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# AM 502
## DIFFERENTIAL AMPLIFIER

INSTRUCTION MANUAL

Tektronix, Inc.
P.O Box 500
Beaverton, Oregon 97077

Serial Number _____

070-1582-01
Product Group 75

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http://manoman.sqhill.com

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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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# TABLE OF CONTENTS


Page

Section 1 Operating Instructions . . . . . 1-1

ENGLISH VERSION
FRENCH VERSION
GERMAN VERSION
JAPANESE VERSION

Section 2 SPECIFICATION AND PERFORMANCE CHECK . . . . . 2-1

*WARNING*

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

Section 3 ADJUSTMENT . . . . . 3-1

Page

Section 4 MAINTENANCE AND INTERFACING INFORMATION . . . . . 4-1

Section 5 CIRCUIT DESCRIPTION . . . . . 5-1

Section 6 OPTIONS . . . . . 6-1

Section 7 REPLACEABLE ELECTRICAL PARTS 7-1

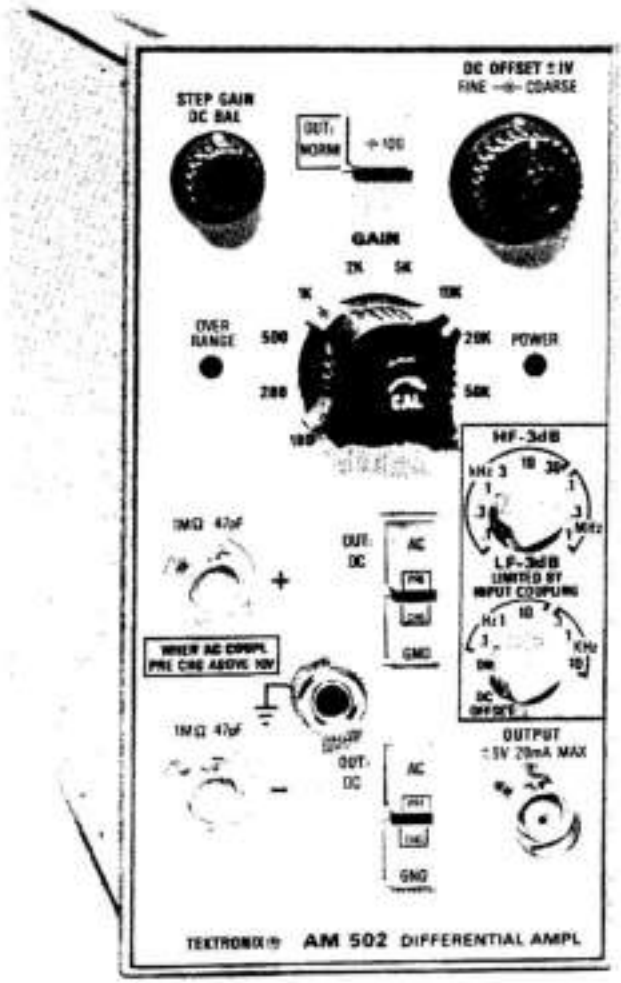
Section 8 DIAGRAM AND CIRCUIT BOARD ILLUSTRATION . . . . . 8-1

Section 9 REPLACEABLE MECHANICAL PARTS AND EXPLODED VIEW . . . . . 9-1

CHANGE INFORMATION




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1582-1

AM 502 Differential Amplifier plug-in module.



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# OPERATING INSTRUCTIONS

## INTRODUCTION

### Description

The AM 502 is a dc-coupled differential amplifier with excellent common-mode rejection capabilities and high gain for low voltage measurements. The dc offset capability permits nulling up to 1 volt dc, so that low level, low frequency signals impressed on a dc level can be amplified without the degradation often introduced by ac input coupling. High and low frequency −3 dB points can be selected at the front panel to suit the application. Signal inputs and outputs are available at the rear connector as well as at the front panel. A front panel lamp indicates most overrange conditions of excessive input signal, excessive gain, or excessive offset.

The input circuit can be represented by approximately 1 megohm to ground paralleled by approximately 47 picofarads. The input impedance can be raised to about 200 megohms with the removal of a jumper.

Overload protection is provided by fuses in series with the input which open when large amounts of current flow due to overloading conditions.

A STEP GAIN DC BALANCE control is provided to adjust for zero shift as the gain switch is changed from one position to another.

The DC OFFSET COARSE and FINE controls give offset up to ±1 volt dc potential difference at the input connectors. The amplifier internal bias is changed to accomplish the offset. The LF −3 dB switch must be in the DC OFFSET position to actuate these controls.

The HF −3 dB switch is used to reduce the upper bandwidth limit as necessary to improve the signal-to-noise ratio when using the AM 502 in low-frequency applications. The LF −3 dB control increases the lower bandwidth frequency.

Use of the pre-charging feature prevents surge currents, due to charging the ac coupling capacitor, from damaging the circuit under test.

### Installation and Removal

**CAUTION**

*Turn the power module off before inserting the plug-in; otherwise, damage may occur to the plug-in circuitry. Because of the high current drawn by the AM 502, it is also recommended that the power module be turned off before removing the AM 502. 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 502 circuit board edge connector.*

Align the AM 502 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 502, pull on the release latch located in the lower left corner, until the interconnecting jack disengages and the AM 502 will slide out.

### Controls and Connectors

Refer to Fig. 1-2. Even though the AM 502 is fully calibrated and ready to use, the functions and actions of the controls and connectors should be reviewed before attempting to use it. Pull the Power switch on the power module to apply power to the AM 502. The POWER indicator light indicates when power is applied to the AM 502.

## OPERATING CONSIDERATIONS

### Overheating

The AM 502 is designed to operate at an ambient temperature from 0° to +50° C. However, when operating several power supplies in a multi-plug-in power module, especially at low output voltages, or when operating close to other heat-producing equipment, internal temperature may exceed safe limits and actuate a thermal cutout in the power module. Refer to the power module instruction manual for more complete information.



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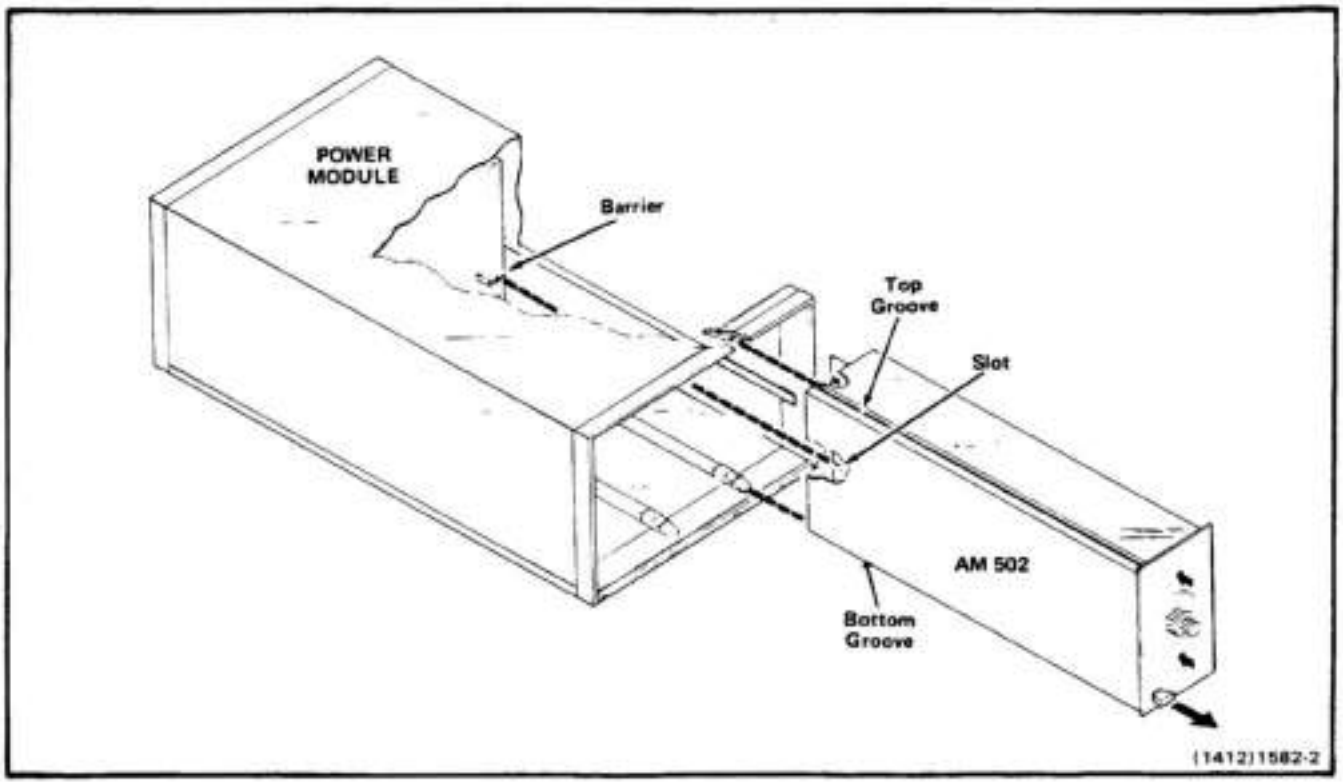



**Fig. 1-1. Plug-in installation and removal.**

## Input Connections

Unshielded test leads can be used to connect the AM 502 to a signal source when a high-level, low-frequency signal is monitored at a low impedance point. However, when any of these factors is missing, it becomes increasingly important to use shielded signal cables. In all cases, the signal-transporting leads should be kept as short as practical.

