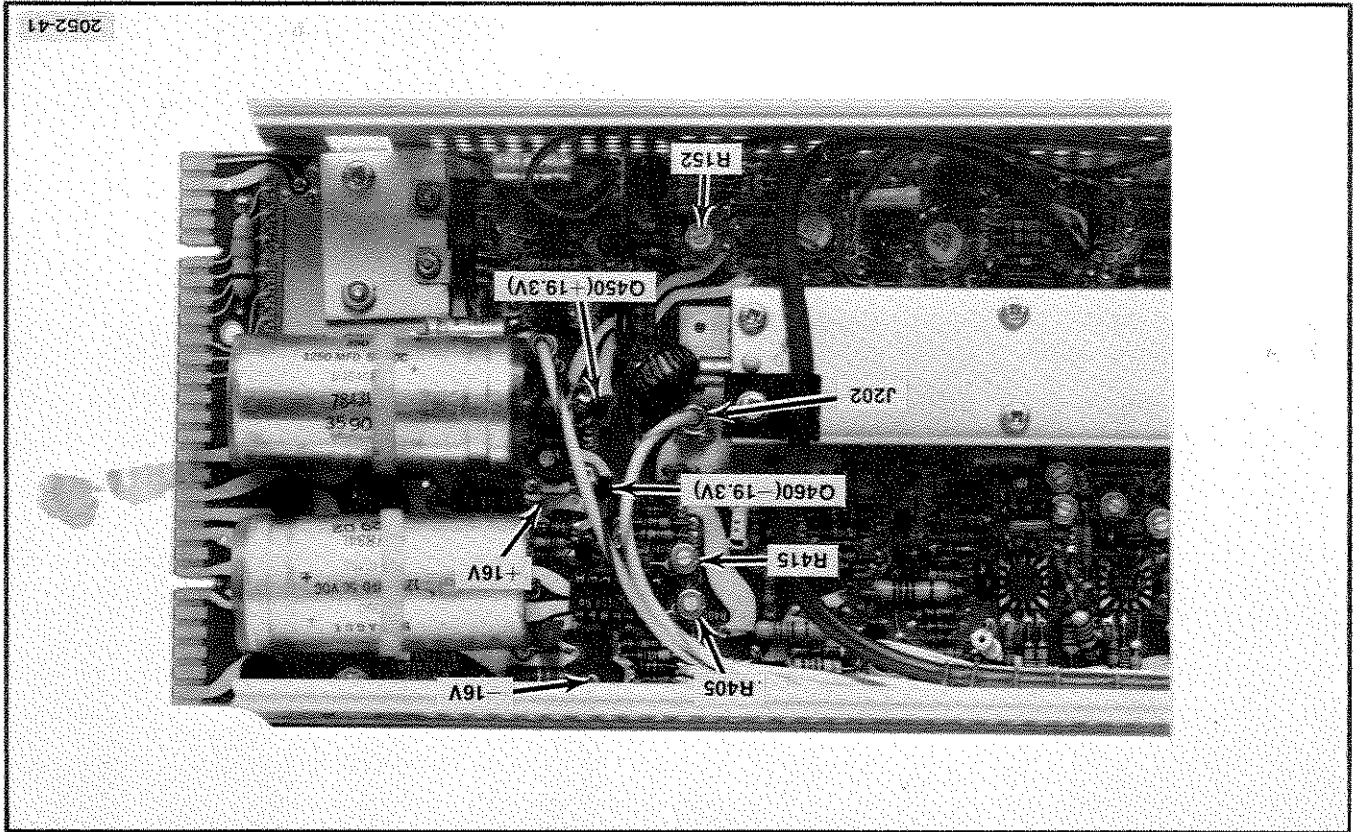
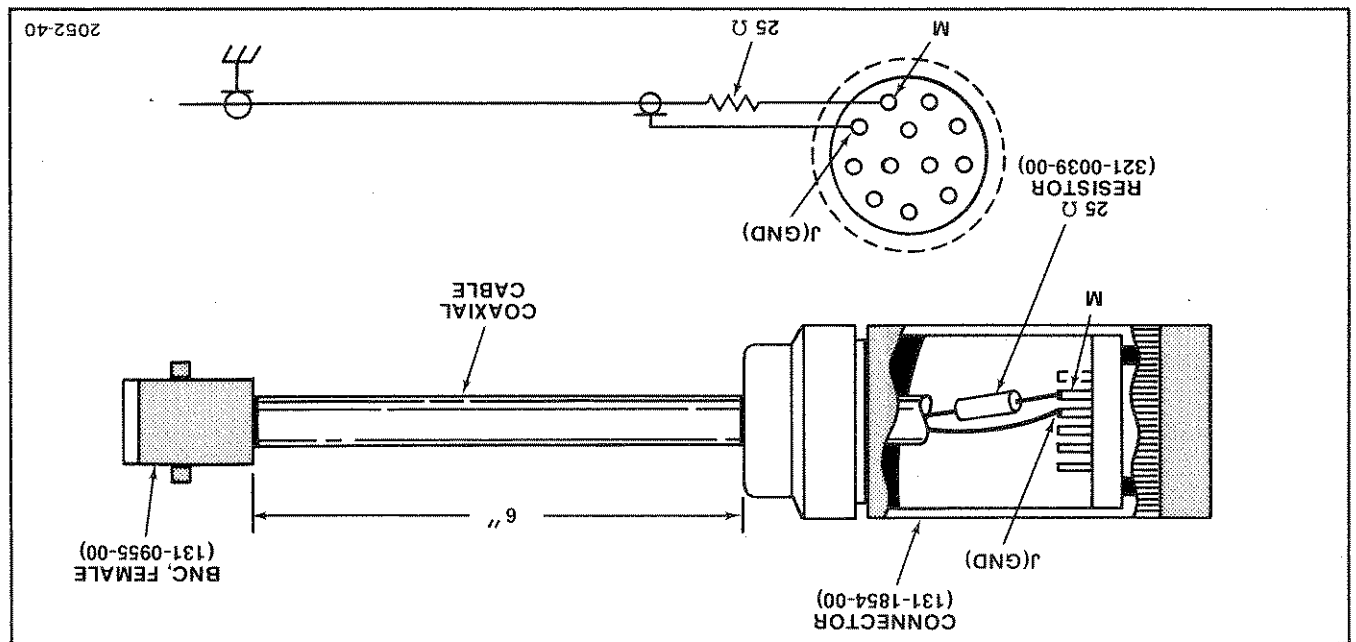


Fig. 3-1. Construction details for Special Adapter.



- g. Adjust—R344 for a four-division display (see Fig. 3-3).
- f. Examine—for a four-division display on the monitor oscilloscope.
- e. Set the monitor oscilloscope to 10 mV.
- d. With a 50 Ω cable and a 50 Ω termination, connect the AM 503 OUTPUT to the monitor oscilloscope.
- c. Using the calibration generator pulse amplitude control, set the display amplitude for 200 mV, (ignoring the first 10 μs of each pulse).
- b. Using a 50 Ω cable and a 50 Ω termination, connect the AM 503 OUTPUT to the monitor oscilloscope input.
- a. Using a 50 Ω cable, the special adapter, and a 10X attenuator, connect the calibration generator fast rise output to the AM 503 INPUT.

- a. Using the special adapter and 50 Ω cable, connect the calibration generator output to the AM 503 INPUT.
- b. Place the 1X probe on J202 (on the back side of the board).
- c. Using the calibration generator pulse amplitude control, set the display amplitude for 200 mV, (ignoring the first 10 μs of each pulse).
- d. With a 50 Ω cable and a 50 Ω termination, connect the AM 503 OUTPUT to the monitor oscilloscope.
- e. Set the monitor oscilloscope to 10 mV.
- f. Examine—for a four-division display on the monitor oscilloscope.
- g. Adjust—R344 for a four-division display (see Fig. 3-3).
- d. Set the monitor oscilloscope time/div to 20 ns.

Monitor Oscilloscope		Calibration Generator	
Volets/Div	10 mV	Period	1 μs
Time/Div	200 ns	Mode	Fast Rise*
		Pulse Amplitude	Minimum
		* Rising edge	-1 V to 0 V
		Coupling	DC
		CURRENT/DIV	5 mA

Set the following controls as indicated:

3. Adjust Compensation

- k. Adjust—R346 for a display of 4.5 divisions.
- j. Examine—for a display of 4.4 to 4.6 divisions.
- i. Connect a jumper wire between P346 (see Fig. 3-3) and ground.

- h. Set the current/Div on the AM 503 to 50 mA. (Display will now be 8 divisions.)

Supply	Test Point	Limits	Adjustment
-16 V	R422	-16.1 V to -15.9 V	R405
+16 V	R412	+15.9 V to +16.1 V	R415
+19.3 V	Q450 emitter	+18 V to +21.5 V	no adjustment
-19.3 V	Q460 emitter	-21.5 V to -18 V	no adjustment

POWER SUPPLY TEST POINTS, LIMITS, AND ADJUSTMENTS

Table 3-2

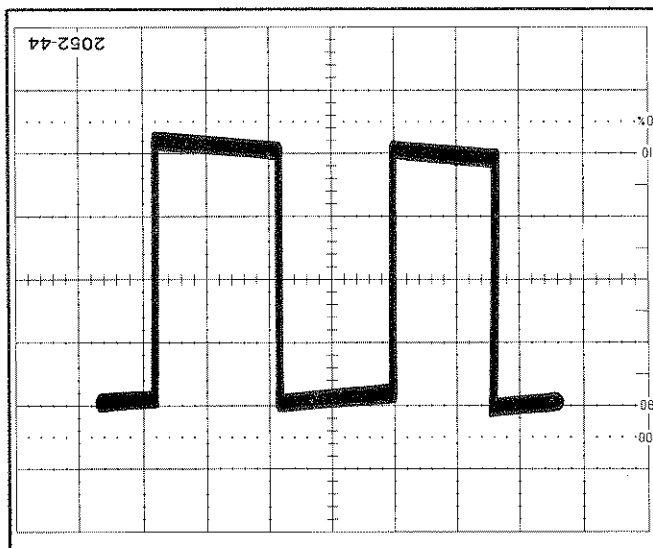
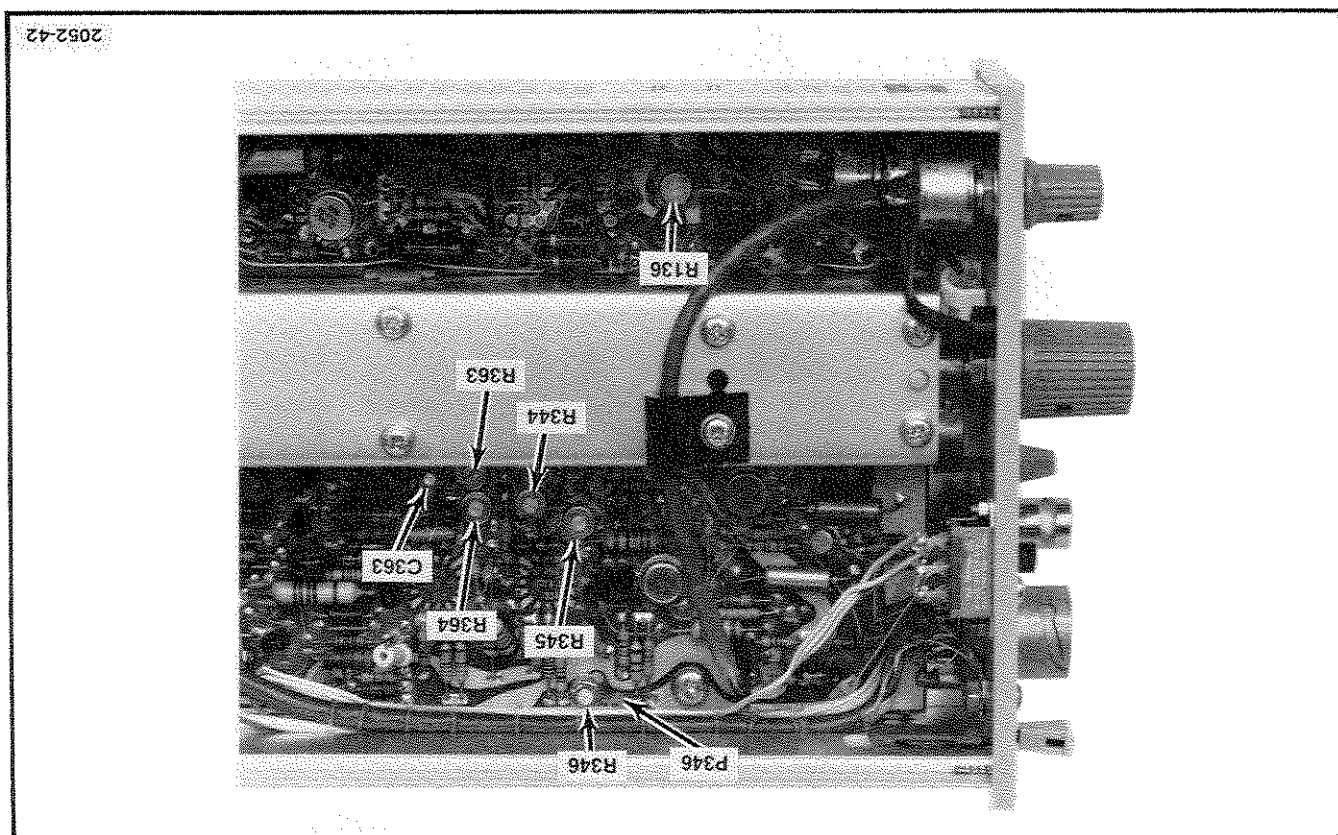


Fig. 3-4. Example of correct compensation.

- e. Examine—front corner of waveform for correct compensation (ignore long-term roll-off caused by L202).
- f. Adjust—R364, R345, C363, and R363 for optimum compensation.
- g. Refer to Fig. 3-4 for example.

Fig. 3-3. Gain and compensation adjustment locations.



Adjustment—AM 503

If compensation adjustments are made, it is necessary to re-check the bandwidths of the instrument. Refer to the RISE TIME/BANDWIDTH procedure in Section 2, Performance Check.

NOTE

- 4. Adjust Degauss Offset/Signal Amplitude. Set the following controls as indicated:

CURRENT/DIV	Fully clockwise
R136	Fully counterclockwise
Coupling	CAL DC LEVEL

Monitor Oscilloscope

Volts/Div	10 mV
Time/Div	1 ms
Triggering	ext
Input Coupling	gnd

Adjustment—AM 503

- a. Connect a 50 Ω coaxial cable from the AM 503 OUTPUT through a 50 Ω termination to the monitor oscilloscope input.
 - b. Position trace to the center graticule line using the monitor oscilloscope vertical Position control.
 - c. Set monitor oscilloscope input coupling to dc.
 - d. Using the AM 503 DC LEVEL control, re-position the trace to the center graticule line.
 - e. Set the AM 503 Coupling to DC.
 - f. Press and hold the AM 503 DEGAUSS button.
- This completes the AM 503 Adjustment Procedure.
- g. Examine—trace positioned at center graticule line.
 - h. Adjust—R152, Degauss Offset (see Fig. 3-2), for zero volts dc (trace positioned on center graticule line).
 - i. Connect the 3.0 Ω resistor between pins M and N of the AM 503 INPUT connector.
 - j. Set the AM 503 CURRENT/DIV fully counter-clockwise.
 - k. Press and hold the DEGAUSS button.
 - l. Adjust—R136, Degauss Level (see Fig. 3-3), for a 4.4 divisions ± 0.4 division display.

MAINTENANCE

This section of the manual contains information about preventative maintenance, corrective maintenance, and troubleshooting.

PREVENTIVE MAINTENANCE

Preventive maintenance steps performed on a regular basis will enhance the reliability of the instrumentation system. However, periodic checks of the semiconductor in the absence of a malfunction are not recommended as preventive maintenance measures. See the semiconductor checking information under Troubleshooting Techniques, which follows. A convenient time to perform preventive maintenance is just before instrument calibration.

Cleaning

The AM 503 should be cleaned as operating conditions are insulating blanket and prevents efficient heat dissipation, which can cause overheating and component breakdown.



Avoid the use of chemical cleaning agents that 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 semi-

conductors, 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 require lubrication.

Pushbutton and Slide Switches. The switches are lubricated prior to leaving the factory and should not require further lubrication. However, if they become electrically noisy, cleaning and lubrication may solve the problem.

Cam Switches. In most cases, the factory lubrication of these switches is adequate for the life of the instrument. The switch contacts are designed to operate dry.

If the switch has been disassembled for the 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 No. 003-0342-01, General Electric Ver-silube® G-322L silicone grease may be applied sparingly so that the lubricant does not get on the contacts. Refer to Fig. 4-1 for lubrication instructions.

CORRECTIVE MAINTENANCE

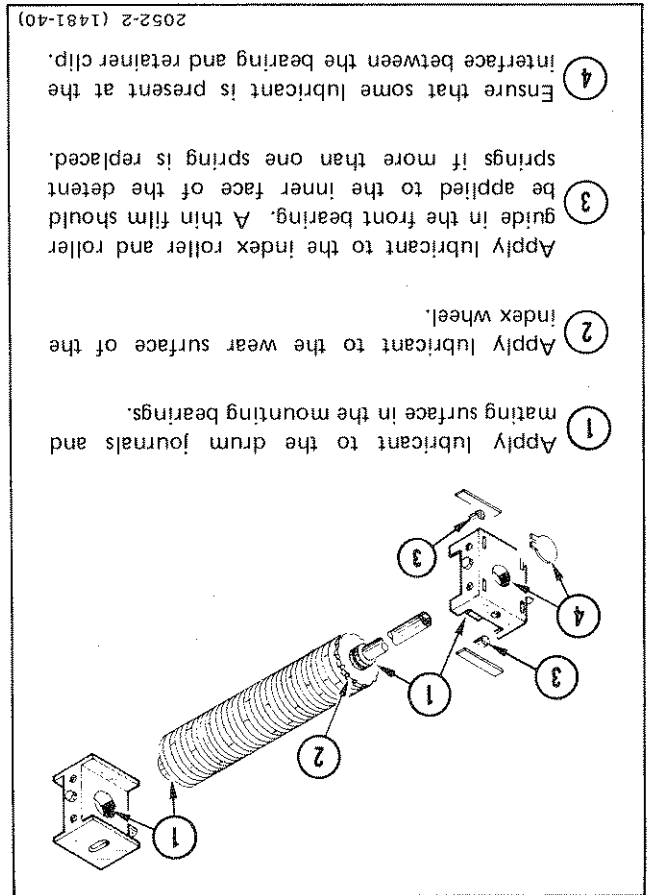
Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

Obtaining Replacement Parts

Most electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, you should be able to obtain many of the

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 are manufactured by Tektronix, Inc. To determine the manufacturer of parts, refer to parts list cross index, Mfr. Code number to Manufacturer.