When making single-ended input measurements (conventional amplifier operation), be sure to establish a common ground connection between the device under test and the AM 502. The shield of a coaxial cable is normally used for this purpose. See Fig. 1-3 for reference. Push the GND button for the input not connected to the device under test.

In some cases differential measurements require no common chassis ground connection, and therefore are less susceptible to interference by ground-loop currents.

Consider the change in the source operating characteristics due to loading by the signal input cables. The circuit at the input connectors can be represented by approximately 1 megohm to ground paralleled by approximately 47 picofarads. Two feet of 50 ohm coaxial cable increases the parallel capacitance by about 60 picofarads, which could be excessive in many situations. To minimize these effects, use a higher impedance cable or an attenuator probe.

## Probes

Attenuator probes decrease the resistive-capacitive loading of a signal source. They also extend the measurement range of the AM 502 to substantially higher voltages. Some measurements require a higher resistance input to the AM 502, with very little source loading or signal attenuation. In such situations use a FET probe or the high-impedance input provision of the AM 502. Contact your Tektronix Representative for further information on probes.

## High Impedance Input

To raise the internal input impedance of the AM 502 to about 200 megohms, remove the P40 plug (Fig. 3-1). Make certain the attenuator is in the NORM mode. Signal source impedance now becomes an important factor. For example, a 100 picoampere gate current through 10 megohms produces a one-millivolt offset. This offset may result in significant error when small voltages are measured.

## Input Overloading

When measuring unknown dc voltages, push the ÷100 pushbutton in, and start with the 100 position on the GAIN switch. Increase the GAIN switch setting and finally release the ÷100 pushbutton until a suitable output signal is obtained. If the input circuit of the AM 502 is overdriven, large amounts of current will flow, opening the protective fuses.



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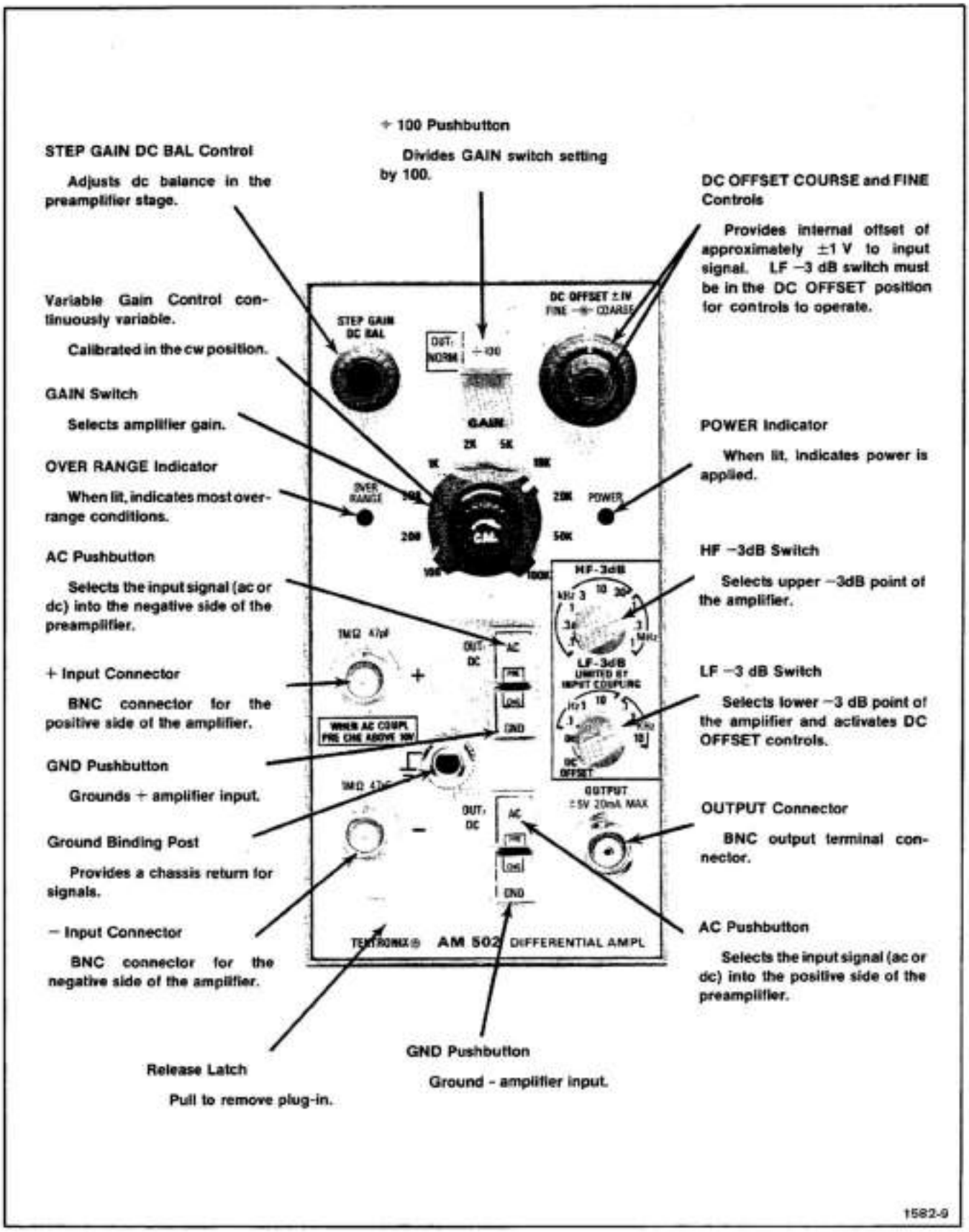



Fig. 1-2. AM 502 controls and connectors.



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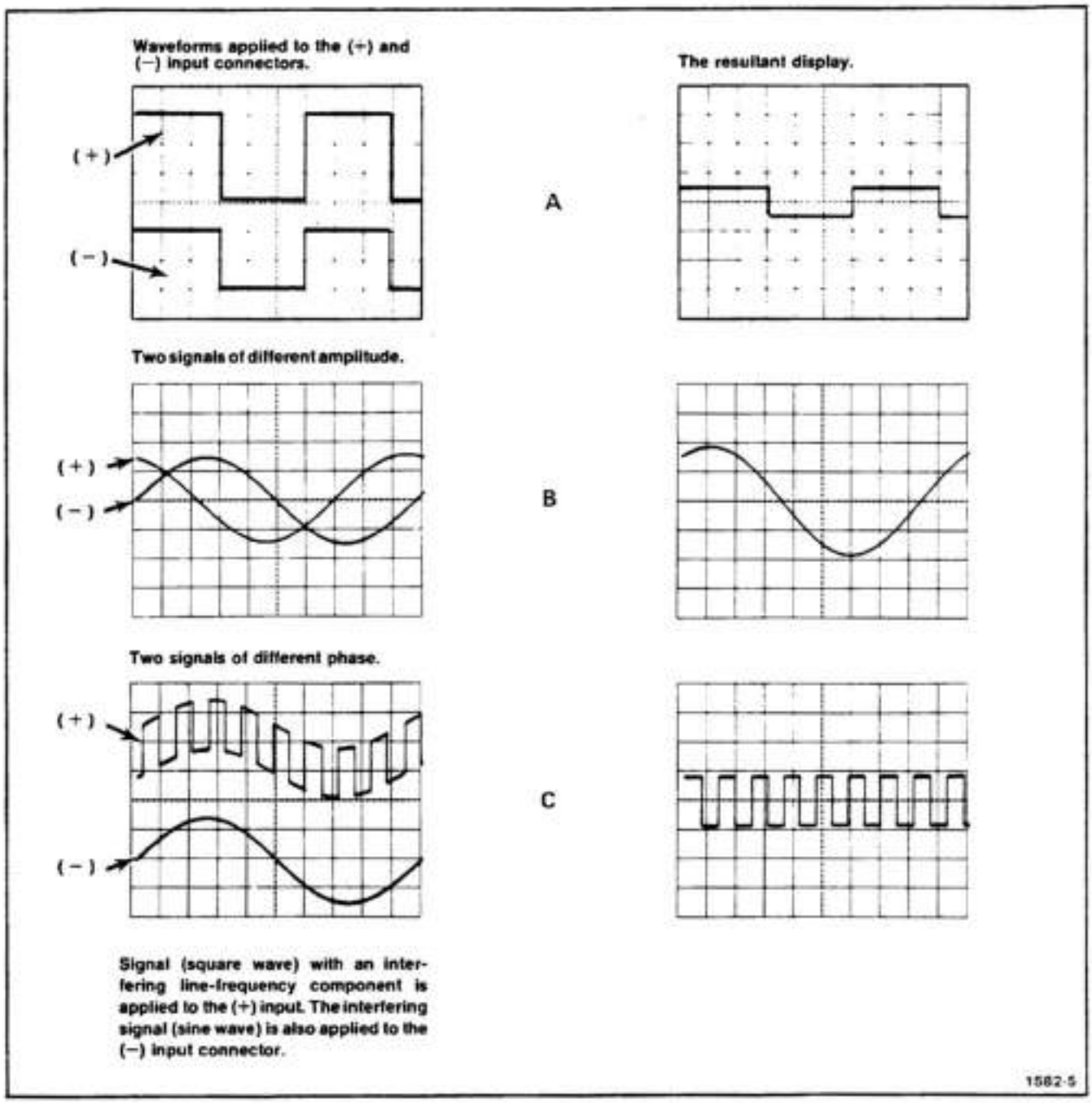



**Fig. 1-3. Waveforms showing differential rejection of a common-mode signal. Resultant waveforms show the difference between the two signals.**

## Output Connections

Make output connections using a bnc to dual binding post connector, or a coaxial cable with at least one bnc connector. To prevent current limiting in the output stage, do not load the output with less than 250 ohms. Output current is limited to 20 milliamperes.