Fig. 4-1. Lubrication procedure for a typical cam switch.



- 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.

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.

NOTE

standard electronic components from a local commercial source in your area. Before you purchase or order a part from a source other than Tektronix Inc., please check the Replaceable Electrical Parts list for the proper value, rating, tolerance and description.

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.

Control Settings

Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see the Operating Instructions section of the manual.

Testing Equipment

Generally, a wide-band oscilloscope, a probe, and a multimeter are all that is needed to perform basic waveform and voltage checks for diagnostic purposes. The Adjustment Procedure lists specific equipment and the features necessary to adequately check out the AM 503.

Circuit Isolation

Note the symptom. It often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by making waveform and voltage measurements.

Incorrect operation of all circuits often means trouble in the power supplies. Using a multimeter, check first for correct voltages of the individual regulated supplies according to the plug-in module schematics and callibrations procedures. Then check the unregulated supplies of the power modules. Defective components elsewhere in the instruments can appear as power supply problems. In these instances, suspected circuits should be disconnected from apparently bad power supplies one at a time to narrow the search.

TROUBLESHOOTING

- 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.

Maximum Ripple Peak-to-Peak	Output Voltage	Power Supply
2 mV	15.9 to 16.1	+16 V
		-16 V
150 mV	18.3 to 20.3	+19.3 V
		-19.3 V

POWER SUPPLY TOLERANCES

Table 4-1

If a power supply is within the tolerance given 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 procedure given in the Adjustment section to adjust the 16-volt power supplies.

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 in the Calibration section of the manual. Check that each power supply is within the tolerance given in Table 4-1.

Capacitors. A leaky or shorted capacitor can be detected by checking resistance with an ohmmeter on the highest scale. Use an ohmmeter which will not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacity meter, or by checking whether it passes AC signals.

Resistors. Check the resistors with an ohmmeter. Resistor tolerances are given in the Replaceable Electrical Parts list in every manual. Resistors do not normally need to be replaced unless the measured value varies widely from the specified value.

A diode may be checked for an open or shorted condition by measuring the resistance between terminals. With an ohmmeter scale having an internal source of high in one direction and very low when the leads are reversed.

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

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

Integrated circuits can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit description is essential to troubleshooting circuits using IC's. Operating waveforms, logic levels, and other operating information for the IC's are given in the circuit description information of the appropriate manual. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin in-line IC's is with an integrated-circuit test clip. This device also doubles as an extraction tool.

A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component for it (or one which 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. A suction-type desoldering tool must be used to remove soldered-in transistors; see component replacement procedure for details.

Transistors and IC's. Turn the power switch off before removing or replacing any semiconductor.

If a component cannot be disconnected from its circuit, considered when evaluating the measurement. Except for soldered-in transistors and integrated circuits, most components can be lifted at one end from the circuit board.

Component Checking

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

Semiconductor Checks

Often defective components can be located by using waveform and voltage indications when they appear on the schematic or in the calibration procedures. Such waveforms and voltage labels are typical indications and will vary between instruments. To obtain operating conditions similar to those used to take these readings, refer to the first diagram in the service sections.

Voltages and Waveforms

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

For metal terminals, (e.g., switch terminals, potentiometers, etc.) a higher wattage soldering iron is required

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.

CAUTION

make a good solder joint. Use only 60/40 rosin-core, electronic-grade solder. Apply only enough solder to make a firm solder joint.

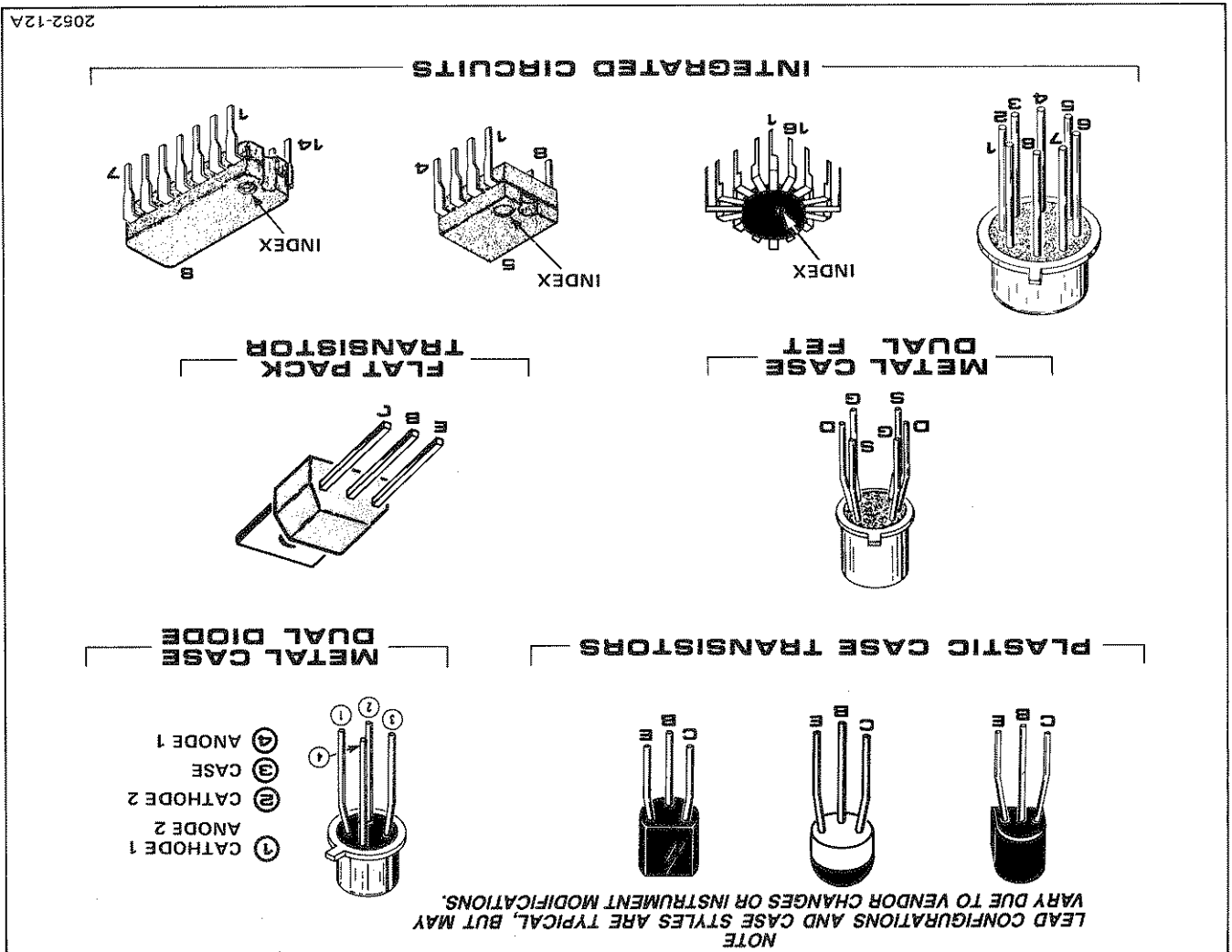
To avoid electric shock, disconnect the instrument from the power source before soldering.

WARNING

The choice of soldering iron is determined by the repair to be made.

SOLDERING TECHNIQUES

Fig. 4-2. Semiconductor lead configurations.



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.

Switches

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 the circuit board to the frame tabs.
4. Slide the circuit board toward the rear of the frame until clear of the front panel and lift out.
5. To replace the circuit board, reverse the order of removal.

Circuit Board Removal

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

Circuit Boards

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

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



COMPONENT REMOVAL AND REPLACEMENT

flux-removing solvent. Be careful not to remove information printed on the board.

6. Clean the area around the solder connection with a board (if not clipped off in step 3).
5. Clip off the excess lead that protrudes through the

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.

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.

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

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.

Some component leads may be difficult to remove if their leads were bent during machine insertion in the manufacturing process. The bent lead held the component in place during a flow-soldering process.

NOTE

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.

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.

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

to accomplish the work. 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.

Cam Switches. The cam switch used in this instrument consists of a rotating cam that 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.



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

A cam switch repair kit is available (Tektronix Part No. 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 in Circuit Board Removal, in this section.

2. Remove eight 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 be replaced only when actually defective. Unnecessary replacement of semiconductors may affect the adjustment of the instrument. If removed from sockets during routine maintenance, return them to their original sockets.



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 maintenance 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 the direction of its hinged side.

2. Re-insert terminal connector into its proper hole in the holder and bend the grooved part of the holder back to its vertical position so connector(s) fit 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 connectors are replaced. If the individual lead-end pin connectors are removed from the plastic holder, note the color of the individual wires for replacement.

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.

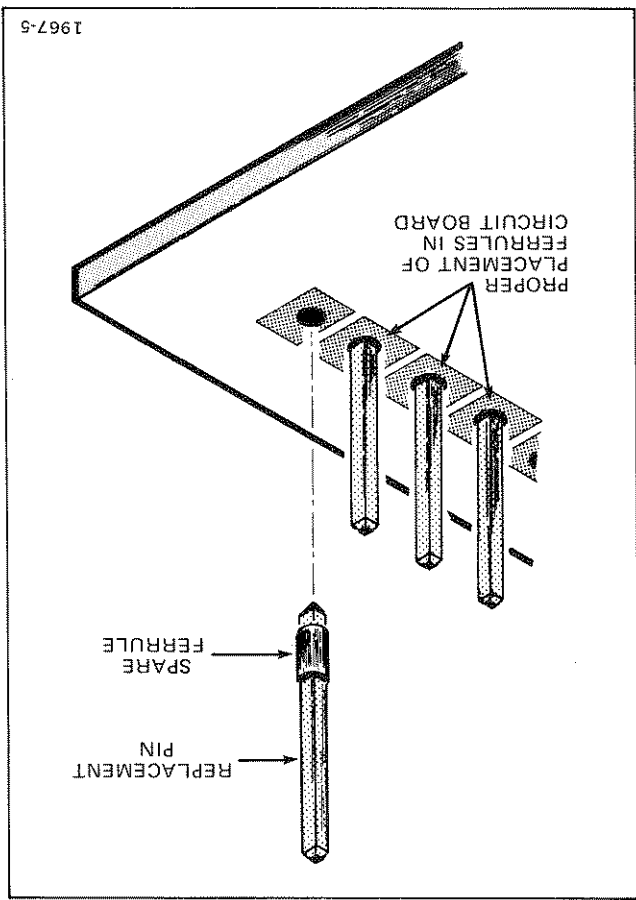
This procedure lists most of the probable causes of a number of possible troubles. The trouble symptom is followed by a check procedure that lists the components that should be checked. See the component locator grid in the Diagrams section for component location.

TROUBLESHOOTING PROCEDURE

5. Solder the pin to the circuit board on each side of the board.
4. Position the replacement pin in the same manner as the old pin.

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 its attached spare ferrule, into the hole.

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.

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.

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.

A circuit-board pin-replacement kit including necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order Tektronix Part No. 040-0542-00.

Fig. 4-3. Installation of lead-end connectors.

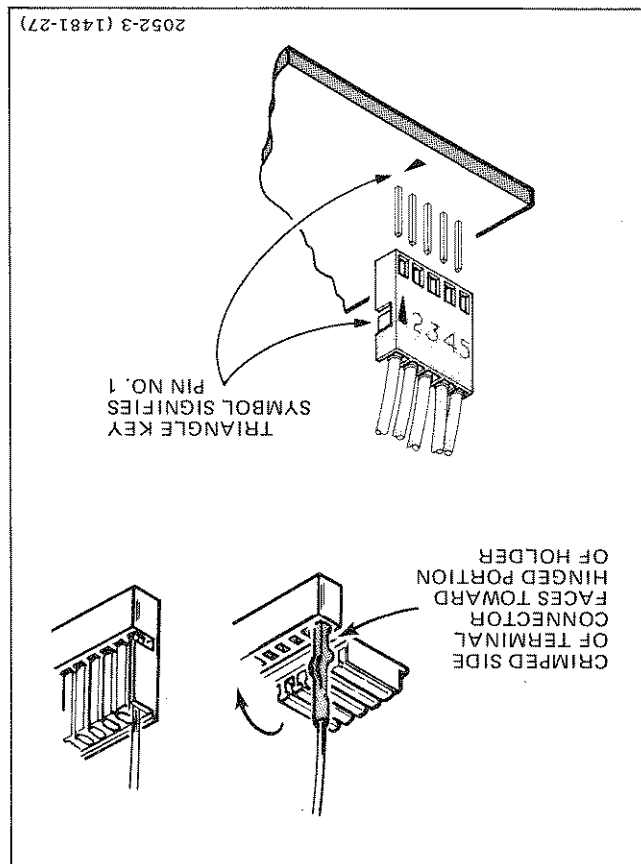


Table 4-2 (cont)
TROUBLESHOOTING

<p>A. TROUBLE SYMPTOM: No signal at OUTPUT connector. (cont)</p>	<p>1. Cable from J380 is properly installed (may be connected for rear interface output).</p> <p>2. ± 16 V Supply</p> <p>a. F402, F406 b. C402, C406 c. U410 d. Q155, Q166 e. R412, R422</p> <p>3. ± 19.3 V Supply</p> <p>a. Q450, Q460 b. VR452, VR462 c. U145</p> <p>4. ± 3 V Supply</p> <p>a. VR100 b. VR172</p> <p>5. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p (with probe connected).</p> <p>a. Cables from J100 to P160 and P202 are properly installed. b. Q155, Q165 c. Q115 d. U145 e. U135 f. Q130</p> <p>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 1X probe (e.g., P6302).</p> <p>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.</p> <p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q310 i. Q315, Q325</p>
<p>A. TROUBLE SYMPTOM: No signal at OUTPUT connector (cont)</p>	<p>1. ± 16 V Supply</p> <p>2. Check bias voltages on schematics 2 and 3.</p> <p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q320 i. Q315, Q325</p> <p>3. Wiper of R302 adjusts between - and +15 volts; with no sudden discontinuities.</p> <p>a. R302 b. R300, R304</p> <p>4. Voltage at P202 with ± 3 V Supply</p> <p>a. VR100 b. VR172</p> <p>5. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p (with probe connected).</p> <p>a. Cables from J100 to P160 and P202 are properly installed. b. Q155, Q165 c. Q115 d. U145 e. U135 f. Q130</p> <p>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 1X probe (e.g., P6302).</p> <p>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.</p> <p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q310 i. Q315, Q325</p>

Table 4-2 (cont)
TROUBLESHOOTING

<p>A. TROUBLE SYMPTOM: No signal at OUTPUT connector (cont)</p>	<p>8. Rotate CURRENT/DIV throughout its full range and note that there is no sudden loss of signal at OUTPUT connector.</p> <p>a. R206 b. R208 c. R210 d. R212 e. R214</p> <p>B. TROUBLE SYMPTOM: Unable to zero output level with Coupling in CAL DC LEVEL</p> <p>1. ± 16 V Supply</p> <p>2. Check bias voltages on schematics 2 and 3.</p> <p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q320 i. Q315, Q325</p> <p>3. Wiper of R302 adjusts between - and +15 volts; with no sudden discontinuities.</p> <p>a. R302 b. R300, R304</p> <p>4. Voltage at P202 with ± 3 V Supply</p> <p>a. VR100 b. VR172</p> <p>5. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p (with probe connected).</p> <p>a. Cables from J100 to P160 and P202 are properly plugged into the correct sockets.</p> <p>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 1X probe (e.g., P6302).</p> <p>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.</p> <p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q310 i. Q315, Q325</p>
<p>A. TROUBLE SYMPTOM: No signal at OUTPUT connector (cont)</p>	<p>1. ± 16 V Supply</p> <p>2. Check bias voltages on schematics 2 and 3.</p> <p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q320 i. Q315, Q325</p> <p>3. Wiper of R302 adjusts between - and +15 volts; with no sudden discontinuities.</p> <p>a. R302 b. R300, R304</p> <p>4. Voltage at P202 with ± 3 V Supply</p> <p>a. VR100 b. VR172</p> <p>5. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p (with probe connected).</p> <p>a. Cables from J100 to P160 and P202 are properly plugged into the correct sockets.</p> <p>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 1X probe (e.g., P6302).</p> <p>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.</p> <p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395 f. U370 g. U350 h. Q310, Q310 i. Q315, Q325</p>

Table 4-2 (cont)
TROUBLESHOOTING

E. TROUBLE SYMPTOM: Excessive Droop in Pulse Response

<p>If CHECK indicates a problem, examine the following components and replace, if necessary.</p>	<p>CHECK:</p>
--	----------------------

<p>1. Probe is CLOSED</p>	<p>CHECK:</p>
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<p>2. ± 3 V Supply</p>	<p>a. VR100 b. VR172</p>
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<p>3. R364 Adjustment</p>	<p>a. Cables from J100 to P160 and P202 are properly installed. b. Q155, Q165 c. Q115 d. U145</p>
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<p>4. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p</p>	<p>5. Press and release DEGAUSS button and set OUTPUT voltage at P202 to zero with BALANCE control.</p>
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<p>5. Press and release DEGAUSS button and set OUTPUT voltage at P202 to zero with BALANCE control.</p>	<p>6. Check probe as shown in "Probe Check" following this troubleshooting table.</p>
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<p>6. With probe reconnected, press and release DEGAUSS button "Probe Check" following this troubleshooting table.</p>	<p>CHECK:</p>
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<p>7. ± 16 V Supply</p>	<p>a. F402, F406 b. U410 c. Q155, Q166 d. R403, R407</p>
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<p>8. Gain Adjustment (R344)</p>	<p>a. Set gain per step B in Adjustments procedure, Section 6.</p>
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<p>9. Aberrations Adjustments (R345 and R363)</p>	<p>a. Adjust per step C2 in Adjustments procedure, Section 6.</p>
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<p>10. With Coupling set to CAL DC LEVEL, adjust DC LEVEL for zero volt at OUTPUT connector and check bias</p>	<p>a. Q230 b. Q360 c. Q385 d. Q390 e. Q395</p>
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Table 4-2 (cont)
TROUBLESHOOTING

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

<p>If CHECK indicates a problem, examine the following components and replace, if necessary.</p>	<p>CHECK:</p>
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<p>5. With probe removed and INPUT pin E shorted to pin F, E BALANCE should vary from at least -5 V to greater than +5 V.</p>	<p>6. With probe reconnected, press and release DEGAUSS button "Probe Check" following this troubleshooting table.</p>
---	--

<p>5. With probe removed and INPUT pin E shorted to pin F, E BALANCE should vary from at least -5 V to greater than +5 V.</p>	<p>a. P110 b. U110 c. R120</p>
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<p>6. With probe reconnected, press and release DEGAUSS button "Probe Check" following this troubleshooting table.</p>	<p>CHECK:</p>
--	----------------------

<p>7. ± 16 V Supply</p>	<p>a. F402, F406 b. U410 c. Q155, Q166 d. R403, R407</p>
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<p>8. ± 19.3 V Supply</p>	<p>a. Q450, Q460 b. VR452, VR462</p>
--	--

<p>9. Voltage at U135, pin 6, with DEGAUSS button depressed is 7 V p-p ± 1 V at about 160 Hz.</p>	<p>10. Voltage at P202 with DEGAUSS button depressed is 11 V, p-p with probe connected.</p>
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<p>11. ± 16 V Supply</p>	<p>a. Q130 b. U135 c. R136</p>
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<p>12. With Coupling set to CAL DC LEVEL, adjust DC LEVEL for zero volt at OUTPUT connector and check bias</p>	<p>a. Q155 b. Q115 c. U145</p>
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TROUBLESHOOTING
Table 4-2 (cont)

<p>F. TROUBLE SYMPTOM: Excessive Pulse Aberrations or Poor Bandwidth (cont)</p>	
<p>f. U370 g. U350 h. Q310, Q320 i. Q315, Q325</p>	<p>2 and 3 in Section 9. voltages on schematics</p>
<p>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.</p>	<p>a. U110 b. ±3 V Supply c. Check probe as shown in "Probe Check" following this troubleshooting table.</p>
<p>G. TROUBLE SYMPTOM: Excessive Line-Frequency Ripple at AM 503 OUTPUT connector</p>	
<p>1. Is AM 503 grounded to display device (monitor oscilloscope)?</p>	<p>a. Be sure AM 503 is grounded to display device.</p>
<p>2. Is AM 503 grounded to display device (monitor oscilloscope)?</p>	<p>If CHECK indicates a problem, examine the following components and replace, if necessary.</p>

TROUBLESHOOTING
Table 4-2 (cont)

<p>G. TROUBLE SYMPTOM: Excessive Line-Frequency Ripple at AM 503 OUTPUT connector (cont)</p>	
<p>2. Voltage level across C402 or C406 should be between 24 and 34 volts with maximum ripple 4.5 V, p-p.</p>	<p>a. Circuit-board edge connector is properly plugged into power supply module. b. F402, F406</p>
<p>3. ±16 V Supply level and ripple shown in Table 4-1.</p>	<p>a. U410 b. R403, R407</p>
<p>4. ±19.3 V Supply level and ripple shown in Table 4-1.</p>	<p>a. Q450, Q460 b. VR452, VR462</p>

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.

CIRCUIT DESCRIPTION

Introduction

This section of the manual contains a description of the circuitry used in the AM 503 Current Probe Amplifier. The description begins with a discussion of the instrument, using the block diagram shown in the Diagrams section.

Block Diagram Description

The block diagram shows the states and the basic interconnections of each major circuit in the description. The number by each title on the block diagram and circuit description refers to the corresponding circuit diagram in the Diagrams section of this manual.

Typical Current Probe. The probe area (depicted in grey tint) is shown to give a general overview of the signal flow from the typical probe. The current probe Hall device output is fed to the Hall device preamp (part of the DC Amplifier), Hall Disconnect, and Power Amplifier. The Power Amplifier output is fed back through the probe transformer to the input attenuators.

With a square wave input, the probe Hall device output and the probe transformer output are combined as shown in Fig. 5-1, to produce the square wave that is fed to the attenuators (Fig. 5-1D) and is seen at the OUTPUT connector.

DC Amplifier

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

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

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

The DC Amplifier also contains a deflection sensitivity indicator circuit. With a 1X probe (e.g., P6302) connected to the INPUT, the 1X lamp is lit (behind the knob-skirt) to indicate the proper deflection sensitivity. Another lamp is lit (10X) behind the knob-skirt when using a 10X probe (e.g., P6303).

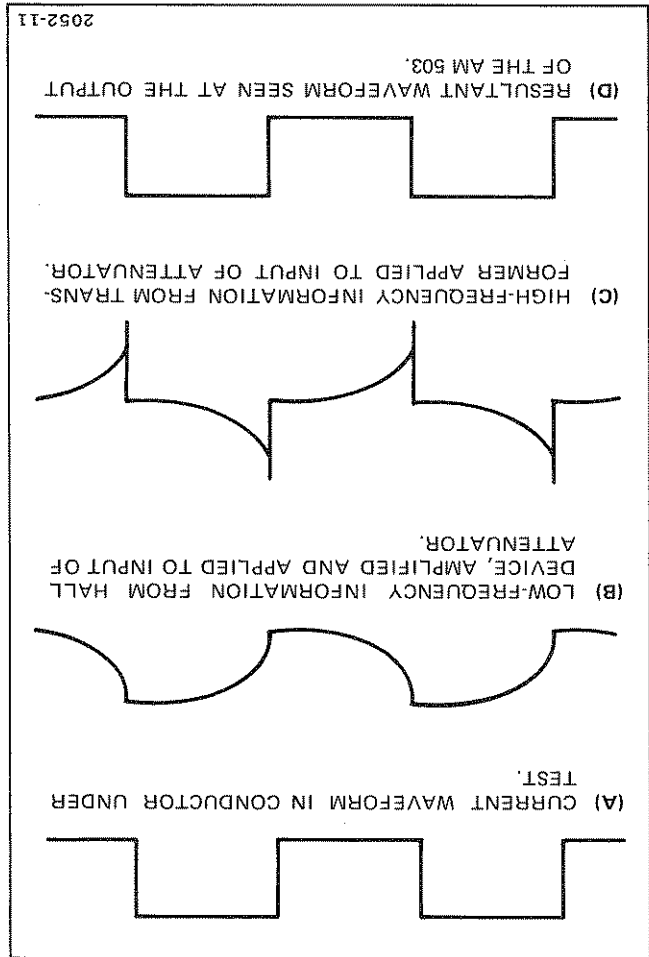


Fig. 5-1. AM 503 and probe waveforms.

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

Attenuator

The attenuator provides current-per-division sensitivities in a 1-2-5 sequence from 1 mA to 5 A for a 1X probe, and from 10 mA to 50 A for a 10X probe. It also provides a 25 Ω input termination for the DC Amplifier in all attenuator positions.

The attenuator also includes a source follower (Q230A and B) that isolates the attenuator output from the X2 Gain Amplifier (on the Output Amplifier block diagram).

When the DEGAUSS switch is released, Q115 remains biased off for approximately 1 second by the time constant of C124-R124, allowing the output of the degauss oscillator time (as determined by C126-R127) to decay to zero. The result is that the signal path is interrupted when the DEGAUSS button is pressed and released, permitting the probe transformer core to be degaussed by the degauss oscillator. The output is fed to the J100 (pins N and K), through P160.

Pressing the DEGAUSS switch (S125) applies -16 V through R122 to Q115 gate and junction of R124 and C124. C124 discharges and Q115 turns off.

The Hall disconnect switch consists of CR115, CR116, and Q115. In normal operation, Q115 gate is at about zero volt and Q115 is conducting. Signals from U110 are applied to Q115 drain through R116 and passed through Q115 to pin 2 of U145. Diodes CR115 and CR116 clamp the drain of Q115 when the signal levels exceed about + or -0.5 V.

Hall Disconnect 1

BALANCE control R120 provides fine adjustment to cancel dc offset in the probe.

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.

With a probe connected to the INPUT connector and the probe coupled around a current-carrying conductor (e.g., a conductor carrying dc or low-frequency ac), the conductor magnetic field induces a voltage (through the probe transformer) at the output of the Hall device. The resultant dc or 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.

The Hall-device preamplifier consists of operational amplifier U110, its associated components, and the BALANCE control (R120).

Hall-Device Preamplifier 1

connector grounds pin L and the anode of CR175, Q180 collector current illuminates DS190, the 10X indicator; its collector voltage reverse-biases Q185. When Q185 is turned off, it turns off the 1X indicator (DS192).

Connecting a 10X probe (e.g., P6303) to the INPUT

With a 1X probe (e.g., P6302) connected to the INPUT connector, pin L of the connector remains ungrounded. 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), its collector is at about -15.5 V, lighting DS192 (1X) through R189.

One of the two lamps (DS190 or DS192), located behind the CURRENT/DIV knob-skirt, illuminates the appropriate deflection factor selector for either a 1X or 10X probe.

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

Deflection Sensitivity Lamp Drivers 1

DC AMPLIFIER

Circuits unique to this instrument are described in detail in this discussion. 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.

Detailed Circuit Description

The power supply provides four regulated voltages, -16, +16, -19.3, and +19.3 V to the AM 503.

Power Supply

The output amplifier provides current drive to the OUTPUT INTO 50 Ω connector, J390. It also provides, via S200A, 5X attenuation in the 50 mA to 50 A CURRENT/DIV switch positions.

The selectable-bandwidth amplifier provides a choice of full bandwidth (100 MHz for the AM 503) or bandwidth limited to 5 MHz. The bandwidth is selected by BAND-WIDTH switch S370.

The selectable-gain amplifier provides a choice between two gains: one gain for the 1X probe and another for the 10X probe.


The X2 Gain Amplifier provides gain and a means of setting the output amplifier dc level (front-panel DC LEVEL control).

Output Amplifier

Above the crossover region, 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 output of the power amplifier (Q155 and Q165) 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 being measured. This feedback system permits the Hall-device element and ferrite core to operate at very low flux densities, providing excellent sensitivity and linearity.

Above the crossover region the output of the Hall device diminishes. At this time L168 blocks the ac signal from the power amplifier and the cable between the input attenuator and J160 is terminated in $50\ \Omega$ 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 $25\ \Omega$ input impedance of the attenuator  terminates the coaxial cable at high frequencies.

Input Overload Indicator

If the output from Q155-Q165 swings about 12 V above or below zero, CR168 illuminates.

Zeners VR166 and VR167 (back to back) provide approximately 10 V drop from the output of Q155-Q165. Bridge rectifier CR167 provides drive to CR168 on both negative and positive output swings.

ATTENUATOR

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 $\pm 10\ \text{V}$.

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

OUTPUT AMPLIFIER

X2-Gain Amplifier

This circuit consists of Q310A and B, Q315, Q325, and

In normal operation (DEGAUSS switch open), C126 charges to $-16\ \text{V}$ through R127. FET Q130 is biased off and the oscillator circuit is not operating.

When DEGAUSS switch S125 is depressed, it discharges C126, which turns on Q130. The Q130 drain-to-source 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 limited 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 and maintain the oscillator output at a constant level, as long as the DEGAUSS is held pressed. Oscillator output reaches U145 via R140.

This circuit consists of U145, Q155, Q165, VR166, VR167, CR167, CR168, and associated components, including the degauss offset control, R152.

Power Amplifier

The 160 Hz degaussing signal from U135 low-frequency input signal is applied to pin 2 of U145. Degaussing offset (R152) adjusts the offset (at J160) of the power amplifier when the DEGAUSS button is pressed.

Output signals from U145 (pin 6) drive the bases of Q155 and Q165, a complementary amplifier. R159, R156, R160, and R162 form the dc bias network for Q155-Q165. Thermal resistors RT156 and RT160 compensate for bias current changes due to temperature variation. CR158 and CR166 are protection diodes.

From dc to the crossover region, the Hall device provides all or most of the signal to the input attenuators.

Degauss Oscillator

The Degauss Oscillator consists of sine-wave oscillator U135, gain-regulating FET Q130, and associated components, including output-amplitude control R136.

associated components in a cascode amplifier having a gain of two.

DC LEVEL control (R302) sets the dc level of the output amplifier at the 50 Ω output connector (J390).

Selectable-Gain Amplifier 3

The selectable-gain amplifier consists of U350, gain control R346, and associated components.

When P346 is at ground potential (through pin B of J100), the gain of U350 is decreased by a factor of about two. This gain is adjustable 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), bandwidth selecting switch S370, and networks R370-R372, R373-R374.

With the BANDWIDTH switch in the 5 MHz position, U370 output is from pins 6 and 8, through a low-pass filter network L380-L383, C380-C383, to Q390.

With the BANDWIDTH switch in the FULL position, the signal path from U370 is changed to pins 5 and 9, by-passing the low-pass filter network.

Q360 is a current-source for U370. Q360 current levels 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 U370.

Output Amplifier 3

Q390 and Q395, cascaded emitter followers, isolate the output of U370 from the OUTPUT INTO 50 Ω connector (J390).

Switch S200A (CURRENT/DIV) connects a 5 times attenuation network in the 50 mA to 50 A positions.

Power Supply 4

The ac voltages from the power module (edge connectors pins 13A, 13B, 1A, and 1B) 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 (U410), and two series-pass transistors (located in the power module) to provide regulated -16 and +16 V. Q440 and Q470 limit the voltage into U410 to +20 and -20 V.

The output voltage of the -16 V supply is adjusted by the volts control (R405). The Balance control (R415) sets the +16 V supply output to match the -16 V supply.

R403 and R407 are the load-current-sensing resistors. They set the bias on the series-pass transistors (located in the power module). The output voltage is sensed at the sense input (U410, pins 4 and 11). This sense voltage determines the current in R403 and R407. For example, if the voltage at the +16 V output decreases, the + sensing circuit increases the current in R403, which increases the forward bias on the series-pass transistor. Thus, the output voltage increases to +16 V.

The current through VR452 and VR462 is set to cause 20 V drop across them. This 20 V sets the pass-transistor bases (Q450-Q460) at 20 V. With 20 V on the base, the output is at about 19.3 V.

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	Q TZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMCOND	SEMICONDUCTOR
ELECTLT	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
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMI-CONDUCTOR PROD. DIV.	5005 E MCDOWELL RD., P O BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMI-CONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
12697	CLAROSTAT MFG. CO., INC.	LOWER WASHINGTON STREET	DOVER, NH 03820
12969	UNITRODE CORPORATION	580 PLEASANT STREET	WATERTOWN, MA 02172
14193	CAL-R, INC.	1601 OLYMPIC BLVD.	SANTA MONICA, CA 90404
14552	MICRO SEMI-CONDUCTOR CORP.	2830 E FAIRVIEW ST.	SANTA ANA, CA 92704
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
14936	GENERAL INSTRUMENT CORP., SEMI-CONDUCTOR PRODUCTS GROUP	P. O. BOX 600, 600 W. JOHN ST.	HICKSVILLE, NY 11802
15238	ITT SEMI-CONDUCTORS, A DIVISION OF INTER NATIONAL TELEPHONE AND TELEGRAPH CORP.	P. O. BOX 168, 500 BROADWAY	LAWRENCE, MA 01841
17856	SILICONIX, INC.	2201 LAURELWOOD DRIVE	SANTA CLARA, CA 95054
17971	ELECTRA-MIDLAND CORP., MEPCO ELECTRA INC.	P O BOX 760	MINERAL WELLS, TX 76067
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	BRADFORD, PA 16701
24931	SPECIALTY CONNECTOR CO., INC.	2620 ENDRESS PLACE	GREENWOOD, IN 46142
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
34333	SILICON GENERAL, INC.	7382 BOLSA AVE.	WESTMINSTER, CA 92683
34371	HARRIS SEMI-CONDUCTOR, DIV. OF HARRIS CORPORATION	P. O. BOX 883	MELBOURNE, FL 32901
50157	MIDWEST COMPONENTS INC.	P. O. BOX 787	MUSKEGON, MI 49443
50522	MONSANTO CO., ELECTRONIC SPECIAL PRODUCTS	3400 HILLVIEW AVENUE	PALO ALTO, CA 94304
51642	CENTRE ENGINEERING INC.	2820 E COLLEGE AVENUE	STATE COLLEGE, PA 16801
55680	NICHICON/AMERICA CORP.	6435 N PROESSEL AVENUE	CHICAGO, IL 60645
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
57668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
59660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
59821	CENTRALAB INC	7158 MERCHANT AVE	EL PASO, TX 79915
71744	SUB NORTH AMERICAN PHILIPS CORP CHICAGO MINIATURE LAMP WORKS	4433 RAVENSWOOD AVE.	CHICAGO, IL 60640
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
76493	BELL INDUSTRIES, INC.	19070 REYES AVE., P O BOX 5825	COMPTON, CA 90224
79727	C-W INDUSTRIES	550 DAVISVILLE RD., P O BOX 96	WARMINSTER, PA 18974
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
90201	MALLOY CAPACITOR CO., DIV. OF MALLOY AND CO., INC.	3029 E. WASHINGTON STREET	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 372	COLUMBUS, NE 68601
96733	SAN FERNANDO ELECTRIC MFG CO	1501 FIRST ST	SAN FERNANDO, CA 91341

Ckt No.	Tektronix Part No.	Serial/Model No.	Discont	Name & Description	Mfr Code	Mfr Part Number
A1	670-4353-00	B010100	B029999	CKT BOARD ASSY:MAIN PLUG IN	80009	670-4353-00
A1	670-4353-01	B030000	B047648	CKT BOARD ASSY:MAIN PLUG IN	80009	670-4353-01
A1	670-4353-02	B047649	B049499	CKT BOARD ASSY:MAIN PLUG IN	80009	670-4353-02
A1	670-4353-03	B049500	B054926	CKT BOARD ASSY:MAIN PLUG IN	80009	670-4353-03
A1	670-4353-04	B054927	B063180	CKT BOARD ASSY:MAIN PLUG IN	80009	670-4353-04
A1	670-4353-06	B063181		CKT BOARD ASSY:MAIN PLUG IN	80009	670-4353-06
C100	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C101	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C103	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C108	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C110	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C112	283-0647-00			CAP.,FXD,MICA D:70PF,1%,100V	00853	D155E70FO
C124	283-1097-00			CAP.,FXD,PLSTC:0.47UF,10%,50V	14752	230B1A474K
C125	283-0693-00			CAP.,FXD,MICA D:1730PF,1%,500V	00853	D19-5F1731FO
C126	290-0525-00			CAP.,FXD,ELECT:4.7UF,20%,50V	00853	196D475X0050K41
C133	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAA
C137	283-1050-00			CAP.,FXD,PLSTC:0.1UF,1%,200V	14752	230B1C104F
C138	283-0051-00			CAP.,FXD,CER DI:0.0033UF,5%,100V	56289	1C20C0CG332J100B
C140	290-0536-00			CAP.,FXD,ELECT:10UF,20%,25V	90201	TD-C106M025FL
C146	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C148	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
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	D105E820FO
C155	290-0272-00			CAP.,FXD,ELECT:47UF,20%,50V	56289	109D476X0050F2
C156	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C160	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C165	290-0272-00			CAP.,FXD,ELECT:47UF,20%,50V	96733	R2676
C166	283-0114-00			CAP.,FXD,CER DI:0.0015UF,5%,200V	59660	805634Y5D0152J
C172	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C176	283-0204-00	B010100	B020286	CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C187	283-0204-00	B010100	B032319	CAP.,FXD,CER DI:2UF,20%,50V	96733	R2676
C218	283-0212-00	B010100		CAP.,FXD,CER DI:0.22UF,10%,50V	72822	8131N075W5R224K
C218	283-0339-00	B032320		CAP.,FXD,CER DI:0.22UF,10%,50V	72822	8131N075W5R224K
C220	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C232	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C234	290-0134-00			CAP.,FXD,ELECT:22UF,20%,15V	56289	150D226X0015B2
C242	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C244	290-0134-00			CAP.,FXD,ELECT:22UF,20%,15V	56289	150D226X0015B2
C306	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C308	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C313	283-0077-00	B010100	B029999	CAP.,FXD,CER DI:330PF,5%,500V	59660	831-500B331J
C323	283-0077-00	B010100	B029999	CAP.,FXD,CER DI:330PF,5%,500V	59660	831-500B331J
C328	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
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	96733	R2676
C360	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
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,25V	73899	DVJ-5006
C364	283-0210-00	B010100	B029999	CAP.,FXD,CER DI:0.0056UF,20%,50V	56289	273C9
C364	283-0639-00	B030000	B047648	CAP.,FXD,MICA D:56PF,1%,100V	00853	D15E60FO
C365	283-0600-00	B047649	B029999	CAP.,FXD,MICA D:43PF,5%,500V	00853	D105E430J0
C365	-----	B010100		(SELECTED)		
C365	283-0212-00	B030000		CAP.,FXD,CER DI:2UF,20%,50V	51642	400-050-Z5U205M