## Step Gain DC Balance

If this control is misadjusted, the dc output level will shift as the GAIN switch position is changed. Push both GND buttons and place the GAIN switch in the 100 position. Rotate the GAIN switch from stop to stop while adjusting the STEP GAIN DC BAL control for no dc shift at the OUTPUT terminal.



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### DC Offset Coarse and Fine

Use these controls to offset up to ±1 volt dc potential difference at the input connectors. The amplifier internal bias is changed to accomplish the offset. The differential rejection capabilities of the AM 502 are not affected. The LF −3dB switch must be in the DC OFFSET position to activate these controls.

### HF and LF Bandwidth Reduction

Use the HF −3dB switch to reduce the upper bandwidth limit, as necessary, to improve the signal-to-noise ratio when using the AM 502 in low-frequency applications. The LF −3dB control increases the lower bandwidth frequency. Use this control to reduce dc drift, when raising the lower bandwidth does not undesirably reduce the bandwidth for the signal being measured.

### Pre-Charging

Use of this feature prevents surge currents, due to charging the ac coupling capacitor in the AM 502, from damaging the circuit under test. Before connecting the AM 502 to a signal containing a dc component, push the AC and GND pushbuttons. Connect the input to the circuit under test. Wait about one second for the coupling capacitor to charge. Release the GND pushbutton, and the coupling capacitor is charged to the value of the dc voltage to be measured.

### Differential Operation

A differential measurement is made by connecting each of the two inputs to selected points in the test circuit. The input to the amplifier will then be the difference in voltage of the two selected points. Consideration should be given to the proper connection method used between the AM 502 and the circuit under test; otherwise improper measurement results may occur. See Fig. 1-4 for reference.

Differential voltage measurements are made by applying the signals to the +input and −input connectors. Set the input coupling switches to the same position, AC or DC, depending on the measurement being made. In differential measurements, only the voltage difference between the two signals is amplified. Common mode signals (common in amplitude, phase, and frequency) are rejected. See Fig. 1-3 A, B, and C for reference.

Single-ended measurements often yield unsatisfactory results because of the interference resulting from ground-loop currents between the AM 502 and the device under test. In other cases, it may be desirable to eliminate a dc voltage by means other than the use of a blocking capacitor, which could limit the low-frequency response. The limitations of single-ended measurements are effectively eliminated by using differential measurements.

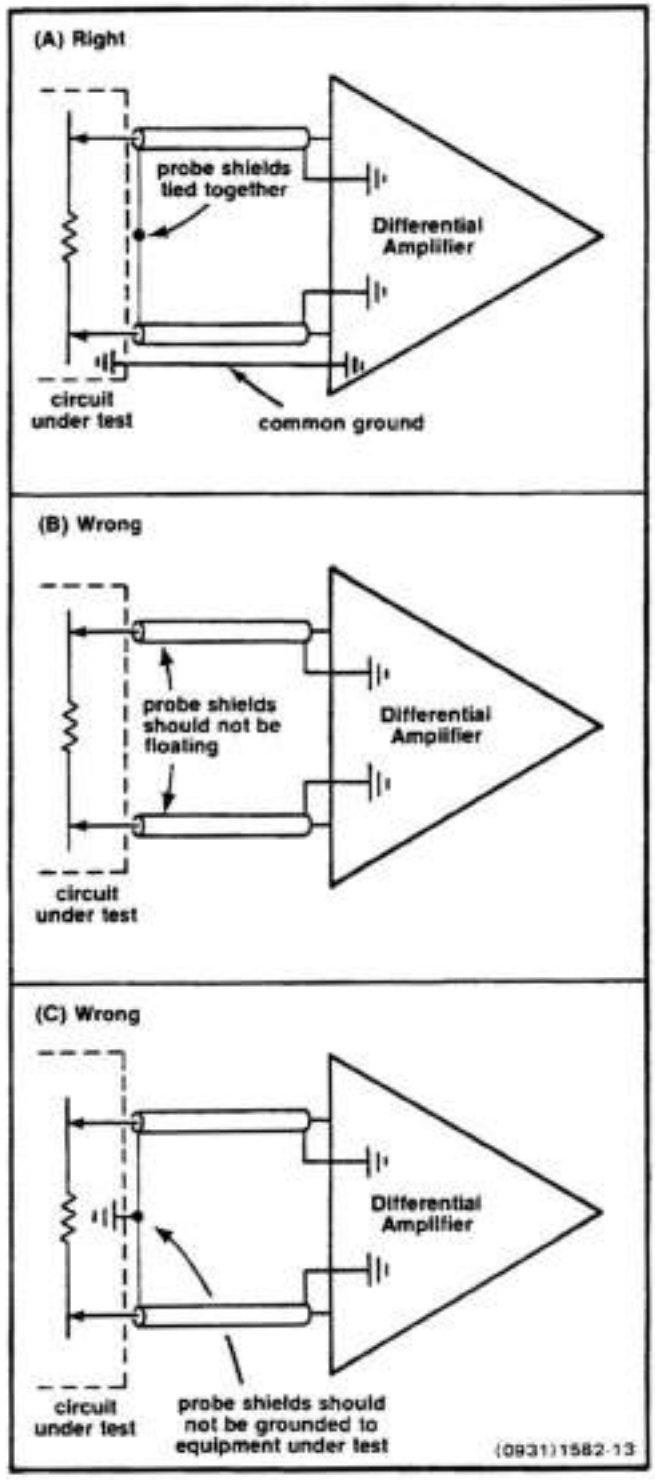



**Fig. 1-4. Connecting a differential amplifier to a signal source.**



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## DC Offset Operation

By using the FINE and COARSE DC OFFSET controls, it is possible to use the AM 502 differentially in a slide-back mode, to observe a small signal whose dc potential difference may be considerable. The offset voltage is continuously adjustable from plus 1 volt to minus 1 volt, and is internally available for all of the GAIN switch positions. The LF −3dB switch must be in the DC OFFSET position to activate the offset circuit.

## Common Mode Rejection Ratio

The ability of the AM 502 to reject common-mode signals is indicated by the common-mode rejection ratio (cmrr). For example, assume that a signal consists of unwanted 60 hertz at 10 volts peak-to-peak (common mode connected to both inputs), plus a desired signal at 1 millivolt peak-to-peak (differentially connected to one input). The AM 502 gain is set at 200. The output of the AM 502 shows the desired signal at an amplitude of 0.2 volt (1 millivolt X 200), and the 60 hertz signal is viewed at an amplitude of 0.02 volts. The cmrr in this application is 100,000 to 1. This figure is calculated by multiplying the value of the common-mode signal (10 volt) by the gain of the amplifier (200) for a product of 2000 volts. This product is divided by the observed 60 hertz voltage at the output (0.02 volt) and result is the cmrr, 100,000 to 1. It would, of course be impossible to view the 1 millivolt signal superimposed on the 60 hertz signal by using single input methods.

## Degradation of Common Mode Rejection

There are a number of factors that degrade common-mode rejection ratio (cmrr). The principal requirement for maximum rejection is for the common-mode signal to arrive at the input FET gates at the same phase and amplitude. A difference of only 0.01% in the attenuation ratios of the input attenuators will reduce the rejection ratio to 10,000 to 1. Also, any difference in source impedance will degrade the rejection ratio. Figures 1-5 and 1-6 show common-mode rejection degradation due to differences in source impedance. The frequency of the common-mode signal also affects the common-mode rejection ratio. Generally, as the frequency of the input signal increases, the common-mode rejection ratio is more difficult to maintain.