Kit No.	Tektronix	Serial/Model No.	Discont	Name & Description	Mfr Code	Mfr Part Number
C366	283-0238-00	B030000	B047648	CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N075X7R0103K
C366	283-0268-00	B047649		CAP.,FXD,CER DI:0.015UF,10%,50V	56289	1C20X7R153K050B
C367	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96736	R2676
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
C385	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C388	290-0517-00	B010100	B047648	CAP.,FXD,MICA D:33PF,5%,500V	90201	TD0685M035FL
C391	283-0615-00	B010100		CAP.,FXD,MICA D:33PF,5%,500V	00853	D156E330J0
C391	283-0779-00	B047649		CAP.,FXD,MICA D:27PF,2%,500V	00853	D155E270G0
C393	281-0593-00			CAP.,FXD,CER DI:3.9PF,10%,500V	04222	7001-C0J-3R9C
C394	281-0626-00			CAP.,FXD,CER DI:3.9PF,1%,500V	59660	301000C0J0393B
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	96733	R2676
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	96733	R2632
C414	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAA
C423	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	96733	R2632
C434	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C436	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96736	R2676
C444	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C446	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C452	290-0782-00	B030000		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	55680	ULA1V4R7TEA
C462	290-0782-00	B030000		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	55680	ULA1V4R7TEA
CR103	150-1001-00			LT EMITTING DIO:RED,660NM,100MA MAX	50522	MV5024
CR115	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR116	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR127	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR133	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR158	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR166	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR167	152-0585-00			SEMICON D DEVICE:SiLICON,BRIDGE,200V,1A	14936	W2M-30
CR168	150-1001-00			LT EMITTING DIO:RED,660NM,100MA MAX	50522	MV5024
CR175	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR226	152-0321-00			SEMICON D DEVICE:SiLICON,30V,0.1A	07263	FSA1480
CR320	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR380	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR383	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR386	152-0141-02			SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR402	152-0585-00			SEMICON D DEVICE:SiLICON,BRIDGE,200V,1A	14936	W2M-30
CR406	152-0585-00			SEMICON D DEVICE:SiLICON,BRIDGE,200V,1A	14936	W2M-30
CR452	152-0141-02	B020000	B029999	SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR462	152-0141-02	B020000		SEMICON D VVC.DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
DS190	150-0046-00			LAMP,INCAND:10V,0.04A	71744	CM2107
DS192	150-0046-00			LAMP,INCAND:10V,0.04A	71744	CM2107
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	218-002
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	218-002
J100	131-1315-01			CONN,RCP,T,ELEC:BN,C,FEMALE	24931	28JR 306-1
J160	131-1003-00			CONN,RCP,T,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
J202	131-1003-00			CONN,RCP,T,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
J380	131-1003-00			CONN,RCP,T,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
J480	131-1003-00			CONN,RCP,T,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00

Ckt No.	Tektronix Part No.	Serial/Model No.	Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
L168	108-0245-00	B010100	B047648		COIL,RF:3.9UH	76493	B6310-1
L202	108-0853-00	B010100	B047649		COIL,RF:48.7UH,TOROIDAL	80009	108-0853-00
L202	108-0200-00	B047649			COIL,RF:40UH	80009	108-0200-00
L380	108-0345-00				COIL,RF:FIXED,1.89UH	80009	108-0345-00
L383	108-0345-00				COIL,RF:FIXED,1.89UH	80009	108-0345-00
Q115	151-1059-00				TRANSISTOR:SILICON,FE,N-CHANNEL	04713	ORDER BY DESCR
Q130	151-1059-00				TRANSISTOR:SILICON,FE,N-CHANNEL	04713	ORDER BY DESCR
Q155	151-0390-00				TRANSISTOR:SILICON,NPN	04713	SPS3414/MPS-U45
Q165	151-0391-00				TRANSISTOR:SILICON,NPN	80009	151-0391-00
Q180	151-0254-00	B010100	B047648		TRANSISTOR:SILICON,NPN	03508	X38L3118
Q180	151-0190-00	B047649			TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
Q185	151-0190-00				TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
Q230	151-1032-00				TRANSISTOR:SILICON,FET,DUAL	17856	DN399
Q310	153-0609-00	B010100	B029999		SEMICONV DVC SE:SILICON,PNP	80009	153-0609-00
Q310	151-0461-00	B0300000			TRANSISTOR:SILICON,NPN,DUAL	04713	SRF72
Q315	151-0188-00				TRANSISTOR:PNP,SI,TO-92	04713	SPS6868
Q320	153-0609-00	B010100	B029999		SEMICONV DVC SE:SILICON,PNP	80009	153-0609-00
Q325	151-0188-00				TRANSISTOR:PNP,SI,TO-92	04713	SPS6868
Q360	151-0190-00				TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
Q385	151-0188-00				TRANSISTOR:PNP,SI,TO-92	04713	SPS6868
Q390	151-0190-00				TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
Q395	151-0188-00				TRANSISTOR:PNP,SI,TO-92	04713	SPS6868
Q440	151-0347-00	B020000			TRANSISTOR:SILICON,NPN	56289	T7916
Q450	151-0190-00				TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
Q460	151-0188-00				TRANSISTOR:PNP,SI,TO-92	04713	SPS6868
Q470	151-0350-00	B020000			TRANSISTOR:SILICON,PNP	04713	SPS6700
R100	308-0243-00				RES.,FXD.,WW:240 OHM,5%,.3W	91637	CW2B240R0J
R102	315-0103-00				RES.,FXD.,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R103	315-0102-00				RES.,FXD.,CMPSN:1K OHM,5%,0.25W	57668	NTR25J-E01K0
R104	321-0162-00				RES.,FXD.,FILM:475 OHM,1%,0.125W	91637	CMF55116G475R0F
R105	321-0162-00				RES.,FXD.,FILM:475 OHM,1%,0.125W	91637	CMF55116G475R0F
R106	321-0354-00				RES.,FXD.,FILM:47.5K OHM,1%,0.125W	91637	CMF55116G47501F
R108	315-0100-00				RES.,FXD.,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R110	315-0100-00				RES.,FXD.,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R112	315-0102-00				RES.,FXD.,CMPSN:1K OHM,5%,0.25W	57668	NTR25J-E01K0
R113	321-0354-00				RES.,FXD.,FILM:47.5K OHM,1%,0.125W	91637	CMF55116G47501F
R114	321-0289-00				RES.,FXD.,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R116	315-0471-00				RES.,FXD.,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470E
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	01121	W-8155
R121	321-0200-00				RES.,FXD.,FILM:1.18K OHM,1%,0.125W	91637	CMF55116G11800F
R122	321-0193-00				RES.,FXD.,FILM:1K OHM,1%,0.125W	19701	5043ED1K00F
R123	321-0183-00				RES.,FXD.,FILM:87 OHM,1%,0.125W	91637	CMF55116G87R0F
R124	315-0225-00				RES.,FXD.,CMPSN:2.2M OHM,5%,0.25W	01121	CB2255
R126	315-0470-00	B030000			RES.,FXD.,CMPSN:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R127	315-0474-00				RES.,FXD.,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
R128	315-0105-00				RES.,FXD.,CMPSN:1M OHM,5%,0.25W	57668	NTR25J-E 1M
R129	321-0164-00				RES.,FXD.,FILM:499 OHM,1%,0.125W	91637	CMF55116G499R0F
R130	315-0200-00	B010100	B019999		RES.,FXD.,CMPSN:20 OHM,5%,0.25W	57668	NTR25J-E 20E
R130	315-0300-00	B020000			RES.,FXD.,CMPSN:30 OHM,5%,0.25W	57668	NTR25J-E 30E
R132	315-0105-00				RES.,FXD.,CMPSN:1M OHM,5%,0.25W	57668	NTR25J-E 1M
R133	315-0104-00				RES.,FXD.,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
R134	315-0104-00				RES.,FXD.,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
R135	321-0230-00	B047649			RES.,FXD.,FILM:2.43K OHM,1%,0.125W	24546	CT552431F

Ckt No.	Tektronix Part No.	Serial/Model No.	Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
R136	311-1267-00	B010100	B047648		RES.,VAR, NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R136	311-1264-00	B047649			RES.,VAR, NONWIR:1.5K OHM,10%,0.50W	32997	3329P-L58-152
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	B010100	B029999		RES.,FXD,CMPNS:820 OHM,5%,0.25W	57668	NTR25J-E 820E
R142	315-0241-00	B010100	B029999		RES.,FXD,CMPNS:240 OHM,5%,0.25W	57668	NTR25J-E 240E
R145	315-0241-00	B020000			RES.,FXD,CMPNS:240 OHM,5%,0.25W	91637	CMF55116G249R0F
R146	315-0100-00				RES.,FXD,CMPNS:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R148	315-0100-00				RES.,FXD,CMPNS:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R150	315-0243-00	B010100	B029999		RES.,FXD,CMPNS:24K OHM,5%,0.25W	57668	NTR25J-E24K0
R150	315-0123-00	B030000			RES.,FXD,CMPNS:12K OHM,5%,0.25W	57668	NTR25J-E12K0
R153	315-0243-00	B010100	B029999		RES.,FXD,CMPNS:24K OHM,5%,0.25W	57668	NTR25J-E24K0
R153	315-0123-00	B030000			RES.,FXD,CMPNS:12K OHM,5%,0.25W	57668	NTR25J-E12K0
R156	321-0181-00				RES.,FXD,FILM:750 OHM,1%,0.125W	91637	CMF55116G750R0F
R158	308-0441-00				RES.,FXD,W:3 OHM,5%,.3W	91637	CW2B-3R00J
R159	322-0292-00				RES.,FXD,FILM:10.7K OHM,1%,0.25W	91637	CMF6042G10701F
R160	321-0181-00				RES.,FXD,FILM:750 OHM,1%,0.125W	91637	CMF55116G750R0F
R162	322-0292-00				RES.,FXD,FILM:10.7K OHM,1%,0.25W	91637	CMF6042G10701F
R166	308-0441-00				RES.,FXD,W:3 OHM,5%,.3W	91637	CMF6042G10701F
R168	321-0068-00				RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G499R90F
R169	315-0620-00				RES.,FXD,CMPNS:62 OHM,5%,0.25W	57668	NTR25J-E 62E
R172	308-0243-00				RES.,FXD,W:240 OHM,5%,.3W	91637	CW2BB240R0J
R174	315-0822-00	B010100	B020286		RES.,FXD,CMPNS:8.2K OHM,5%,0.25W	57668	NTR25J-E 8K2
R175	315-0274-00	B010100	B047648		RES.,FXD,CMPNS:270K OHM,5%,0.25W	57668	NTR25J-E270K
R175	315-0103-00	B047649			RES.,FXD,CMPNS:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R176	302-0274-00				RES.,FXD,CMPNS:270K OHM,5%,0.25W	57668	NTR25J-E270K
R181	302-0271-00				RES.,FXD,CMPNS:270 OHM,10%,0.50W	01121	EB2711
R182	315-0682-00				RES.,FXD,CMPNS:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
R183	315-0153-00				RES.,FXD,CMPNS:15K OHM,5%,0.25W	57668	NTR25J-E 15K
R185	315-0512-00	B010100	B020286		RES.,FXD,CMPNS:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R187	315-0512-00	B010100	B020286		RES.,FXD,CMPNS:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R189	302-0271-00				RES.,FXD,CMPNS:270 OHM,10%,0.50W	01121	EB2711
R202	321-0040-00				RES.,FXD,FILM:25.5 OHM,1%,0.125W	91637	CMF55116G25R50F
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	B010100	B032319		RES.,FXD,CMPNS:1K OHM,5%,0.25W	57668	NTR25J-E01K0
R222	315-0203-00	B010100	B032319		RES.,FXD,CMPNS:20K OHM,5%,0.25W	57668	NTR25J-E20K0
R224	315-0101-00				RES.,FXD,CMPNS:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R232	315-0201-00				RES.,FXD,CMPNS:200 OHM,5%,0.25W	57668	NTR25J-E200E
R234	315-0621-00				RES.,FXD,CMPNS:620 OHM,5%,0.25W	57668	NTR25J-E620E
R236	321-0030-00				RES.,FXD,FILM:20 OHM,1%,0.125W	91637	CMF55116G20R00F
R242	315-0201-00				RES.,FXD,CMPNS:200 OHM,5%,0.25W	57668	NTR25J-E200E
R244	315-0621-00				RES.,FXD,CMPNS:620 OHM,5%,0.25W	57668	NTR25J-E620E
R246	321-0030-00				RES.,FXD,FILM:20 OHM,1%,0.125W	91637	CMF55116G20R00F
R300	315-0101-00				RES.,FXD,CMPNS:100 OHM,5%,0.25W	57668	NTR25J-E 100E

Ckt No.	Tektronix	Serial/Model No.	Eff	Descrt	Name & Description	Mfr Code	Mfr Part Number
R302	311-0546-00	B010100	B050203	RES.,VAR,NONWIR:10K OHM,20%,0.75W	RES.,VAR,NONWIR:10K OHM,20%,0.5W	01121	W-8154A
R306	315-0101-00	B010100	B029999	RES.,FXD,FILM:12.4 OHM,1%,0.125W	RES.,FXD,FILM:12.4 OHM,1%,0.125W	91637	MFF1816G12R40F
R307	315-0101-00	B010100	B029999	RES.,FXD,FILM:140 OHM,1%,0.125W	RES.,FXD,FILM:140 OHM,1%,0.125W	91637	MFF1816G140R0F
R308	315-0151-00	B010100	B029999	RES.,FXD,CMPNS:150 OHM,5%,0.25W	RES.,FXD,CMPNS:150 OHM,5%,0.25W	57668	NTR25J-E150E
R309	322-0172-00	B030000		RES.,FXD,FILM:604 OHM,1%,0.25W	RES.,FXD,FILM:604 OHM,1%,0.25W	75042	CEBT0-6040F
R310	322-0172-00	B030000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R311	321-0068-00	B030000		RES.,FXD,FILM:12.4 OHM,1%,0.125W	RES.,FXD,FILM:12.4 OHM,1%,0.125W	91637	MFF1816G12R40F
R312	321-0068-00	B030000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R313	322-0172-00	B030000		RES.,FXD,FILM:604 OHM,1%,0.25W	RES.,FXD,FILM:604 OHM,1%,0.25W	75042	CEBT0-6040F
R314	321-0068-00	B030000		RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R315	308-0553-00	B010100	B029999	RES.,FXD,WW:680 OHM,1%,.3W	RES.,FXD,WW:680 OHM,1%,.3W	91637	RS2B 680 OHM 1%
R317	321-0068-00	B010100	B029999	RES.,FXD,FILM:12.4 OHM,1%,0.125W	RES.,FXD,FILM:12.4 OHM,1%,0.125W	91637	MFF1816G12R40F
R318	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R319	321-0068-00	B010100	B029999	RES.,FXD,CMPNS:150 OHM,5%,0.25W	RES.,FXD,CMPNS:150 OHM,5%,0.25W	57668	NTR25J-E150E
R320	322-0172-00	B030000		RES.,FXD,FILM:604 OHM,1%,0.25W	RES.,FXD,FILM:604 OHM,1%,0.25W	75042	CEBT0-6040F
R321	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R322	321-0068-00	B010100	B029999	RES.,FXD,FILM:12.4 OHM,1%,0.125W	RES.,FXD,FILM:12.4 OHM,1%,0.125W	91637	MFF1816G12R40F
R323	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R324	315-0151-00	B010100	B029999	RES.,FXD,CMPNS:150 OHM,5%,0.25W	RES.,FXD,CMPNS:150 OHM,5%,0.25W	57668	NTR25J-E150E
R325	322-0172-00	B030000		RES.,FXD,FILM:604 OHM,1%,0.25W	RES.,FXD,FILM:604 OHM,1%,0.25W	75042	CEBT0-6040F
R326	315-0242-00	B030000		RES.,FXD,CMPNS:820 OHM,5%,0.25W	RES.,FXD,CMPNS:820 OHM,5%,0.25W	57668	NTR25J-E 820E
R327	317-0680-00	B030000		RES.,FXD,FILM:3.24K OHM,1%,0.125W	RES.,FXD,FILM:3.24K OHM,1%,0.125W	24546	CTS5 3241 F
R328	317-0680-00	B030000		RES.,FXD,CMPNS:68 OHM,5%,0.125W	RES.,FXD,CMPNS:68 OHM,5%,0.125W	01121	BB6805
R329	322-0662-00	B010100	B029999	RES.,FXD,FILM:334 OHM,1%,0.25W	RES.,FXD,FILM:334 OHM,1%,0.25W	75042	CEBT0-3340F
R330	321-0140-00	B030000		RES.,FXD,FILM:280 OHM,1%,0.125W	RES.,FXD,FILM:280 OHM,1%,0.125W	91637	CMF55116G280R0F
R331	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R332	321-0068-00	B010100	B029999	RES.,FXD,FILM:12.4 OHM,1%,0.125W	RES.,FXD,FILM:12.4 OHM,1%,0.125W	91637	MFF1816G12R40F
R333	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R334	321-0097-00	B030000		RES.,FXD,FILM:100 OHM,1%,0.125W	RES.,FXD,FILM:100 OHM,1%,0.125W	91637	CMF55116G100R0F
R335	322-0109-00	B030000		RES.,FXD,FILM:133 OHM,1%,0.25W	RES.,FXD,FILM:133 OHM,1%,0.25W	91637	MFF1421G133R0F
R336	321-0111-00	B010100	B029999	RES.,FXD,FILM:140 OHM,1%,0.125W	RES.,FXD,FILM:140 OHM,1%,0.125W	91637	CMF55116G140R0F
R337	321-0111-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R338	321-0111-00	B010100	B029999	RES.,FXD,FILM:12.4 OHM,1%,0.125W	RES.,FXD,FILM:12.4 OHM,1%,0.125W	91637	MFF1816G12R40F
R339	321-0111-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R340	315-0121-00	B010100	B029999	RES.,FXD,CMPNS:120 OHM,5%,0.25W	RES.,FXD,CMPNS:120 OHM,5%,0.25W	57668	NTR25J-E 120E
R341	311-1260-00	B010100	B029999	RES.,VAR,NONWIR:250 OHM,10%,0.50W	RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R342	311-1259-00	B010100	B047648	RES.,VAR,NONWIR:100 OHM,10%,0.50W	RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3329P-L58-101
R343	311-1268-00	B010100	B047648	RES.,VAR,NONWIR:10K OHM,10%,0.50W	RES.,VAR,NONWIR:10K OHM,10%,0.50W	32997	3329P-L58-103
R344	311-1260-00	B010100	B029999	RES.,VAR,NONWIR:250 OHM,10%,0.50W	RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R345	311-1259-00	B010100	B047648	RES.,VAR,NONWIR:100 OHM,10%,0.50W	RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3329P-L58-101
R346	311-1267-00	B047649		RES.,VAR,NONWIR:5K OHM,10%,0.50W	RES.,VAR,NONWIR:5K OHM,10%,0.50W	32997	3329P-L58-502
R347	315-0102-00	B010100	B029999	RES.,FXD,CMPNS:1K OHM,5%,0.25W	RES.,FXD,CMPNS:1K OHM,5%,0.25W	57668	NTR25J-E01K0
R348	321-0068-00	B010100	B029999	RES.,FXD,CMPNS:10K OHM,5%,0.25W	RES.,FXD,CMPNS:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R349	315-0103-00	B010100	B029999	RES.,FXD,CMPNS:10K OHM,5%,0.25W	RES.,FXD,CMPNS:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R350	321-0173-00	B010100	B029999	RES.,FXD,FILM:19 OHM,1%,0.125W	RES.,FXD,FILM:19 OHM,1%,0.125W	91637	CMF55116G619R0F
R351	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R352	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R353	321-0085-00	B010100	B029999	RES.,FXD,FILM:75 OHM,1%,0.125W	RES.,FXD,FILM:75 OHM,1%,0.125W	91637	CMF55116G75R00F
R354	321-0085-00	B010100	B029999	RES.,FXD,FILM:75 OHM,1%,0.125W	RES.,FXD,FILM:75 OHM,1%,0.125W	91637	CMF55116G75R00F
R355	322-0109-00	B010100	B029999	RES.,FXD,FILM:133 OHM,1%,0.25W	RES.,FXD,FILM:133 OHM,1%,0.25W	91637	MFF1421G133R0F
R356	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R357	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R358	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R359	321-0068-00	B010100	B029999	RES.,FXD,FILM:49.9 OHM,1%,0.125W	RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R360	321-0085-00	B010100	B029999	RES.,FXD,FILM:75 OHM,1%,0.125W	RES.,FXD,FILM:75 OHM,1%,0.125W	91637	CMF55116G75R00F
R361	321-0085-00	B010100	B029999	RES.,FXD,FILM:75 OHM,1%,0.125W	RES.,FXD,FILM:75 OHM,1%,0.125W	91637	CMF55116G75R00F
R362	301-0131-00	B010100	B029999	RES.,FXD,CMPNS:130 OHM,5%,0.5W	RES.,FXD,CMPNS:130 OHM,5%,0.5W	57668	TR50J-E130E
R363	311-1263-00	B010100	B029999	RES.,VAR,NONWIR:1K OHM,10%,0.50W	RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3329P-L58-102
R364	311-1265-00	B010100	B047648	RES.,VAR,NONWIR:2K OHM,10%,0.50W	RES.,VAR,NONWIR:2K OHM,10%,0.50W	32997	3329P-L58-202
R365	311-1260-00	B030000	B047648	RES.,VAR,NONWIR:250 OHM,10%,0.50W	RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251
R366	311-1265-00	B047649		RES.,VAR,NONWIR:2K OHM,10%,0.50W	RES.,VAR,NONWIR:2K OHM,10%,0.50W	32997	3329P-L58-202
R367	311-1260-00	B030000	B047648	RES.,VAR,NONWIR:250 OHM,10%,0.50W	RES.,VAR,NONWIR:250 OHM,10%,0.50W	32997	3329P-L58-251

Ckt No.	Part No.	Textonix	Serial/Model No.	Eff	Discont	Name & Description	Code	Mfr Part Number
R365	315-0222-00	B030000				RES.,FXD,CMPNS:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
R366	315-0911-00	B030000				RES.,FXD,CMPNS:910 OHM,5%,0.25W	57668	NTR25J-E910E
R367	315-0103-00					RES.,FXD,CMPNS:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R368	315-0682-00					RES.,FXD,CMPNS:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
R370	315-0152-00					RES.,FXD,CMPNS:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
R372	321-0176-00					RES.,FXD,FILM:665 OHM,1%,0.125W	91637	CMF55116G665R0F
R373	315-0152-00					RES.,FXD,CMPNS:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
R374	321-0176-00					RES.,FXD,FILM:665 OHM,1%,0.125W	91637	CMF55116G665R0F
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	CMF55116G100R0F
R383	321-0097-00					RES.,FXD,FILM:100 OHM,1%,0.125W	91637	CMF55116G100R0F
R384	301-0681-00					RES.,FXD,CMPNS:680 OHM,5%,0.50W	01121	EB6815
R386	321-0068-00					RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R387	321-0306-00					RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R388	315-0822-00					RES.,FXD,CMPNS:8.2K OHM,5%,0.25W	57668	NTR25J-E 8K2
R390	322-0212-00					RES.,FXD,FILM:1.58K OHM,1%,0.25W	75042	CEB70-1581F
R391	321-0068-00	B010100	B020287			RES.,FXD,FILM:49.9 OHM,1%,0.125W	91637	CMF55116G49R90F
R391	321-0066-00	B020287				RES.,FXD,FILM:47.5 OHM,1%,0.125W	91637	MFF1816G47R50F
R392	315-0122-00					RES.,FXD,CMPNS:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
R393	315-0470-00					RES.,FXD,CMPNS:47 OHM,5%,0.25W	57668	NTR25J-E47E0
R394	321-0135-00					RES.,FXD,FILM:249 OHM,1%,0.125W	91637	CMF55116G249R0F
R395	323-0183-00					RES.,FXD,FILM:787 OHM,1%,0.50W	91637	CMF55116G78700F
R396	315-0391-00					RES.,FXD,CMPNS:390 OHM,5%,0.25W	57668	NTR25J-E390E
R397	315-0511-00					RES.,FXD,CMPNS:150 OHM,5%,0.25W	57668	NTR25J-E150E
R398	315-0511-00	B010100	B054926			RES.,FXD,CMPNS:510 OHM,5%,0.25W	57668	NTR25J-E150E
R398	301-0661-00	B054927				RES.,FXD,CMPNS:360 OHM,5%,0.5W	01121	EB3615
R399	321-0078-01					RES.,FXD,FILM:63.4 OHM,0.5%,0.125W	91637	MFF1816G63R40D
R403	317-0101-00					RES.,FXD,CMPNS:100 OHM,5%,0.125W	01121	BB1015
R404	321-0380-00	B010100	B047648			RES.,FXD,FILM:88.7K OHM,1%,0.125W	91637	MFF1816G88701F
R404	321-0387-00	B047649				RES.,FXD,FILM:105K OHM,1%,0.125W	91637	MFF1816G10502F
R405	311-1271-00					RES.,VAR,NONWIR:50K OHM,10%,0.50W	32997	3329P-L58-503
R406	321-0377-00	B010100	B047648			RES.,FXD,FILM:82.5K OHM,1%,0.125W	91637	MFF1816G82501F
R406	321-0369-00	B047649				RES.,FXD,FILM:68.1K OHM,1%,0.125W	91637	CMF55116G68101F
R407	317-0101-00					RES.,FXD,CMPNS: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	B010100	B019999			RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
R422	308-0755-00	B010100				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,CMPNS:2.7 OHM,5%,0.25W	01121	CB27G5
R436	315-0100-00					RES.,FXD,CMPNS:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R442	307-0103-00					RES.,FXD,CMPNS:2.7 OHM,5%,0.25W	01121	CB27G5
R446	315-0100-00					RES.,FXD,CMPNS:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R452	315-0102-00					RES.,FXD,CMPNS:1K OHM,5%,0.25W	57668	NTR25J-E01K0
R454	315-0471-00	B010100	B019999			RES.,FXD,CMPNS:470 OHM,5%,0.25W	57668	NTR25J-E470E
R454	315-0430-02	B020000				RES.,FXD,CMPNS:43 OHM,5%,0.25W	01121	CB4305
R458	308-0240-00	B047649				RES.,FXD,WW:2 OHM,5% 3W	91637	RS2B-D2R000J
R462	315-0102-00					RES.,FXD,CMPNS:1K OHM,5%,0.25W	57668	NTR25J-E01K0
R464	315-0471-00	B010100	B019999			RES.,FXD,CMPNS:470 OHM,5%,0.25W	57668	NTR25J-E470E
R464	315-0430-02	B020000				RES.,FXD,CMPNS:43 OHM,5%,0.25W	01121	CB4305
R480	323-0068-00					RES.,FXD,FILM:49.9 OHM,1%,0.50W	75042	CECT0-49R90F

Ckt No.	Tektronix	Serial/Model No.	Part No.	Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
RT135			307-0122-00			RES.,THERMAL:50 OHM,10%	50157	3D1515
RT156			307-0126-00			RES.,THERMAL:100 OHM,10%	14193	2D21-101-D
RT160			307-0126-00			RES.,THERMAL:100 OHM,10%	14193	2D21-101-D
RT342			307-0126-00			RES.,THERMAL:100 OHM,10%	14193	2D21-101-D
S125			260-1421-00			SWITCH,PUSH:1 STA,MOMENTARY,NON-SHORT	59821	2KAA010000512
S200			263-1111-00			SW CAM ACTR AS:CURRENT/DIV	80009	263-1111-00
S200			105-0243-00			(S200A) ACTUATOR,SWITCH:AC,DC	80009	105-0243-00
S200			-----			(S200B)		
S370			260-0816-00			SWITCH,SLIDE:PDPT,0.5A,125VAC	79727	GF-126-0012A
U110			156-0317-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	34371	HA2-2625-5
U135			156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	04713	MC1741CP1
U135	B056560	B010100	156-0067-01			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,CHK	04713	MC1741CP1DS
U145	B049499	B010100	156-0317-03			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	34371	HA2-2625-5
U145	B049500	B049500	156-0317-03			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SCRN	34371	HA2-2625-7
U350	B033930	B010100	155-0078-11			MICROCIRCUIT,LI:ML,VERTICAL AMPLIFIER,SEL	80009	155-0078-11
U350	B033931	B033931	155-0078-10			MICROCIRCUIT,LI:ML,VERTICAL AMPLIFIER	80009	155-0078-10
U370	B033930	B010100	155-0078-11			MICROCIRCUIT,LI:ML,VERTICAL AMPLIFIER,SEL	80009	155-0078-11
U370	B033931	B033931	155-0078-10			MICROCIRCUIT,LI:ML,VERTICAL AMPLIFIER	80009	155-0078-10
U370	B033930	B010100	155-0078-11			MICROCIRCUIT,LI:ML,VERTICAL AMPLIFIER,SEL	80009	155-0078-11
U410	B010100	B010100	156-0208-00			MICROCIRCUIT,LI:DUAL TRACKING VOLT RGLTR	34333	SG8195/3501AJ
U410	B049499	B010100	156-0208-01			MICROCIRCUIT,LI:DUAL TRACKING VOLT RGLTR	80009	156-0208-01
VR100			152-0278-00			SEMICONV DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR103			152-0278-00			SEMICONV DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR166			152-0306-00			SEMICONV DEVICE:ZENER,0.4W,9.1V,5%	15238	Z5409
VR167	B047648	B010100	152-0306-00			SEMICONV DEVICE:ZENER,0.4W,9.1V,5%	15238	Z5409
VR172			152-0278-00			SEMICONV DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR187			152-0226-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
VR380			152-0278-00			SEMICONV DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR452	B029999	B010100	152-0304-00			SEMICONV DEVICE:ZENER,0.4W,20V,5%	15238	Z5411
VR452	B030000	B030000	152-0680-00			SEMICONV DEVICE:ZENER,0.4W,19.3V,1%	80009	152-0680-00
VR462	B010100	B010100	152-0304-00			SEMICONV DEVICE:ZENER,0.4W,20V,5%	15238	Z5411
VR462	B030000	B030000	152-0680-00			SEMICONV DEVICE:ZENER,0.4W,19.3V,1%	80009	152-0680-00
W452	B047648	B030000	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
W452	B047648	B030000	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
W462	B030000	B030000	131-0566-00			BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0

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 (μ F).
- Resistors = Ohms (Ω).

Graphic symbols and class designation letters 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 overline on a signal name indicates that the signal performs its intended function when it goes to the low state. Abbreviations are based on ANSI Y1.1-1972.

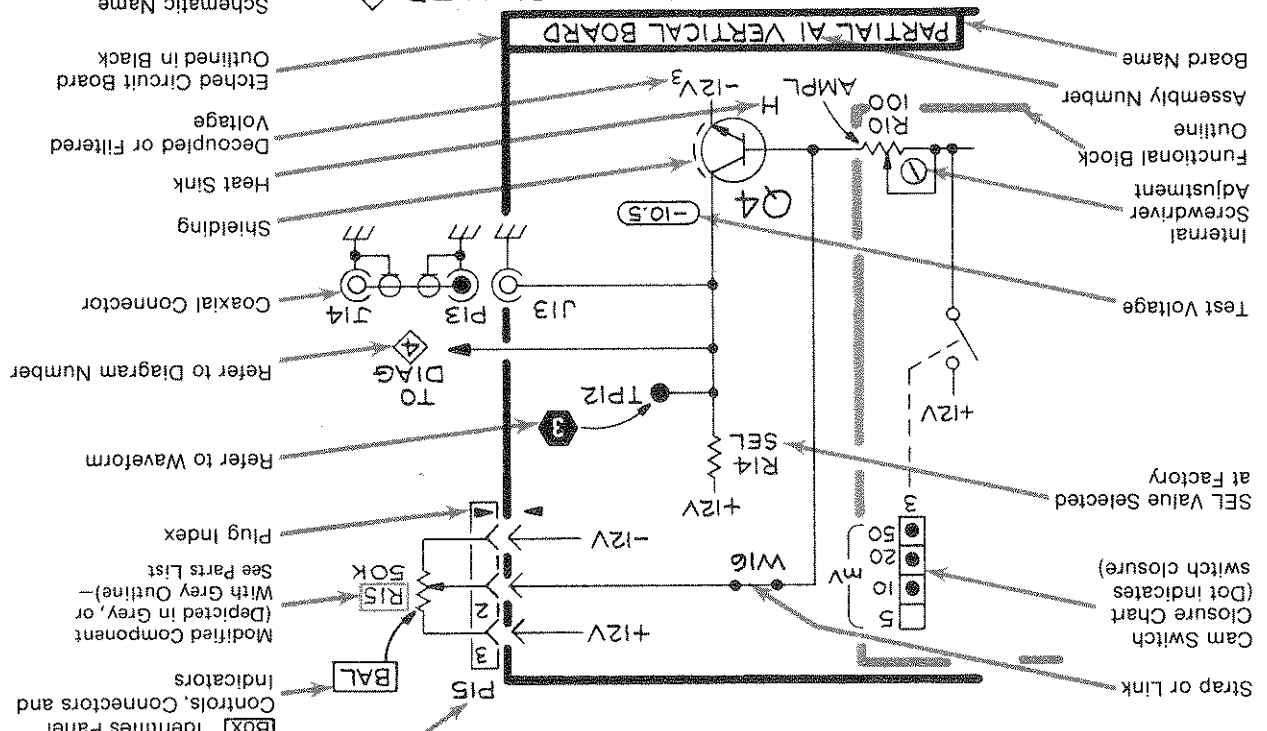
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

- Y14.15, 1966 Drafting Practices.
- Y14.2, 1973 Line Conventions and Lettering.
- Y10.5, 1968 Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