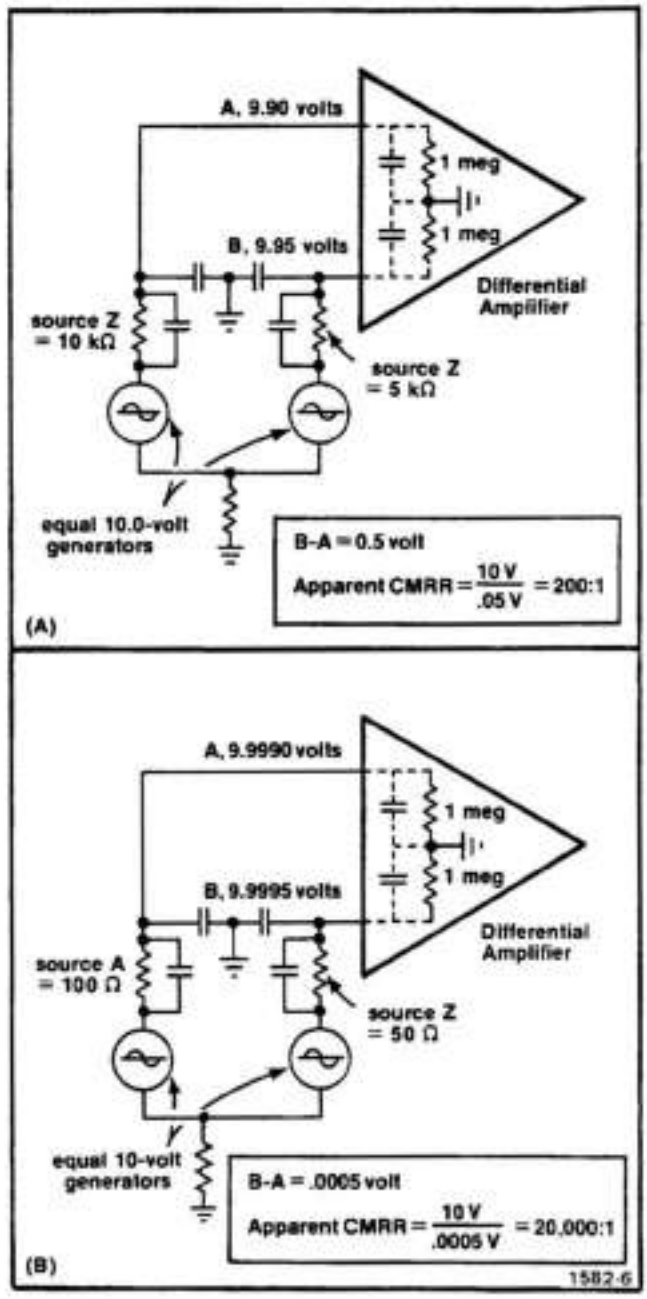
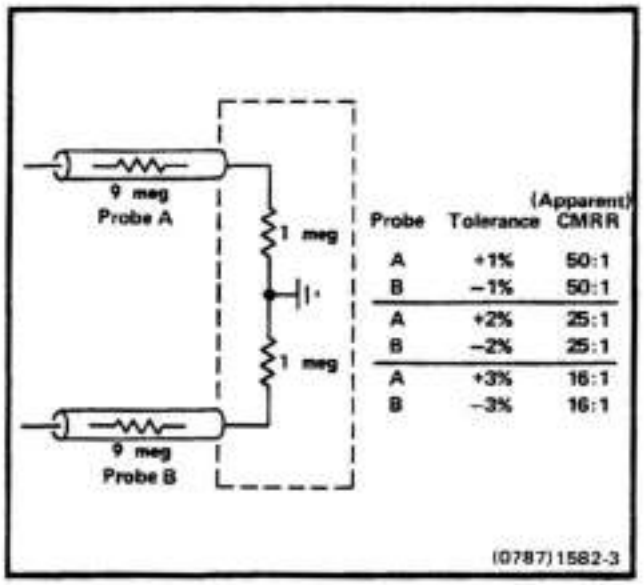



**Fig. 1-5. Relationship of test point source impedance to the amplifier input impedance and the apparent CMRR caused by (A) large difference between test-point impedances and (B) low impedance test points.**



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| Probe | Tolerance | (Apparent) CMRR |
|---|---|---|
| A | +1% | 50:1 |
| B | −1% | 50:1 |
| A | +2% | 25:1 |
| B | −2% | 25:1 |
| A | +3% | 16:1 |
| B | −3% | 16:1 |

**Fig. 1-6. Simplified input circuit and table showing the change in apparent CMRR due to 10X probes that are within 1, 2, and 3% of their attenuation values (with matched 1 megohm resistors).**

The high frequency cmrr will also depend upon the signal source impedance, since various shunt capacitances between the source and the input gate must charge and discharge through that impedance.

Outside influences such as magnetic fields can also degrade the performance, particularly when low level signals are involved. Magnetic interference may be reduced by using identical signal transporting leads to the two inputs. Twist the two leads together over as much of their length as possible. Low-frequency measurements can be similarly protected by using a shielded cable that contains a twisted pair of conductors.



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# SPECIFICATION AND PERFORMANCE CHECK

## SPECIFICATION

### Performance Conditions

The electrical characteristics are valid only if the AM 502 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 noted.

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

**Table 2-1**

**ELECTRICAL CHARACTERISTICS**

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Gain | | |
| Normal Mode | 100 to 100,000 within 2%, 10 steps in 1, 2, 5 sequence. | |
| ÷100 Mode | 1 to 1000 within 2%. | |
| Variable Range | | Continuously variable uncalibrated gain to at least 2.5 times the calibrated gain setting. |
| Frequency Response | | |
| Direct Coupled | dc to 1 MHz | With Gain control set to 20K or less, selectable HF −3dB points are within +1dB, −2dB. Upper −3dB point reduces to 500 KHz at 50K gain, and 250 KHz at 100K gain. |
| AC Coupled | 2 Hz or less, at lower frequency −3dB point to 1 MHz. | |
| Bandwidth | | |
| HF −3dB | 100 Hz to 1 MHz, 9 steps in 1-3 sequence. | Reference approximately 5.0 V peak-to-peak output at 1 KHz. |
| Accuracy | +1dB, −2dB | Reading range −2dB to −5dB. |
| LF −3dB | 0.1 Hz to 10 kHz 6 steps in 1-10 sequence. | |
| Accuracy | +1dB, −2dB | Reading range −2dB to −5dB. |



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Table 2-1 (Con't)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Output | | |
| Voltage Swing | ±5 V. | |
| Current | | ±20 mA |
| $R_o$ | | 5 Ω or less |
| Minimum Load Impedance | | 250 Ω |
| Common Mode | | |
| Normal Mode Range | ±5 V. | |
| Rejection Range | 100 dB, dc to 50 kHz. | Direct coupled with inputs shorted together. |
| ÷100 Mode Range | ±50 V. | |
| Rejection Range | 50 dB, dc to 50 kHz. | Direct coupled with less than 100 V peak-peak sine-wave input. |
| DC Offset Range | | At least + and − 1 V. |
| Maximum Safe Input Voltage | | |
| Direct Coupled Normal Mode | | 15 V (dc plus peak ac) to 5 MHz or less. |
| ÷100 Mode | | 350 V (dc plus peak ac) to 5 MHz or less. |
| AC Coupled | | 350 V (dc plus peak ac) with coupling capacitor precharged. |
| Maximum Input Gate Current (each input) | | 50 pA at 25°C. |
| Noise (Referred to Input) | | |
| NORM mode | ≤25 μV, tangentially measured with 25 Ω or less source resistance. | 10 Hz to 1 MHz selected bandwidth. Typically ≤6.0 nV/$\sqrt{\text{Hz}}$ above 1 kHz. |
| ÷100 Mode | | Typically ≤2.0 μV/$\sqrt{\text{Hz}}$ from 1 kHz to 9 kHz, decreasing in a 1/F fashion to ≤600 nV/$\sqrt{\text{Hz}}$ above 30 kHz. |
| Voltage Drift with Time | | |
| Short Term | | 10 μV (peak-to-peak) per hour |



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Table 2-1 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| Long Term | | 20 μV (peak-to-peak) per hour. |
| Voltage Drift with Temperature | | 100 μV per °C. |
| Input R and C | | Resistance, 1 MΩ.<br>Capacitance, Approximately 47 pF. |

Table 2-2

ENVIRONMENTAL

| Characteristics | Information |
|---|---|
| Temperature | |
| Operating | 0° C to +50° C |
| Storage | −40° C to +75° C |
| Altitude | |
| Operating | To 15,000 feet; maximun operating temperature decreased by 1° C/1000 feet from 5000 to 15,000 feet. |
| Storage | To 50,000 feet. |
| Vibration | |
| Operating and Non-operating | With the instrument complete and operating, vibration frequency swept from 10 to 55 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015 inch total displacement. Hold 10 minutes at any major resonanace, or in none, at 55 Hz. Total time 75 minutes. |
| Shock | |
| Operating and Non-operating | 30 g's 1/2 sine, 11 ms duration, 2 shocks in each direction along 3 major axes, for a total of 18 shocks. |

Table 2-3

PHYSICAL CHARACTERISTICS

| Characteristics | Information |
|---|---|
| Overall Dimensions (measured at maximum points) | |
| Height | 5.0 inches<br>12.7 centimeter |
| Width | 2.5 inches<br>6.35 centimeter |
| Length | 11.8 inches<br>30.0 centimeter |
| Net Weight (Instrument Only) | 1.8 lbs.<br>.82 kilograms |



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# PERFORMANCE CHECK

## Introduction

This procedure checks the electrical characteristics of the AM 502 that appear in the Specification section of this manual. If the instrument fails to meet the requirements given in this performance check, the calibration 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 502 is calibrated at an ambient temperature of +20° C to +30° C and operated at an ambient temperature of 0° C to +50° C. Forced air circulation is required for ambient temperature above +40° 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 | Performance Requirements | Applications | Example |
|---|---|---|---|
| Oscilloscope | Bandwidth, dc to 2 MHz; Minimum deflection factor, 20 mV/div; sweep rate, .2 ms/div to 1 μs/div; accuracy, within 3%. | Used throughout procedure to provide display. | TEKTRONIX 5110, 5A13N, 5B10N. |
| Power Module | Three compartments or more. | All tests | TEKTRONIX TM 503 or TM 504. |
| Calibration Generator | Amplitude calibration, 5 mV to 10 V; accuracy, ±0.25% into 1 MΩ; output, square wave at approximately 1 kHz. | Amplifier gain check | TEKTRONIX PG 506 Calibration Generator.* |
| Function Generator | Waveforms, sine and square; voltage amplitude, 10 V p-p; frequency range, 1 kHz to 50 kHz; accuracy, within 3%. | Signal generation for cross neutralization and high frequency cmrr check. | TEKTRONIX FG 501 Function Generator.* |
| Termination | Impedance, 50 Ω; accuracy, within 2%; connectors, bnc. | Output termination for signal generator. | Tektronix Part No. 011-0049-01 |
| Attenuator, 10X (4 required) | Impedance, 50 Ω; accuracy, within 2%; connectors, bnc. | Output attenuation for signal generator. Noise check. | Tektronix Part No. 011-0059-02 |
| Coaxial cable (2 required) | Impedance, 50 Ω; length, 36 inches; connectors, bnc. | Provides signal interconnection. | Tektronix Part No. 012-0057-01 |

* Requires TM 500-Series power module



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### Preliminary Procedure

1. Ensure that all test equipment and the AM 502 under test are suitably adapted to the line voltage to be applied. Refer to the installation section of the power module manual.

2. Ensure that all test equipment is suitably adapted to the applied line voltage.

3. Install the AM 502 into the power module, and if applicable, install the TM 500 series test equipment into the test equipment power module.

4. Connect the equipment under test and the test equipment to a suitable line voltage source. Turn all equipment on and allow at least 20 minutes for the equipment to stabilize.

### Initial Control Settings

Set the following controls during warm-up time:

**AM 502**

| | |
|---|---|
| STEP GAIN DC BAL | midrange |
| ÷100 | pushbutton out |
| DC OFFSET | |
| FINE and COARSE | midrange |
| GAIN | 100 |
| CAL | fully clockwise (cal) |
| HF −3dB | 1 MHz |
| LF −3dB | DC OFFSET |
| + AC | pushbutton out |
| + GND | pushbutton out |
| − AC | pushbutton out |
| − GND | pushbutton in |

**Oscilloscope**

| | |
|---|---|
| Intensity, Focus | Set for well-defined trace and normal brightness. |

**Vertical Amplifier**

| | |
|---|---|
| Volts/Div | 1 V |
| + Input | dc |
| Variable | fully clockwise (cal) |

**Time Base Plug-In**

| | |
|---|---|
| Time/Div | .5 ms |
| Variable | (cal in) |
| Triggering | |
| + Slope | selected |
| Mode | p-p auto |
| Coupling | ac |
| Source | internal |
| Position | Set so trace starts at left side of graticule. |
| Display Mode | main sweep |
| Magnifier | X1 |

**Calibration Generator**

| | |
|---|---|
| Amplitude | 1 V |

## PERFORMANCE CHECK PROCEDURE

*NOTE*

*The oscilloscope vertical amplifier system gain, the 50-ohm termination, and 50-ohm attenuator are required to be calibrated within 0.5% accuracy prior to proceeding with Steps 1 and 2. The PG 506 calibration generator may be used to set the system to 0.5% accuracy.*

### 1. Check Amplifier Gain. Gain Accuracy is within 2%

a. Connect the calibration generator to the AM 502 + input connector through a 50-ohm cable, a 50-ohm 10X attenuator and 50-ohm terminator.

b. Connect a 50-ohm cable from the AM 502 OUTPUT connector to the vertical amplifier input connector.

c. Adjust the AM 502 DC OFFSET controls (FINE and COARSE) until the OVERRANGE indicator light goes out. Position the crt display to the center of the graticule with the vertical amplifier position control.

d. Check—using the AM 502 GAIN and calibration generator amplitude settings given in Table 2-5, check the vertical deflection within the given limits.



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*NOTE*

*The OVER RANGE indicator light must remain off during all switch settings. Adjust the DC OFFSET controls as required during the check procedure.*

*NOTE*

*Install both plug-in side covers and insert plug-in into power module for checking gain below 5K setting to minimize noise on the display.*

**Table 2-5**

**AMPLIFIER GAIN ACCURACY**

| AM 502 GAIN Setting | AM 502 HF −3 dB Switch Setting | Calibration Generator Amplitude Setting | Vertical Deflection in Divisions |
|---|---|---|---|
| 100 | 1 MHz | 1 V | 4.9 - 5.1 |
| 200 | 1 MHz | .5 V | 4.9 - 5.1 |
| 500 | 1 MHz | .2 V | 4.9 - 5.1 |
| 1K | 1 MHz | .1 V | 4.9 - 5.1 |
| 2K | 1 MHz | 50 mV | 4.9 - 5.1 |
| 5K | 1 MHz | 20 mV | 4.9 - 5.1 |
| 10K | 10 kHz | 10 mV | 4.9 - 5.1 |
| 20K | 10 kHz | 5 mV | 4.9 - 5.1 |
| 50K | 10 kHz | 2 mV | 4.9 - 5.1 |
| 100K | 10 kHz | 1 mV | 4.9 - 5.1 |

### 2. Check ÷100 Amplifier Gain Accuracy. Gain Accuracy is within 2%

a. Disconnect all cables and repeat Step 1 parts a, b, c, and d.

b. Set the AM 502 GAIN switch to 10K and the HF −3 dB switch to 1 MHz; push in the ÷100 pushbutton.

c. Set the calibration generator amplitude control to 1 V. Adjust the AM 502 DC OFFSET control (FINE and COARSE) until the OVERRANGE indicator light goes out.

d. Position the crt display to the center of the graticule with the vertical amplifier position control.

e. Check—the crt display amplitude for 4.9 to 5.1 divisions.

f. Disconnect the 50-ohm terminator from the AM 502 + input connector and connect it to the − input connector. Push in the + input GND pushbutton and push and release the − input GND pushbutton.

g. Check—repeat parts d, e, and f of this step.

h. Disconnect the 50-ohm termination, 10X attenuator, and cable.

### 3. Check Common Mode Rejection. Rejection Ratio is 100 dB, dc to 50 kHz

a. Connect a dual-input connector cable between the AM 502 + input and − input connector.

b. Set the AM 502 ÷100 pushbutton out; the + input and − input AC and GND pushbuttons out, and the GAIN switch to 100.

c. Set the AM 502 HF −3 dB switch to .3 MHz and the LF −3 dB switch to DC.

d. Set the vertical amplifier deflection factor for 10 mV/div.

e. Connect a 50-ohm cable from the function generator to the center connector of the dual-input connector. Set the function generator for a 10 V, 50 kHz sine-wave output signal, with DC offset set to 0 at <1 V.

f. Adjust vertical amplifier position to center display on screen.

g. Check—the crt display for one division of vertical deflection or less.

### 4. Check ÷100 Common Mode Rejection. Rejection Ratio is 50 dB, dc to 50 kHz

a. Disconnect the 50-ohm cable from the function generator and connect it to the calibration generator output. Press in the ÷100 pushbutton.

b. Set the vertical amplifier deflection factor for 100 mV/div.

c. Set the calibration generator for a 100 volt, square-wave output signal.

d. Check—crt display for 3.1 divisions or less of vertical deflection.

e. Disconnect the dual-input connector and 50-ohm cable from the AM 502 input connectors.



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**5. Check HF −3 dB Bandwidth. Accuracy is +1 dB, −2 dB**

a. Set the AM 502 HF −3 dB switch to 1 MHz, the − input pushbutton to GND, and ÷100 pushbutton out.

b. Set the vertical amplifier deflection factor to 1 V/div, and the time-base sweep rate to 1 ms/div.

c. Set the function generator controls for a 50 mV, 1 kHz sine-wave output signal. (Use appropriate attenuation to eliminate input overdrive condition.)

d. Connect a 50-ohm cable from the function generator to the AM 502 + input connector. Adjust the vertical deflection amplitude for a five-division display.

e. Set the function generator output frequency to 1 MHz.

f. Check—the amplitude of the crt display for 3.15 to 3.85 divisions.

*NOTE*

*The specification in part f of this step must be met before proceeding with part g of this step.*

g. Check—the remaining settings of the HF −3 dB switch, using Table 2-6 as reference. (Change time-base sweep rate as needed for lower frequencies.)

**Table 2-6**

**HF −3 dB BANDWIDTH ACCURACY**

| AM 502 HF −3 dB Switch Setting | Function Generator Output Frequency | Vertical Deflection in Divisions |
|---|---|---|
| .3 MHz | 300 kHz | 3.15 - 3.85 |
| .1 MHz | 100 kHz | 3.15 - 3.85 |
| 30 kHz | 30 kHz | 3.15 - 3.85 |
| 10 kHz | 10 kHz | 3.15 - 3.85 |
| 3 kHz | 3 kHz | 3.15 - 3.85 |
| 1 kHz | 1 kHz | 3.15 - 3.85 |
| .3 kHz | 300 Hz | 3.15 - 3.85 |
| .1 kHz | 100 Hz | 3.15 - 3.85 |

i. Set the HF −3 dB switch to 1 MHz.