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

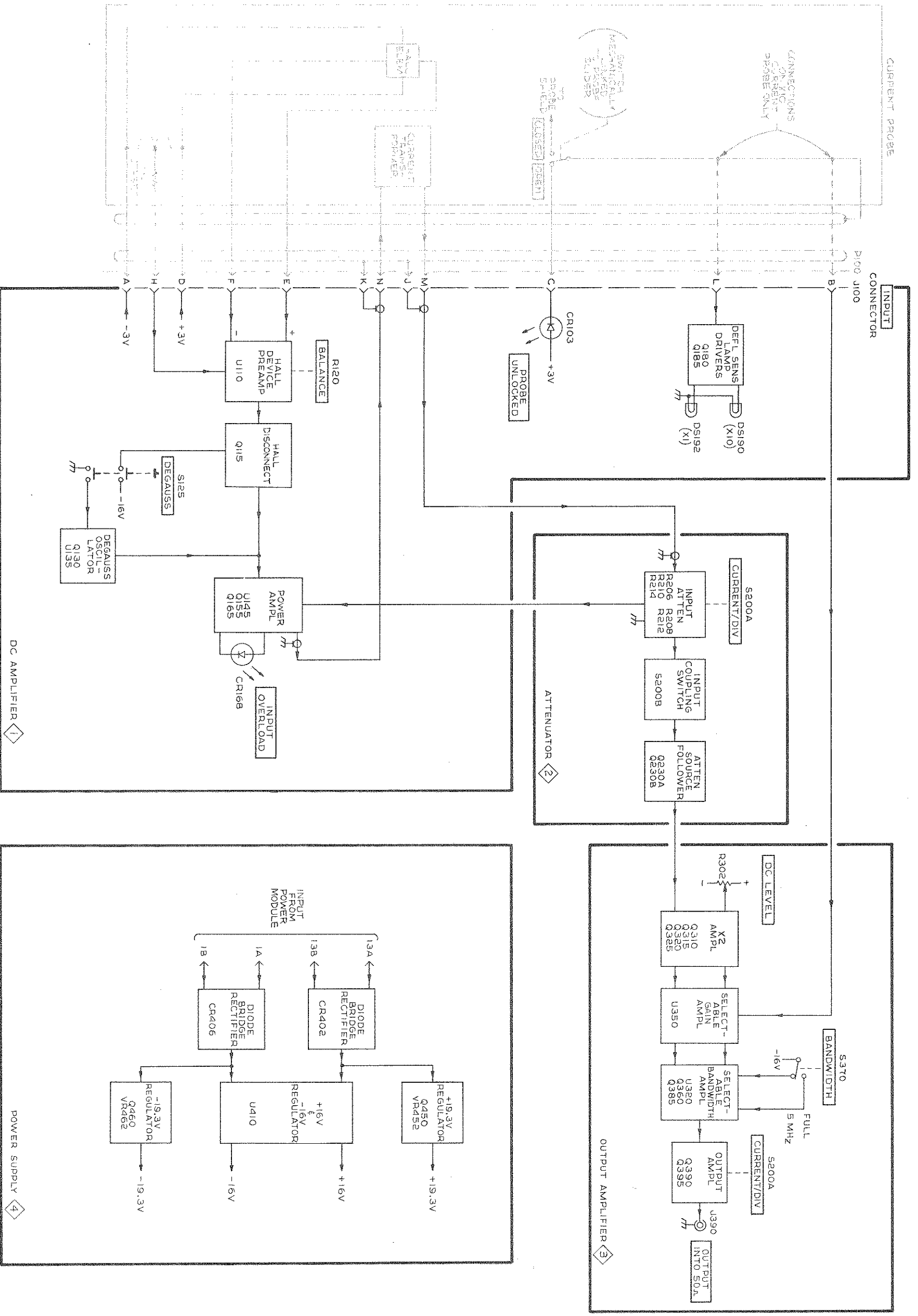
A	Assembly, separable or repairable	FL	Filter
AT	Attenuator, fixed or variable	F	Fuse
B	Battery	E	Spark Gap, Ferrite bead
BT	Battery	DS	indicating device (lamp)
C	Capacitor, fixed or variable	DL	Delay line
CB	Circuit breaker	CR	Diode, signal or rectifier
CR	Diode, signal or rectifier	CB	Circuit breaker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

The following special symbols may appear on the diagrams:

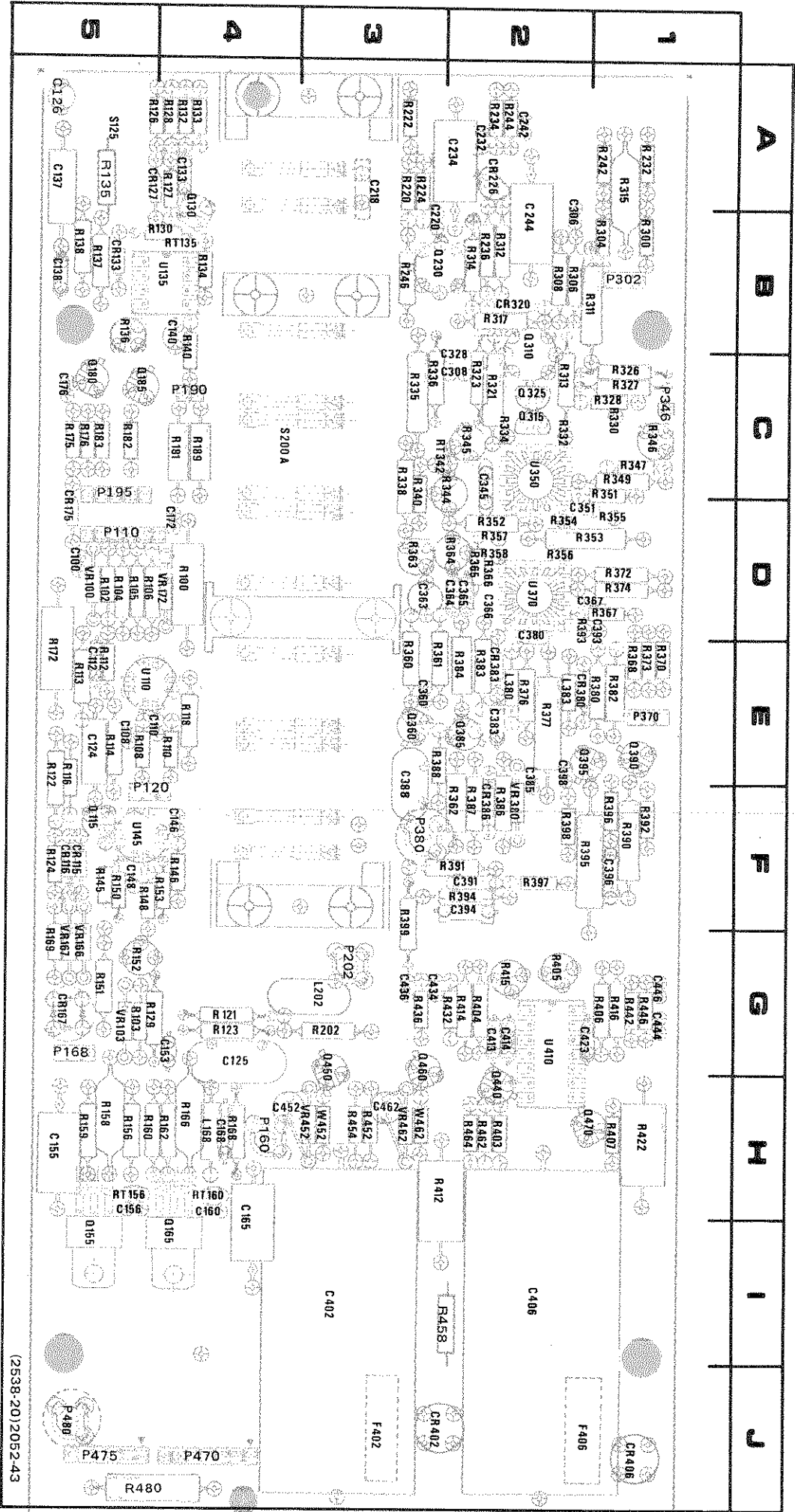


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BLOCK DIAGRAM

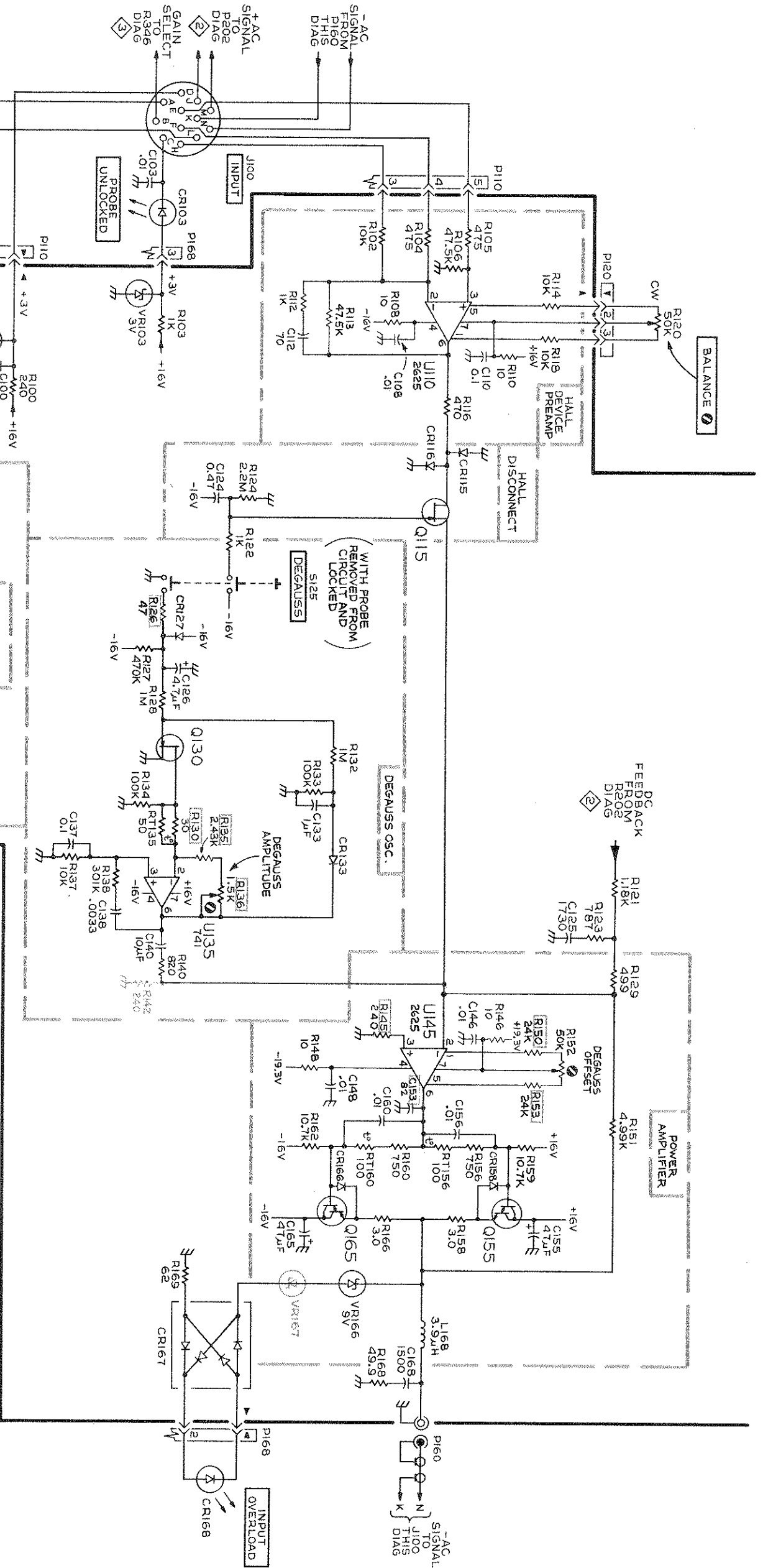


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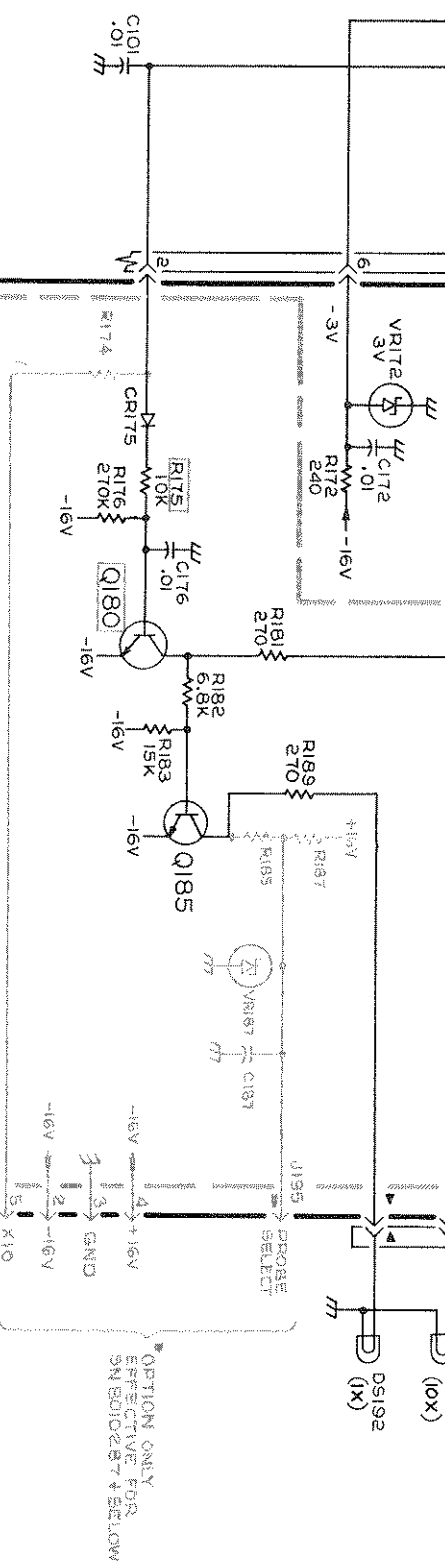
† Located on back of board
* See Parts List for
serial number ranges.

Fig. 7-1. A1—Amplifier circuit board with component locations of components (SN B030830 & above).

CR100	5D	CR133	5B	R112	5E	R314	2B	R404	2G
C108	5E	CR167	5G	R113	5E	R315	1A	R405	2G
C110	4E	CR175	5D	R114	5E	R317	2B	R406	1G
C112	5E	CR226	2A	R116	5E	R321	2C	R407	1H
C124	5E	CR320	2B	R118	4E	R323	2C	R412	3H
C125	4G	CR380	2E	R121	4G	R326	1C	R414	2G
C133	4A	CR383	2E	R122	5E	R327	1C	R415	2G
C137	5A	CR386	2F	R123	4G	R328	1C	R416	1G
C138	5B	CR402	3J	R124	5F	R330	1C	R422	1H
C140	4B	CR406	1J	R126	5A	R332	2C	R432	2G
C146	4F	F402†	3J	R127	4A	R334	2C	R436	3G
C148	5F	F406†	1J	R128	4A	R335	3C	R442	1G
C153	4G	L168	4H	R129	5G	R336	3C	R446	1G
C155	5H	L202	3G	R130	4B	R338	3C	R452	3H
C156	5H	L380	2E	R131	5A	R340	3C	R454	3H
C168	4H	L383	2E	R132	4A	R342	3C	R458*	3I
C172	4D	L383	2E	R133	4A	R344	2C	R462	2H
C176	5C	L383	2E	R134	4B	R345	2C	R464	2H
C218†	3A	L383	2E	R135*	5A	R347	1C	R480	5J
C220	3B	L383	2E	R136	5B	R349	1C	R480	5J
C232	2A	L383	2E	R137	5B	R351	1C	R480	5J
C234	2A	L383	2E	R138	5B	R353	1D	R480	5J
C242	2A	L383	2E	R139	5B	R355	1D	R480	5J
C244	2B	L383	2E	R140	4B	R357	2D	R480	5J
C306	2B	L383	2E	R141	4B	R359	2D	R480	5J
C308	2C	L383	2E	R142	4B	R361	3E	R480	5J
C328	2C	L383	2E	R143	4B	R363	3D	R480	5J
C345	2C	L383	2E	R144	4B	R365	2D	R480	5J
C351	2D	L383	2E	R145	5F	R367	1D	R480	5J
C360	3E	L383	2E	R146	4F	R369	2D	R480	5J
C363	3D	L383	2E	R147	4F	R371	2D	R480	5J
C364	2D	L383	2E	R148	5F	R373	1E	R480	5J
C365	2D	L383	2E	R149	5F	R375	2E	R480	5J
C366	2D	L383	2E	R150	5F	R377	2E	R480	5J
C367	1D	L383	2E	R151	5G	R379	1D	R480	5J
C380	2D	L383	2E	R152	5G	R381	1E	R480	5J
C383	2E	L383	2E	R153	5G	R383	2E	R480	5J
C385	2E	L383	2E	R154	5G	R385	2E	R480	5J
C388	3E	L383	2E	R155	5G	R387	2F	R480	5J
C391	2F	L383	2E	R156	5H	R389	3E	R480	5J
C393	1D	L383	2E	R157	5H	R391	1F	R480	5J
C394	2F	L383	2E	R158	5H	R393	2D	R480	5J
C396	1F	L383	2E	R159	5H	R395	2F	R480	5J
C398	2E	L383	2E	R160	5H	R397	2F	R480	5J
C402	3I	L383	2E	R161	5H	R399	3F	R480	5J
C406	2I	L383	2E	R162	4H	R401	1F	R480	5J
C413	2G	L383	2E	R163	4H	R403	2H	R480	5J
C414	2G	L383	2E	R164	4H	R405	2G	R480	5J
C423	2G	L383	2E	R165	4H	R407	1H	R480	5J
C434	3G	L383	2E	R166	4H	R409	3H	R480	5J
C444	1G	L383	2E	R167	4H	R411	3H	R480	5J
C446	1G	L383	2E	R168	4H	R413	3H	R480	5J
C452	4H	L383	2E	R169	4H	R415	2G	R480	5J
C462	3H	L383	2E	R170	4H	R417	1G	R480	5J
CR115	5F	L383	2E	R171	4H	R419	2G	R480	5J
CR116	5F	L383	2E	R172	4H	R421	1H	R480	5J
CR127	5A	L383	2E	R173	4H	R423	3H	R480	5J
CR133	5B	L383	2E	R174	4H	R425	3H	R480	5J
CR167	5G	L383	2E	R175	5C	R427	2G	R480	5J
CR175	5D	L383	2E	R176	5C	R429	2G	R480	5J
CR175	5D	L383	2E	R177	5C	R431	2G	R480	5J
CR175	5D	L383	2E	R178	5C	R433	2G	R480	5J
CR175	5D	L383	2E	R179	5C	R435	3G	R480	5J
CR175	5D	L383	2E	R180	5C	R437	3G	R480	5J
CR175	5D	L383	2E	R181	5C	R439	3G	R480	5J
CR175	5D	L383	2E	R182	5C	R441	3G	R480	5J
CR175	5D	L383	2E	R183	5C	R443	3G	R480	5J
CR175	5D	L383	2E	R184	5C	R445	3G	R480	5J
CR175	5D	L383	2E	R185	5C	R447	3G	R480	5J
CR175	5D	L383	2E	R186	5C	R449	3G	R480	5J
CR175	5D	L383	2E	R187	5C	R451	3G	R480	5J
CR175	5D	L383	2E	R188	5C	R453	3G	R480	5J
CR175	5D	L383	2E	R189	5C	R455	3G	R480	5J
CR175	5D	L383	2E	R190	5C	R457	3G	R480	5J
CR175	5D	L383	2E	R191	5C	R459	3G	R480	5J
CR175	5D	L383	2E	R192	5C	R461	3G	R480	5J
CR175	5D	L383	2E	R193	5C	R463	3G	R480	5J
CR175	5D	L383	2E	R194	5C	R465	3G	R480	5J
CR175	5D	L383	2E	R195	5C	R467	3G	R480	5J
CR175	5D	L383	2E	R196	5C	R469	3G	R480	5J
CR175	5D	L383	2E	R197	5C	R471	3G	R480	5J
CR175	5D	L383	2E	R198	5C	R473	3G	R480	5J
CR175	5D	L383	2E	R199	5C	R475	3G	R480	5J
CR175	5D	L383	2E	R200	5C	R477	3G	R480	5J
CR175	5D	L383	2E	R201	5C	R479	3G	R480	5J
CR175	5D	L383	2E	R202	5C	R481	3G	R480	5J
CR175	5D	L383	2E	R203	5C	R483	3G	R480	5J
CR175	5D	L383	2E	R204	5C	R485	3G	R480	5J
CR175	5D	L383	2E	R205	5C	R487	3G	R480	5J
CR175	5D	L383	2E	R206	5C	R489	3G	R480	5J
CR175	5D	L383	2E	R207	5C	R491	3G	R480	5J
CR175	5D	L383	2E	R208	5C	R493	3G	R480	5J
CR175	5D	L383	2E	R209	5C	R495	3G	R480	5J
CR175	5D	L383	2E	R210	5C	R497	3G	R480	5J
CR175	5D	L383	2E	R211	5C	R499	3G	R480	5J
CR175	5D	L383	2E	R212	5C	R501	3G	R480	5J
CR175	5D	L383	2E	R213	5C	R503	3G	R480	5J
CR175	5D	L383	2E	R214	5C	R505	3G	R480	5J
CR175	5D	L383	2E	R215	5C	R507	3G	R480	5J
CR175	5D	L383	2E	R216	5C	R509	3G	R480	5J
CR175	5D	L383	2E	R217	5C	R511	3G	R480	5J
CR175	5D	L383	2E	R218	5C	R513	3G	R480	5J
CR175	5D	L383	2E	R219	5C	R515	3G	R480	5J
CR175	5D	L383	2E	R220	5C	R517	3G	R480	5J
CR175	5D	L383	2E	R221	5C	R519	3G	R480	5J
CR175	5D	L383	2E	R222	5C	R521	3G	R480	5J
CR175	5D	L383	2E	R223	5C	R523	3G	R480	5J
CR175	5D	L383	2E	R224	5C	R525	3G	R480	5J
CR175	5D	L383	2E	R225	5C	R527	3G	R480	5J
CR175	5D	L383	2E	R226	5C	R529	3G	R480	5J
CR175	5D	L383	2E	R227	5C	R531	3G	R480	5J
CR175	5D	L383	2E	R228	5C	R533	3G	R480	5J
CR175	5D	L383	2E	R229	5C	R535	3G	R480	5J
CR175	5D	L383	2E	R230	5C	R537	3G	R480	5J
CR175	5D	L383	2E	R231	5C	R539	3G	R480	5J
CR175	5D	L383	2E	R232	5C	R541	3G	R480	5J
CR175	5D	L383	2E	R233	5C	R543	3G	R480	5J
CR175	5D	L383	2E	R234	5C	R545	3G	R480	5J
CR175	5D	L383	2E	R235	5C	R547	3G	R480	5J
CR175	5D	L383	2E	R236	5C	R549	3G	R480	5J
CR175	5D	L383	2E	R237	5C	R551	3G	R480	5J
CR175	5D	L383	2E	R238	5C	R553	3G	R480	5J
CR175	5D	L383	2E	R239	5C	R555	3G	R480	5J
CR175	5D	L383	2E	R240	5C	R557	3G	R480	5J
CR175	5D	L383	2E	R241	5C	R559	3G	R480	5J
CR175	5D	L383	2E	R242	5C	R561	3G	R480	5J
CR175	5D	L383	2E	R243	5C	R563	3G	R480	5J
CR175	5D	L383	2E	R244	5C	R565	3G	R480	5J
CR175	5D	L383	2E	R245	5C	R567	3G	R480	5J
CR175	5D	L383	2E	R246	5C	R569	3G	R480	5J
CR175	5D	L383	2E	R247	5C	R571	3G	R480	5J
CR175	5D	L383	2E	R248	5C	R573	3G	R480	5J
CR175	5D	L383	2E	R249	5C	R575	3G	R480	5J
CR175	5D	L383	2E	R250	5C	R577	3G	R480	5J
CR175	5D	L383	2E	R251	5C	R579	3G	R480	5J
CR175	5D	L383	2E	R252	5C	R581	3G	R480	5J
CR175	5D	L383	2E	R253	5C	R583	3G	R480	5J
CR175	5D	L383	2E	R254	5C	R585	3G	R480	5J
CR175	5D	L383	2E	R255	5C	R587	3G	R480	5J
CR175	5D	L383	2E	R256	5C	R589	3G	R480	5J
CR175	5D	L383	2E	R257	5C	R591	3G	R480	5J
CR175	5D	L383	2E	R258	5C	R593	3G	R480	5J
CR175	5D	L383	2E	R259	5C	R595	3G	R480	5J
CR175	5D	L383	2E	R260	5C	R597	3G	R480	5J
CR175	5D	L383	2E	R261	5C	R599	3G	R480	5J
CR175	5D	L383	2E	R262	5C	R601	3G	R480	5J
CR175	5D	L383	2E	R263	5C	R603	3G	R480	5J
CR175	5D	L383	2E	R264	5C	R605	3G	R480	5J
CR175	5D	L383	2E	R265	5C	R607	3G	R480	5J
CR175	5D	L383	2E	R266	5C	R609	3G	R480	5J
CR175	5D	L383	2E	R267	5C	R611	3G	R480	5J
CR175	5D	L383	2E	R268	5C	R613	3G	R480	5J
CR175	5D	L383	2E	R269	5C	R615	3G	R480	



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



OPTION ONLY EFFECTIVE FOR 3N BUID 257 & BELOW

PARTIAL AI AMPLIFIER BOARD

AM503

2052-33
REV MAR 1984

DC AMPLIFIER 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.

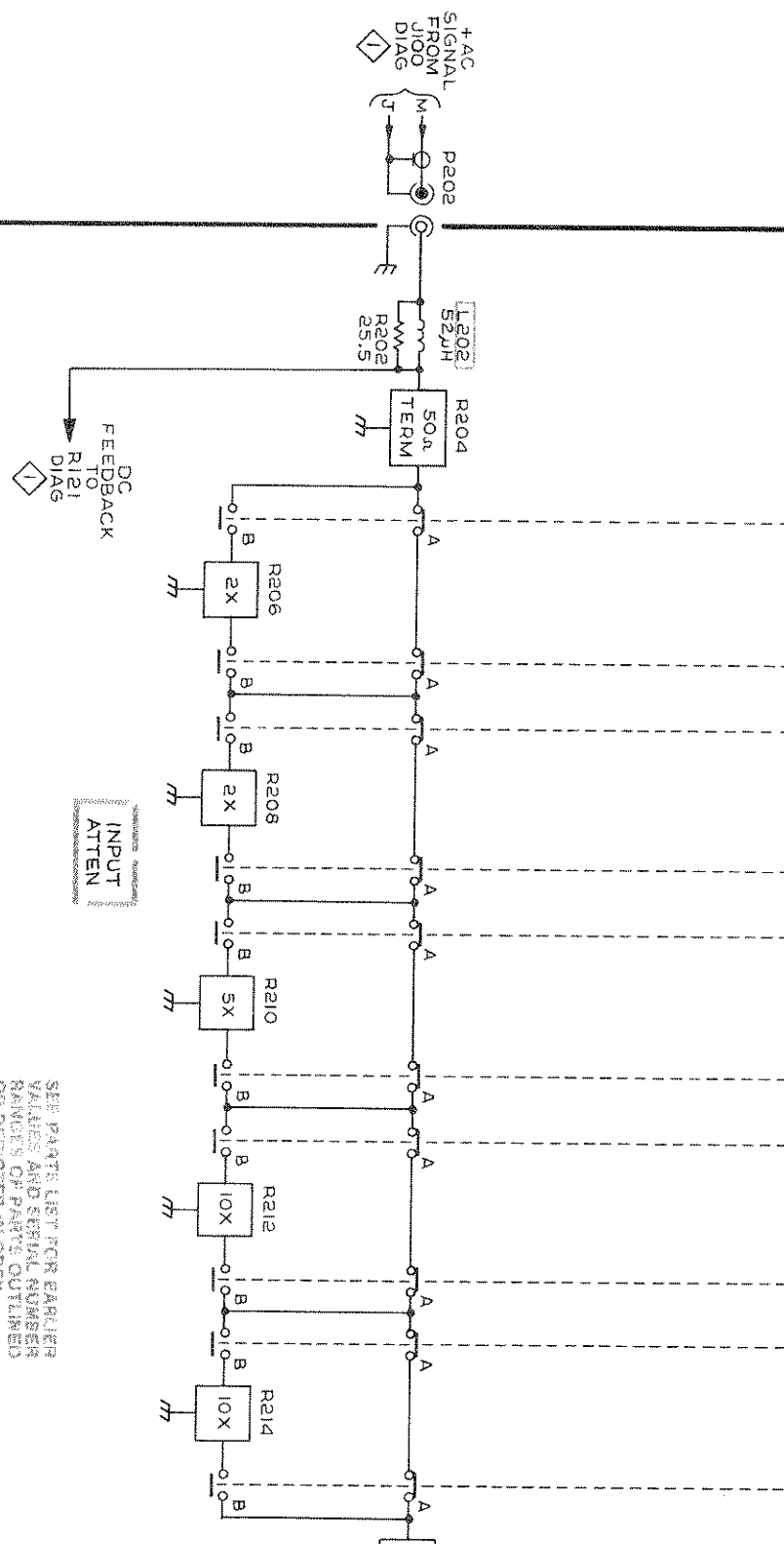
Set voltage at output to zero volts (into 50 ohms) with DC Level control.



VOLTAGE & WAVEFORM CONDITIONS

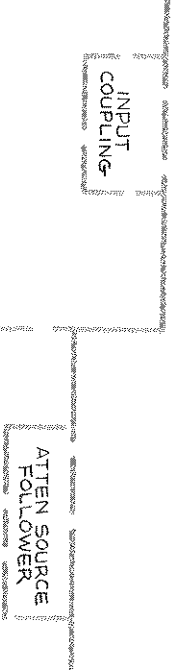
S200A
CURRENT/DIV
(WITH OSCILLOSCOPE AT 10mV/DIV)

mA	1	2	5	10	20	50	0.1	0.2	0.5	1	2	5
28	•	•	•	•	•	•	•	•	•	•	•	•
24	•	•	•	•	•	•	•	•	•	•	•	•
23	•	•	•	•	•	•	•	•	•	•	•	•
19	•	•	•	•	•	•	•	•	•	•	•	•
15	•	•	•	•	•	•	•	•	•	•	•	•
11	•	•	•	•	•	•	•	•	•	•	•	•
10	•	•	•	•	•	•	•	•	•	•	•	•
6	•	•	•	•	•	•	•	•	•	•	•	•
5	•	•	•	•	•	•	•	•	•	•	•	•
1	•	•	•	•	•	•	•	•	•	•	•	•