**6. Check LF −3 dB Bandwidth. Accuracy is +1 dB, −2 dB**

a. Check—the settings of the LF −3 dB switch, using Table 2-7 as reference. Adjust the time-base sweep rate to obtain an appropriate display.

**Table 2-7**

**LF −3 dB BANDWIDTH ACCURACY**

| AM 502 LF −3 dB Switch Setting | Function Generator Output Frequency | Vertical Deflection in Divisions |
|---|---|---|
| 10 kHz | 10 kHz | 3.15 - 3.85 |
| 1 kHz | 1 kHz | 3.15 - 3.85 |
| .1 kHz | .1 kHz | 3.15 - 3.85 |
| 10 Hz | 10 Hz | 3.15 - 3.85 |
| 1 Hz | 1 Hz | 3.15 - 3.85 |

*NOTE*

*The components used in the .1 Hz position are also used in the other positions of the switch; therefore, the tolerance of the .1 Hz position is checked.*

b. Press in the AM 502 + input AC pushbutton. Set the function generator controls for a 2 Hz output signal.

c. Check—the amplitude of the crt display for 3.15 to 3.85 divisions.

d. Disconnect the 50-ohm cable from the AM 502 + input connector and connect it to the − input connector.

e. Press in the AM 502 + input GND pushbutton and − input AC pushbutton. Press to release the − input GND pushbutton.

f. Check—the amplitude of the crt display for 3.15 to 3.85 divisions.

g. Set the LF −3 dB switch to the DC OFFSET position. Press in the AM 502 − input GND pushbutton.

h. Disconnect the 50-ohm cable from the AM 502 − input connector.



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## 7. Check Overall Noise (Tangentially Measured)

a. Set the AM 502 GAIN control to 100K; press in to release the + input AC and GND pushbutton, and the − input AC pushbutton.

b. Set the vertical amplifier deflection factor to 5 V/div. Set the time-base sweep rate to 10 μs/div, and the trigger source switch to external.

c. Connect a 50-ohm termination to the AM 502 + input connector; connect four series-connected 10X attenuators to the 50-ohm termination.

d. Connect a 50-ohm cable from the calibration generator fast-rise output connector to the end of the attenuator string. Set the pulse duration control for 1 ms.

e. Adjust the AM 502 DC OFFSET controls (FINE and COARSE) until the OVER RANGE indicator light goes out.

f. Adjust the calibration generator pulse amplitude control and observe two noise bands as shown in Fig. 2-1A (remove one attenuator if necessary, to produce the desired display).

g. Decrease the calibration generator pulse amplitude until the noise bands just merge. See Fig. 2-1B.

h. Remove three of the attenuators and connect the signal through the 50-ohm attenuator (including the 50-ohm termination), to the vertical amplifier input and measure the pulse amplitude. Calculate the tangentially measured display noise as follows:

$$\text{Noise (in } \mu\text{V)} = \frac{\text{Signal level (measured in part h)}}{\text{Attenuation Removed}}$$

Typical figures are:

$$\frac{12 \text{ mV}}{10^{3}} = 12 \times 10^{-6} = 12 \ \mu\text{V of noise}$$

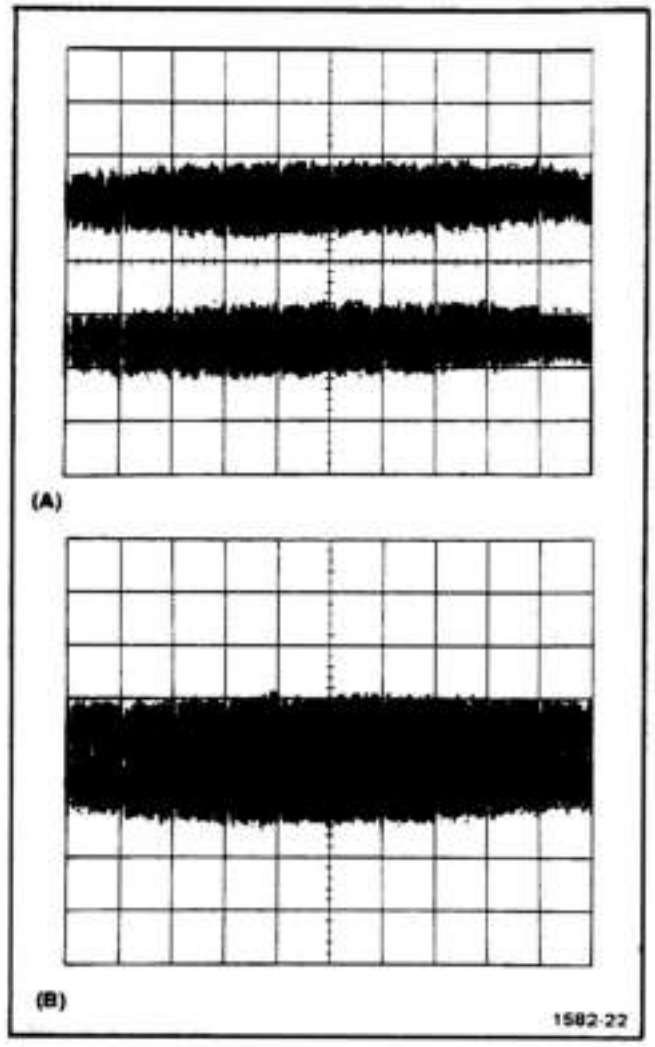



**Fig. 2-1. Typical display of (A) two noise bands and (B) noise bands merged.**

i. Disconnect all cables and equipment.

This completes the Performance Check of the AM 502 Differential Amplifier.



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# ADJUSTMENT

## Introduction

This adjustment procedure is to be used to restore the AM 502 to the original performance specification. 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.

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.

## Services Available

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.

## Test Equipment Required

The test equipment listed in Table 3-1, or equivalent, is required for adjustment of the AM 502. 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.

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

A flexible plug-in extender, Tektronix Part No. 067-0645-03, is useful for troubleshooting or adjusting the AM 502; however, the complete Adjustment Procedure can be performed without use of the extender. Remove the power module cabinet to make adjustments to the AM 502 inside the power module.



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**Table 3-1**

**LIST OF TEST EQUIPMENT REQUIREMENTS**

| Description | Performance Requirements | Applications | Example |
|---|---|---|---|
| Oscilloscope | Bandwidth, dc to 2 MHz; minimum deflection factor, 20 mV/div; sweep rate, .2 ms/div to 1 μs/div; accuracy, within 3% | Used throughout procedure to provide display | TEKTRONIX 5110, 5A13N, 5B10N |
| Digital Voltmeter | Range, 0 to 50 V; accuracy, within 0.1% | Voltage measurements. Output voltage flatness check. | TEKTRONIX DM 501 Digital Multimeter.* |
| Power Module | Three compartments or more. | All tests | TEKTRONIX TM 503 or TM 504. |
| Calibration Generator | Amplitude calibration, 5 mV to 10 V; accuracy, ±0.25% into 1 MΩ; output, square wave at approximately 1 kHz. | Amplifier gain check | TEKTRONIX PG 506 Calibration Generator.* |
| Function Generator | Waveforms, sine and square; voltage amplitude, 10 V p-p; frequency range, 1 kHz to 50 kHz; accuracy, within 3%. | Signal generation for cross neutralization and high frequency cmrr check. | TEKTRONIX FG 501 Function Generator.* |
| Autotransformer with ac voltmeter | Capable of supplying an output voltage from 90 to 132 V, ac; 120 watts of power at the upper limit. | Power supply check. | General Radio W10MTR3W Variac Autotransformer. |
| Input RC normalizer | Time constant, 1 MΩ x 47 pF; connectors, bnc. | Input capacitance check. | Tektronix Part No. 067-0541-00 |
| Termination | Impedance, 50 Ω; connectors, bnc. | Output termination for signal generator. | Tektronix Part No. 011-0049-01. |
| Attenuator, 10X (4 required) | Impedance, 50 Ω; connectors, bnc. | Output attenuation for signal generator. Noise check. | Tektronix Part No. 011-0059-02 |
| Coaxial cable (2 required) | Impedance, 50 Ω; length, 36 inches; connectors, bnc. | Provides signal interconnection. | Tektronix Part No. 012-0057-01. |

*Requires TM 500 Series power module



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### Preparation

a. Remove the left and right side covers of the AM 502 to gain access to the component side of the circuit boards. Pull the rear end of the side cover outward from the side of the instrument (the cover snaps into place).

b. Install the AM 502 into the left power module compartment, or if appropriate, connect the AM 502 to the power module by means of the flexible plug-in extender.

c. Set the power module for the line voltage to be applied (see power module manual) and connect it to the variable autotransformer; connect the autotransformer to the line voltage source. Be sure that the power switch is off.

d. Install the TM 500-series equipment, including the AM 502 into the power module.

e. Connect all test equipment to a suitable line voltage source.

f. Turn on all test equipment and allow at least 20 minutes for the equipment to warm up and stabilize.

### Initial Control Settings

Set the following controls during warm-up time:

**AM 502**

| | |
|---|---|
| STEP GAIN DC BAL | midrange |
| ÷100 | pushbutton out |
| DC OFFSET (FINE and COARSE) | midrange |
| GAIN | 100 |
| CAL | fully clockwise (cal) |
| HF −3dB | .1 kHz |
| LF −3dB | 10 kHz |
| + AC | pushbutton out |
| + GND | pushbutton in |
| − AC | pushbutton out |
| − GND | pushbutton in |

**Oscilloscope**

| | |
|---|---|
| Intensity, Focus | Set for well-defined trace and normal brightness. |

**Vertical Amplifier**

| | |
|---|---|
| Volts/Div | 1 V |
| + Input | dc |
| Variable | fully clockwise (cal) |

**Time Base Plug-in**

| | |
|---|---|
| Time/Div | .5 ms |
| Variable | (cal in) |
| Triggering | |
| + Slope | selected |
| Mode | peak-to-peak Auto |
| Coupling | ac |
| Source | internal |
| Position | Set so trace starts at left side of graticule. |
| Display Mode | main sweep |
| Magnifier | X1 |

## ADJUSTMENT PROCEDURE

### 1. Check +15 Volt Power Supply

a. Connect the digital voltmeter between the +15 V test point on the Main circuit board, and chassis ground. See Fig. 3-1 for voltage test point location.

b. Check—for a meter reading of +14.25 to +15.75 volts.

c. Disconnect the digital voltmeter.

### 2. Check −15 Volt Power Supply

a. Connect the digital voltmeter between the −15 V test point on the Main circuit board, and chassis ground. See Fig. 3-1 for voltage test point location.

b. Check—for a meter reading of −14.25 to −15.75 volts.

c. Disconnect the digital voltmeter.

### 3. Check +5 Volt Power Supply

a. Connect the digital voltmeter between the +5 V test point on the Main circuit board, and chassis ground. See Fig. 3-1 for voltage test point location.

b. Check—for a meter reading of +4.50 to +5.50 volts.

c. Adjust the autotransformer output voltage from the low limit to the high limit as indicated in Table 3-2. Meter reading should not vary more than ±500 millivolts. Repeat this check for the +15 volt and −15 volt supplies, except the meter reading should not vary more than ±750 millivolts. Return the autotransformer to the nominal line voltage setting.

d. Disconnect the digital voltmeter.



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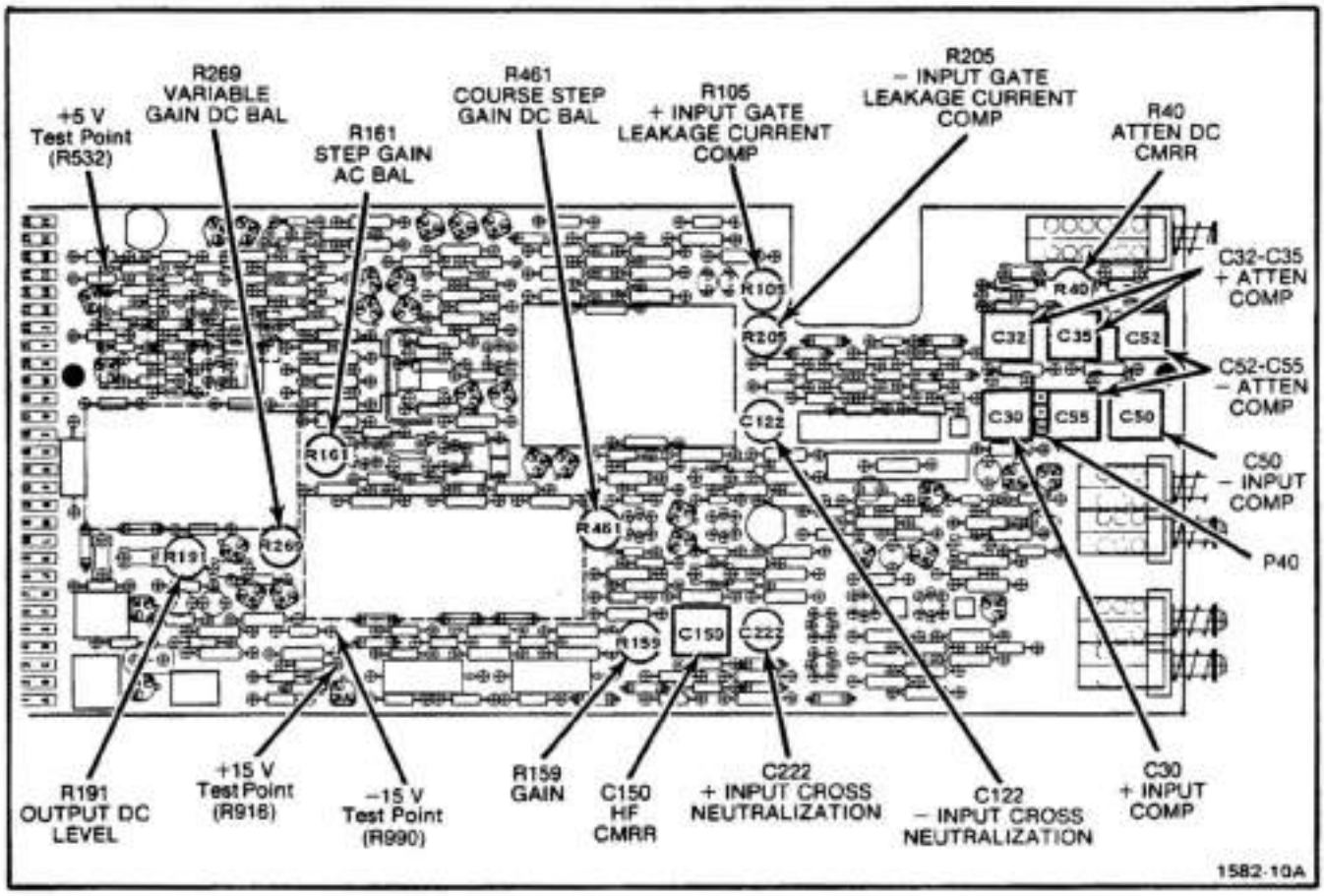



**Fig. 3-1. Location of power supply test points, and all adjustments.**

**Table 3-2**

**POWER MODULE UNIVERSAL TRANSFORMER**

| Line Selector Block Position | Regulating Ranges | |
|---|---|---|
| | 110-Volts Nominal | 220-Volts Nominal |
| L | 90 V ac to 110 V ac | 180 V ac to 220 V ac |
| M | 99 V ac to 121 V ac | 198 V ac to 242 V ac |
| H | 108 V ac to 132 V ac | 216 V ac to 264 V ac |
| Line Fuse Data | 1.6 A slow-blow | 0.8 A slow-blow |

### 4. Adjust Step Gain AC Balance

a. Connect a 50-ohm cable from the AM 502 OUTPUT connector the vertical amplifier input.

b. Check—for a trace shift of not more than three divisions vertically while switching the AM 502 GAIN switch bwtween the 100 and 100K positions.

c. Adjust—Step Gain AC Bal, R161, for minimum trace shift while switching the AM 502 GAIN switch between the 100 and 100K positions. See Fig. 3-1 for adjustment location.

d. Return the AM 502 GAIN switch to the 100 position.

### 5. Adjust Variable Gain DC Balance

a. Set the vertical amplifier deflection factor to .1 V/div.

b. Check—for a trace shift of not more than one division vertically while rotating the AM 502 CAL control from fully clockwise to fully counterclockwise position.

c. Adjust—Variable Gain DC BAL, R269, for minimum trace shift while rotating the AM 502 CAL control from fully clockwise to fully counterclockwise position. See Fig. 3-1 for adjustment location. Return control to the fully clockwise position and note the position of the trace.



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### 6. Adjust Output DC Level

a. Set the vertical amplifier deflection factor to 10 mV/div.

b. Without changing the AM 502 control positions from the previous step, note the position of the trace.

c. Adjust—Output DC Level, R191, to place trace at same position as was established in Step 5 part c.

### 7. Adjust Coarse Step Gain DC Balance

a. Set the vertical amplifier deflection factor to 2 V/div. Position the trace to the center of the graticule.

b. Set the LF −3 dB switch to the DC position (not DC OFFSET), the GAIN switch to 10K, and STEP GAIN DC BAL control to midrange. Leave the other AM 502 controls as in the previous step.

c. Adjust—Coarse Step Gain DC Bal, R461, to return trace to the center of the graticule. See Fig. 3-1 for adjustment location.

d. Turn the AM 502 STEP GAIN DC BAL control fully clockwise and fully counterclockwise, and observe trace shift of at least two divisions above and below the graticule centerline, respectfully. Return the trace to the graticule center.

### 8. Adjust + Input Gate Leakage Current Compensation

a. Connect a 50-ohm termination to the AM 502 + input connector.

b. Set the vertical amplifier deflection factor to .1 V/div. Press in to release the + GND pushbutton.

c. Adjust—the + Input Gate Leakage Current Comp, R105, while alternately depressing and releasing the +AC pushbutton, for minimum trace shift.

d. Press in to release the +GND and +AC pushbuttons. Remove the termination from the + input connector.

### 9. Adjust — Input Gate Leakage Current Compensation

a. Connect a 50-ohm termination to the AM 502 − input connector.

b. Press in to release the − GND pushbutton.

c. Adjust—the − Input Gate Leakage Current Comp, R205, while alternately depressing and releasing the − AC pushbutton, for minimum trace shift.

d. Press in the − GND pushbutton, and press in to release the −AC pushbutton. Remove the termination from the − input connector.