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

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



PARTIAL AI AMPLIFIER BOARD

AM 503

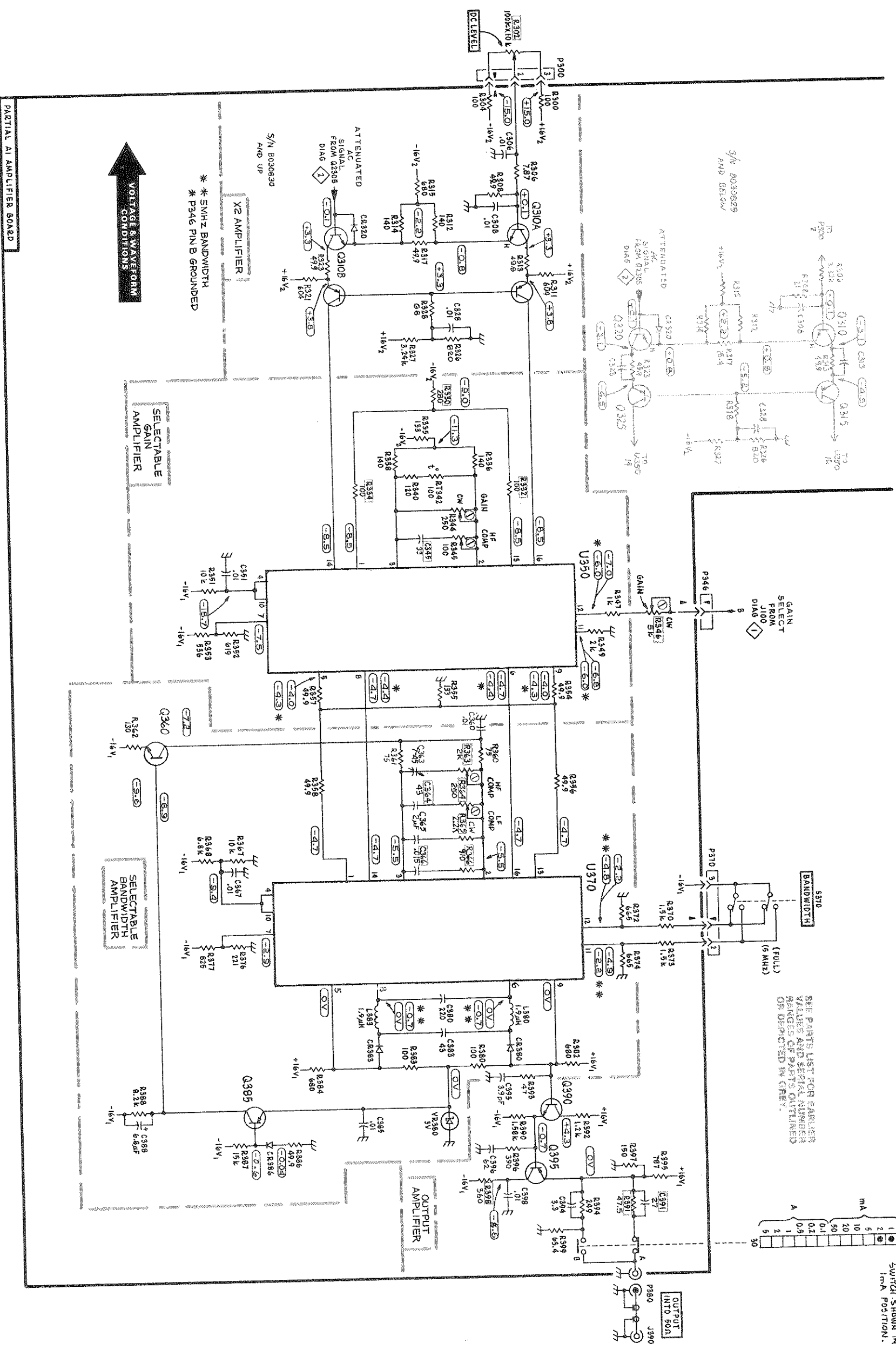
2052-34
REV. C, OCT. 1979

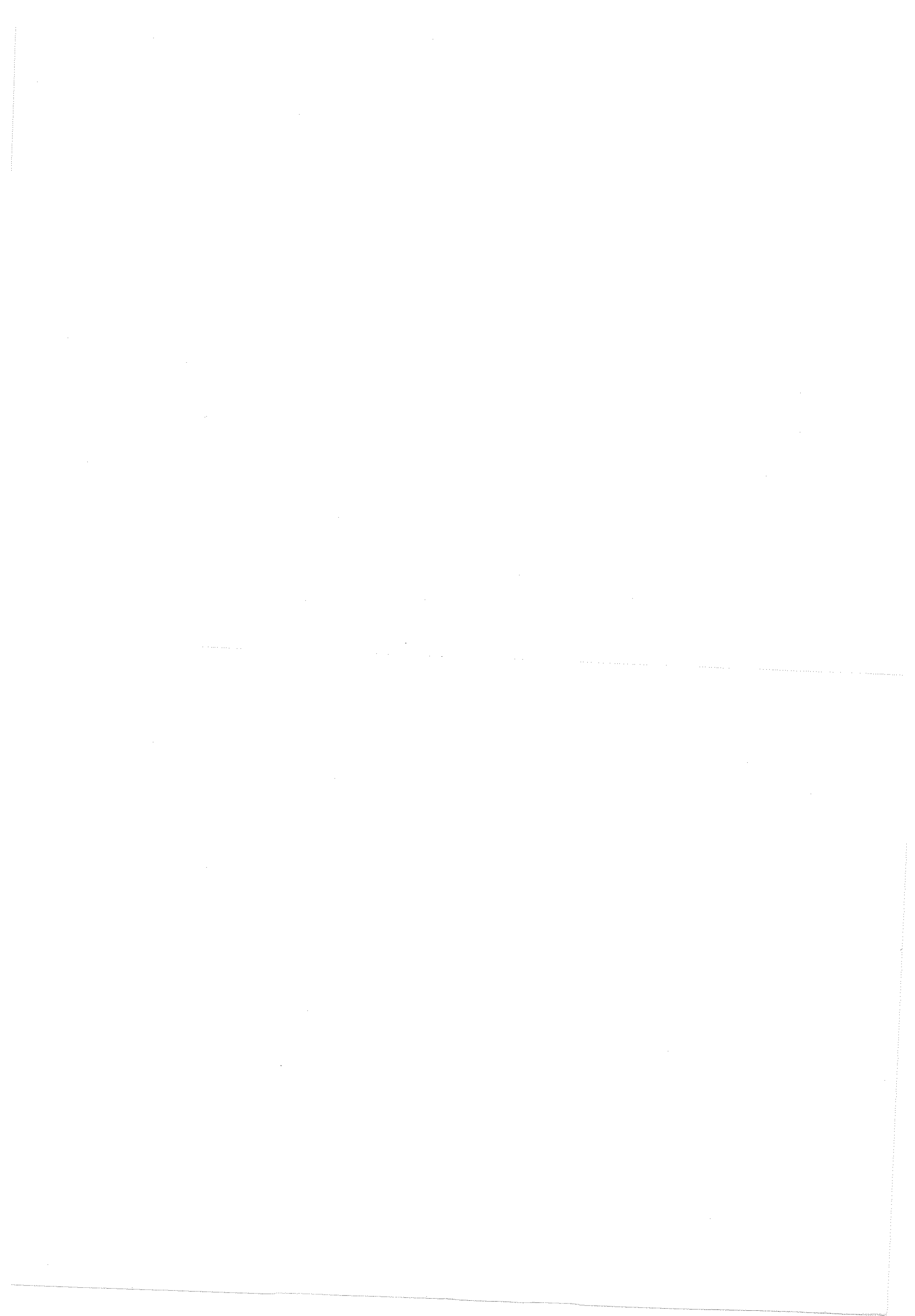
ATTENUATOR

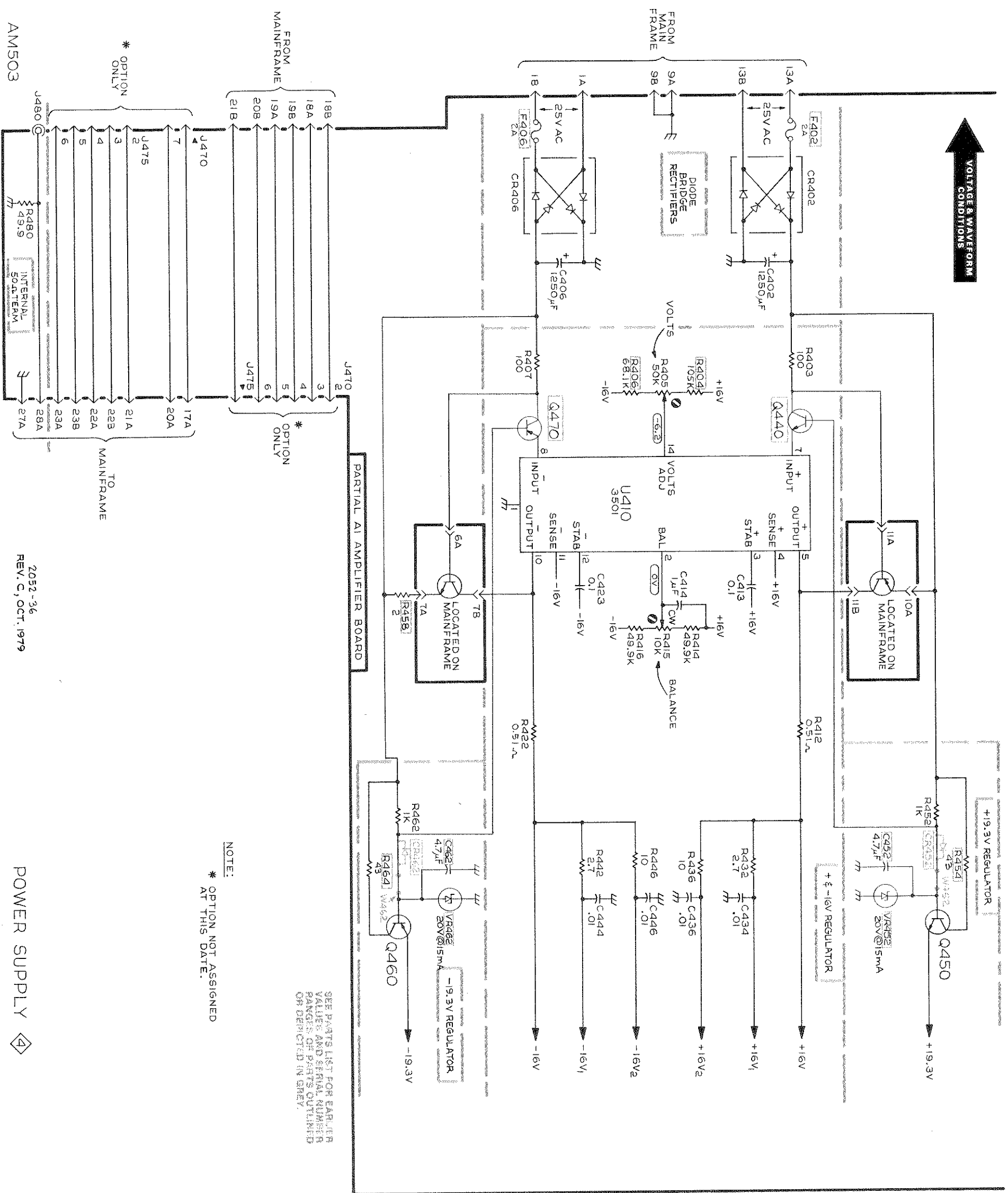
ATTENUATOR

2

CT	NO	GRID	R352	2D	R368	1E	R391*	2F	R414	2G	RT160	4H	VR103	5G
CT	NO	GRID	R353	1D	R370	1E	R392	1F	R415	2G	RT342	3C	VR166	5G
CT	NO	GRID	R354	2D	R372	1D	R393	2D	R416	1G	RT135	4B	VR167	5G
CT	NO	GRID	R355	1D	R373	1E	R394	2F	R422*	1H			VR172	4D
CT	NO	GRID	R356	2D	R374	1D	R395	2F	R432	2G	S125	5A	VR187*	4C
CT	NO	GRID	R357	2D	R376	2E	R396	1F	R436	3G	S200A	4C	VR380	2F
CT	NO	GRID	R358	2C	R377	2E	R397	2F	R442	1G			VR452*	3H
CT	NO	GRID	R360	3E	R380	1E	R398	2F	R446	1G	U110	5E	VR462*	3H
CT	NO	GRID	R361	3E	R382	1E	R399	3F	R452	3H	U135	4B		
CT	NO	GRID	R362	2F	R383	2E	R403	2H	R454*	3H	U145	5F		
CT	NO	GRID	R363*	3D	R384	2E	R404	2G	R462	2H	U350*	2C		
CT	NO	GRID	R364	2D	R386	2F	R405	2G	R464*	2H	U370*	2D		
CT	NO	GRID	R365	2D	R387	2F	R406	1G	R480	5J	U410	2G		
CT	NO	GRID	R366	2D	R388	3E	R407	1H						
CT	NO	GRID	R367	1D	R390	1F	R412*	3H	RT156	5H	VR100	5D		







VOLTAGE & WAVEFORM CONDITIONS

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES. OF PARTS OBTAINED OR DERIVED IN MEY.

NOTE:
* OPTION NOT ASSIGNED AT THIS DATE.

AM503

2052-36
REV. C, OCT. 1979

POWER SUPPLY



CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000CY	NORTHWEST FASTENER SALES, INC.	7923 SW CIRRUS DRIVE	BEAVERTON, OR 97005
000EX	O'HARA METAL PRODUCT COMPANY	542 BRANNAN STREET	SAN FRANCISCO, CA 94107
02660	BUNKER RAMO CORP., CONNECTOR DIVISION	2801 S 25TH AVENUE	BROADVIEW, IL 60153
09922	BUNRDY CORPORATION	RICHARDS AVENUE	NORWALK, CT 06852
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
45722	USM CORP., PARKER-KALON FASTENER DIV.	16931 MILLIKEN AVE.	CAMPBELLVILLE, KY 42218
57668	R-OHM CORP.		IRVINE, CA 92713
70278	ALLIED STEEL AND CONVEYORS, DIV. OF SPARTON CORP.	17333 HEALY	DETROIT, MI 48212
73743	FISHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
77900	SHAKEPROOF DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN, IL 60120
78189	SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
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
85480	MICRODOT MFG. INC., CENTRAL SCREW DIV.	31275 N. WESTERN HIGHWAY	FARMINGTON HILLS, MI 48024
86928	SEASTROM MFG. COMPANY, INC.	701 SONORA AVENUE	GLENDALE, CA 91201
87308	DIV. N. L. INDUSTRIES, INC., SOUTHERN SCREW		
93907	TEXTRON INC. CAMCAR DIV	P. O. BOX 1360 600 18TH AVE	STATESVILLE, NC 28677
T0435	LEWIS SCREW CO.	4114 SOUTH PERORIA AVE.	CHICAGO, IL 60609

Fig. & Index	Tektronix	Serial/Model No.	Eff	Discont	Qty	1	2	3	4	5	Name & Description	Code	Mfr	Mfr Part Number
1-45					1						SUBPANEL,FRONT:(ATTACHING PARTS).....	80009		386-3501-00
4-6					4						SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH ST(ATTACHING PARTS).....	93907		ORD BY DESCR
4-7					1						SHIELD,ELEC:FRONT PANEL(ATTACHING PARTS).....	80009		337-2292-00
4-8		B010100		B061549	1						SHIELD,ELEC:CONNECTOR	80009		337-2369-00
		B061550			1						SHIELD,ELEC:CONNECTOR	80009		337-2369-01
4-9					1						SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL(ATTACHING PARTS).....	83385		ORD BY DESCR
5-0					1						ACTUATOR,SWITCH:AC,DC(ATTACHING PARTS).....	80009		105-0243-00
5-2					1						SCREW,CAP SCH:2-56 X 0.375"HEX HD STL(ATTACHING PARTS).....	70278		ORD BY DESCR
5-3					2						STRAP,RETAINING:(ATTACHING PARTS).....	85480		CPNY-1728K
5-4					2						SCR,ASSEM WSHR:4-40 X 0.312 DOUBLE SEMS(ATTACHING PARTS).....	83385		ORD BY DESCR
6-74		B010100		B047648	1						CKT BOARD ASSY:ATTENUATOR(ATTACHING PARTS).....	80009		672-0574-00
6-75		B047649			1						CKT BOARD ASSY:ATTENUATOR	80009		672-0574-01
6-76		B047649			1						CKT BOARD ASSY:ATTENUATOR	80009		672-0574-02
5-55		B010100		B047648	4						SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL WASHER,FLAT:0.140 ID X 0.281" OD,STL WASHER,FLAT:0.140 ID X 0.281" OD,STL	83385		ORD BY DESCR
5-56					6						ATTENUATOR,FXD:(SEE R206,R208,R210 R212, R214 AND R216 REPL)(ATTACHING PARTS).....	000EX		ORD BY DESCR
5-57					7						CLIP,ATTENUATOR:(ATTACHING PARTS).....	80009		344-0248-00
5-58					1						SW CAM ACTR AS:CURRENT/DIV(ATTACHING PARTS).....	80009		263-1111-00
5-58					8						SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS(ATTACHING PARTS).....	83385		ORD BY DESCR
5-59					1						COVER,CAM SW:5.625 L X 0.876 H,AL(ATTACHING PARTS).....	80009		200-1950-00
6-0					8						SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL(ATTACHING PARTS).....	78189		ORD BY DESCR
6-1					1						CONTACT,ELEC:GROUNDING(ATTACHING PARTS).....	000EX		ORD BY DESCR
6-2					3						NUT,PLAIN,HEX:4-40 X 0.188,BRS,CD PL SPRING,FLAT,RED COLORED(ATTACHING PARTS).....	73743		12161-50
6-3					2						ROLLER,DETENT:(ATTACHING PARTS).....	80009		214-1752-00
6-4					2						BEARING,CAM SW:FRONT & REAR(ATTACHING PARTS).....	80009		401-0180-00
6-6					1						RING,RETAINING:0.338 ID X 0.025" THK,STL(ATTACHING PARTS).....	79136		5100-37MD
6-67					1						DRUM ASSY,CAM S:AC-DC DRUM TYPE(ATTACHING PARTS).....	80009		105-0716-00
6-68					1						SHAFT,CAM SW:FRONT	80009		384-0878-01
6-69					3						NUT,PLAIN,HEX:4-40 X 0.188,BRS,CD PL BEARING,CAM SW:CENTER/REAR(ATTACHING PARTS).....	73743		12161-50
7-0					1						BEARING,CAM SW:FRONT & REAR(ATTACHING PARTS).....	80009		401-0178-01
7-1		B010100		B050999	3						NUT,PLAIN,HEX:4-40 X 0.188,BRS,CD PL BRACKET,COVER:ABS(ATTACHING PARTS).....	73743		12161-50
7-2		B010100			1						BRACKET COVER:(ATTACHING PARTS).....	80009		407-1199-00
7-3		B051000			1						DRUM ASSY,CAM S:ATTENUATOR	80009		105-0651-00
7-4		B010100		B053639	1						SHAFT,CAM SW:7.4 L X 0.188 DIA SHAFT,CAM SW:14.0 L X 0.188 OD	80009		384-1424-01
7-5		B053640			4						NUT,PLAIN,HEX:4-40 X 0.188,BRS,CD PL SPRING,FLAT,RED COLORED(ATTACHING PARTS).....	73743		12161-50
7-6					2						ROLLER,DETENT:(ATTACHING PARTS).....	80009		214-1752-00
7-7					2						BEARING,CAM SW:FRONT & REAR(ATTACHING PARTS).....	80009		401-0180-00
7-79					1						RING,RETAINING:0.338 ID X 0.025" THK,STL(ATTACHING PARTS).....	79136		5100-37MD



FIG. 1 EXPLODED

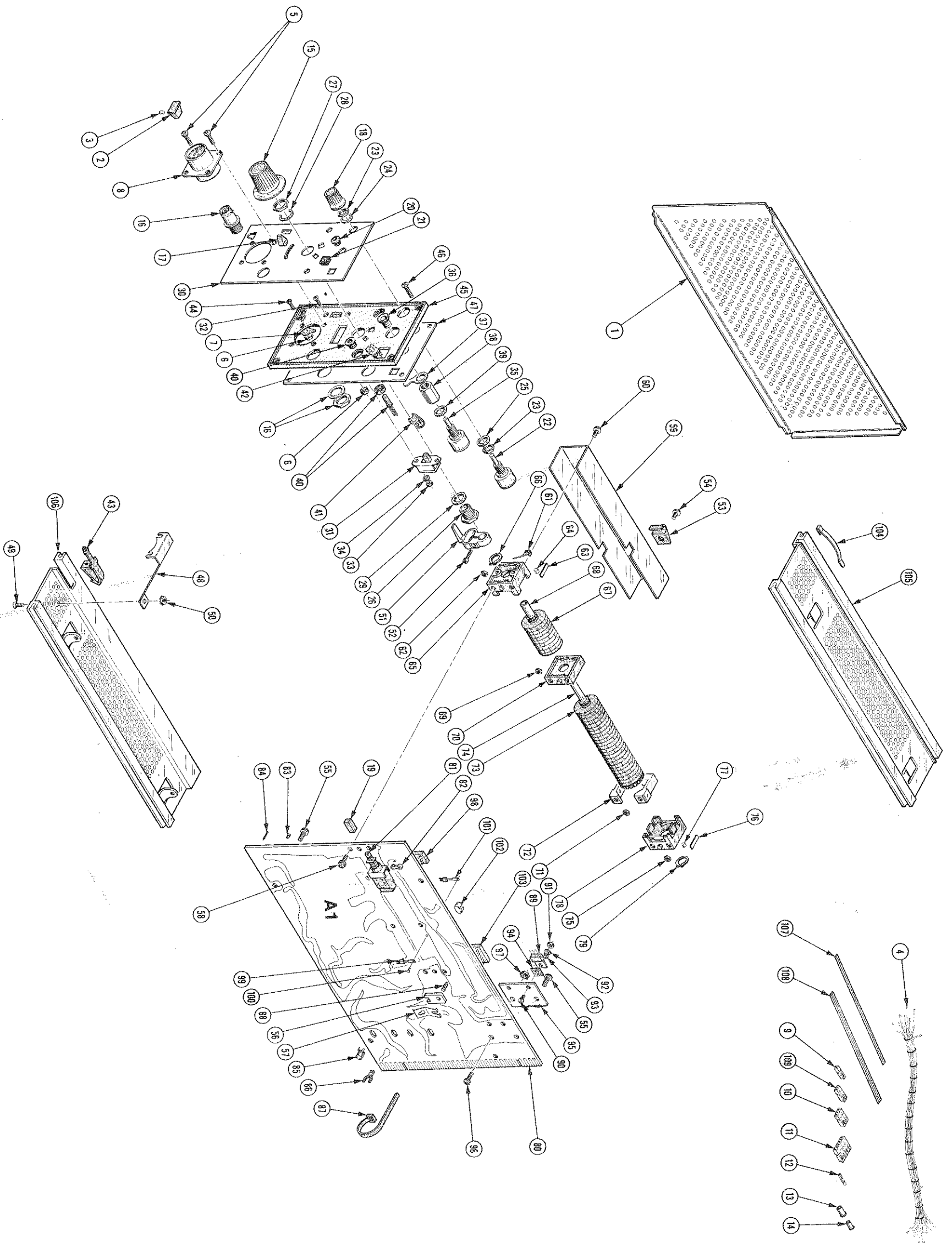
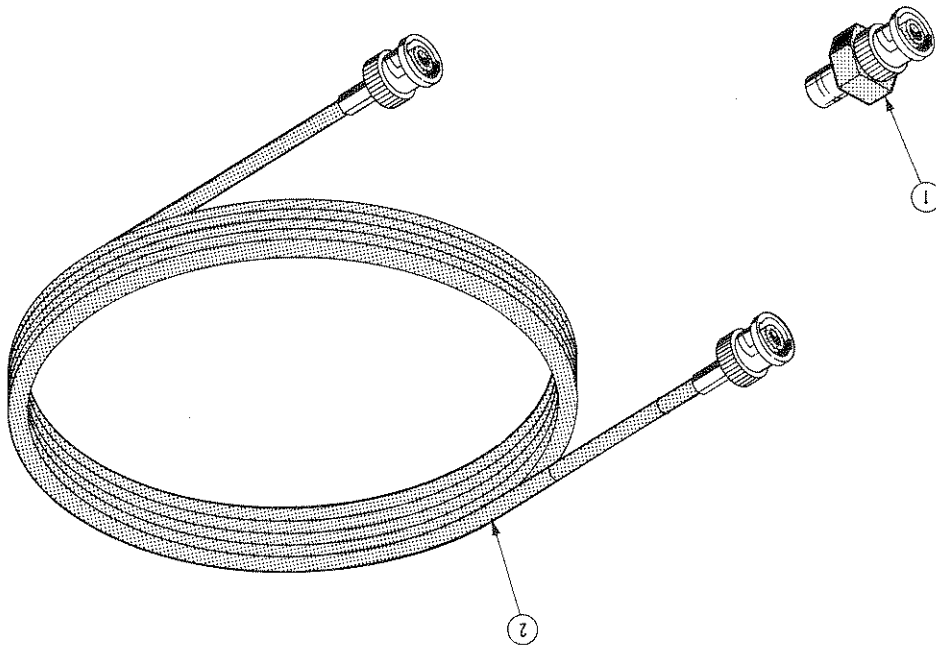


Fig. & Index
 Tektronix Part No. Serial/Model No. Eff. Dscont Qty 1 2 3 4 5 Name & Description Code Mfr Mfr Part Number

Fig. & Index	Tektronix Part No.	Serial/Model No.	Eff.	Dscont	Qty	1	2	3	4	5	Name & Description	Code	Mfr	Mfr Part Number
2-1	011-0049-01				1						TERMIN.COAX:50 OHM,2W,BNC	18203		T132 D6
-2	012-0057-01				1						CABLE ASSY,RF:50 OHM COAX W/BNC	80009		012-0057-01
	070-2052-01				1						MANUAL,TECH:INSTRUCTION	80009		070-2052-01
											OPTIONAL ACCESSORIES			
					1						PROBE CURRENT:A6302			
					1						PROBE CURRENT:A6303			



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