*NOTE*

*The oscilloscope vertical amplifier system gain, the 50-ohm termination, and 50-ohm attenuator are required to be calibrated within 0.5% accuracy prior to proceeding with Steps 10 and 11. The PG 506 calibration generator may be used to set the system to 0.5% accuracy.*

### 10. Check Amplifier Gain.

a. Set the vertical amplifier deflection factor to 0.2 V/div.

b. Set the AM 502 GAIN control to 100, the LF −3dB switch to DC OFFSET, and the HF −3dB switch to 1 MHz.

c. Connect the calibration generator to the vertical amplifier input, using a 50-ohm cable.

d. Set the calibration generator for a five-division, square-wave display; set the Deflection Error control for zero per cent error. Disconnect the 50-ohm cable from the vertical amplifier input.

e. Connect the calibration generator to the AM 502 + input connector through a 50-ohm cable, a 50-ohm 10X attenuator, and a 50-ohm termination. (This reduces the generator output by 50%.)

f. Connect a 50-ohm cable from the AM 502 OUTPUT connector to the vertical amplifier input connector. Set the vertical amplifier deflection factor to 1 V/div.

g. Adjust the AM 502 DC OFFSET controls (FINE and COARSE) until the OVER RANGE indicator light goes out. Position the crt display to the center of the graticule with the vertical amplifier position control.

h. Adjust—Gain, R159, for a five-division display amplitude.



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i. Rotate the AM 502 CAL control fully counterclockwise and check for two divisions or less of display amplitude.

j. Set the AM 502 CAL control fully clockwise and in the detent position.

k. Check—using the AM 502 GAIN and calibration generator amplitude settings given in Table 3-3, check the vertical deflection within the given limits.

*NOTE*

*The OVER RANGE indicator light must remain off during all switch settings. Adjust the DC OFFSET controls as required during the check procedure.*

*NOTE*

*Install both plug-in side covers and insert plug-in into power module for checking gain below 5K setting to minimize noise on the display.*

**Table 3-3**

**AMPLIFIER GAIN ACCURACY**

| AM 502 GAIN Setting | HF −3 dB Switch Setting | Calibration Generator Amplitude Setting | Vertical Deflection in Divisions |
|---|---|---|---|
| 100 | 1 MHz | 1 V | 4.9 - 5.1 |
| 200 | 1 MHz | .5 V | 4.9 - 5.1 |
| 500 | 1 MHz | .2 V | 4.9 - 5.1 |
| 1K | 1 MHz | .1 V | 4.9 - 5.1 |
| 2K | 1 MHz | 50 mV | 4.9 - 5.1 |
| 5K | 1 MHz | 20 mV | 4.9 - 5.1 |
| 10K | 10 kHz | 10 mV | 4.9 - 5.1 |
| 20K | 10 kHz | 5 mV | 4.9 - 5.1 |
| 50K | 10 kHz | 2 mV | 4.9 - 5.1 |
| 100K | 10 kHz | 1 mV | 4.9 - 5.1 |

### 11. Check ÷100 Amplifier Gain Accuracy. Gain Accuracy is within 2%

a. Disconnect all cables and repeat Step 10 parts a through f.

b. Set the AM 502 GAIN switch to 10K and the HF −3dB switch to 1 MHz; push in the ÷ 100 pushbutton.

c. Set the calibration generator amplitude control to 1.0 V. Adjust the AM 502 DC OFFSET control (FINE and COARSE) until the OVER RANGE indicator light goes out.

d. Position the crt display to the center of the graticule with the vertical amplifier position control.

e. Check—the crt display amplitude for 4.9 to 5.1 divisions.

f. Disconnect the 10X attenuator from the AM 502 + input connector and connect it to the − input connector. Push in the + input GND pushbutton and push in to release the − input GND pushbutton.

g. Check—repeat parts d and e of this step.

h. Disconnect the 50-ohm termination, 10X attenuator, and cable.

### 12. Adjust Input Cross Neutralization

a. Set the AM 502 ÷ 100 pushbutton out, the + and − input GND pushbuttons out, the + and − AC pushbuttons in, the LF −3dB switch to DC, and the GAIN switch to 100.

b. Connect a 50-ohm termination and a 10X attenuator to the AM 502 + input connector.

c. Connect a 50-ohm cable from the fast-rise output of the calibration generator to the 10X attenuator on the + input of the AM 502.

d. Set the calibration generator amplitude control to produce a five-division crt display (1 ms period). Set the time-base triggering controls for a stable, triggered display.

e. Check—the crt display for roll-off or overshoot (upper corner of the leading edge) within 0.2 division.

f. Adjust— + Input Cross Neutralization, C222, for minimum roll-off or overshoot (upper front corner of the leading edge).

g. Disconnect the 50-ohm termination (with 10X attenuator and 50-ohm cable attached) from the + input connector, and connect it to the − input connector.

h. Repeat part e of this step.

i. Adjust— −Input Cross Neutralization, C122, for minimum roll-off or overshoot (upper corner of the leading edge).



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### 13. Adjust Input Capacitance

a. Disconnect the 50-ohm termination from the − input and connect a 47 pF Normalizer to the − input connector; connect the 50-ohm termination to the other end of the 47 pF Normalizer.

b. Increase the signal amplitude of the calibration generator to maintain five divisions of display.

c. Check—the upper front corner of the leading edge for roll-off or overshoot, within 0.2 division.

d. Adjust— −Input Comp, C50, for the best upper corner on the leading edge of the displayed square wave.

e. Disconnect the 47 pF Normalizer, with 50-ohm termination, 10X attenuator, and 50-ohm cable from the − input connector and connect them to the + input connector.

f. Repeat part c of this step.

g. Adjust— +Input Comp, C30, for best flat top (minimum roll-off or overshoot on upper front corner) on displayed waveform. See Fig. 3-1 for adjustment location.

### 14. Adjust Attenuator Compensation

a. Press in the ÷ 100 pushbutton. Set the vertical amplifier deflection factor to .1 V/division.

b. Disconnect the 10X attenuator that is connected between the 50-ohm termination and the 50-ohm cable; reconnect the 50-ohm cable to the termination.

c. Readjust the calibration generator amplitude control to maintain a five-division display.

d. Check—the crt display for roll-off or overshoot (upper corner of the leading edge) within 0.2 division.

e. Adjust— + Atten Comp, C32-C35, for best flat top (minimum roll-off or overshoot on upper front corner) on displayed waveform. See Fig. 3-1 for adjustment location.

f. Disconnect the 47 pF Normalizer, 50-ohm termination, and 50-ohm cable from the + input connector and connect them to the − input connector.

g. Readjust the calibration generator amplitude control to maintain a five-division display.

h. Check—the crt display for roll-off or overshoot (upper corner of the leading edge) within 0.2 division.

i. Adjust— −Atten Comp, C52-C55, for best flat top (minimum roll-off or overshoot on upper front corner) on displayed waveform. See Fig. 3-1 for adjustment location.

j. Disconnect the 47 pF Normalizer, 50-ohm termination and cable from the AM 502 − input connector.

### 15. Adjust High Frequency Common Mode Rejection

a. Connect a dual-input connector cable between the AM 502 + input and the − input connector.

b. Set the AM 502 ÷ 100 pushbutton out; the + input and − input AC and GND pushbuttons out, and the GAIN switch to 100.

c. Set the AM 502 HF −3 dB switch to .3 MHz and LF −3 dB switch to DC.

d. Set the vertical amplifier deflection factor for 10 mV/div.

e. Connect a 50-ohm cable from the function generator output to the center connector of the dual-input connector. Set the function generator for a 10 V, 50 kHz sine-wave output signal.

f. Check—the crt display for one division of vertical deflection or less.

g. Adjust—HF CMRR, C150, for minimum crt display amplitude within one division or less.

### 16. Adjust ÷ 100 Common Mode Rejection

a. Set the AM 502 ÷ 100 pushbutton in.

b. Set the vertical amplifier deflection factor for .1 V/div.

c. Disconnect the 50-ohm cable from the function generator output and connect it to the calibration generator output. Set the calibration generator for a 100 volt output signal.

d. Check – the crt display for 3.16 divisions of vertical deflection or less. (Disregard spikes on squarewave.)



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e. Adjust— − Atten Comp, C52, and Atten DC CMRR, R40, for minimum crt display amplitude within one division or less. (Interaction between C52 and R40 will occur. Adjust for optimum display.)

f. Disconnect the dual-input connector and 50-ohm cable from AM 502.

## 17. Check HF −3dB Bandwidth

a. Set the AM 502 HF −3dB switch to 1 MHz, the ÷ 100 pushbutton out, the − input pushbutton to GND.

b. Set the vertical amplifier deflection factor to 1 V/div, and the time-base sweep rate to 1 ms/div.

c. Set the function generator controls for a 50 mV, 1 kHz sine-wave output signal. (Use appropriate attenuation to eliminate input overdrive condition.)

d. Connect a 50-ohm cable from the function generator output to the AM 502 + input connector. Adjust the vertical deflection amplitude for a five-division display.

e. Set the function generator output frequency to 1 MHz.

f. Check—the amplitude of the crt display for 3.15 to 3.85 divisions.

*NOTE*

*The specification in part f of this step must be met before proceeding with part g of this step.*

g. Check—the remaining settings of the HF −3dB switch, using Table 3-4 as reference. (Change time-base sweep rate as needed for lower frequencies.)

**Table 3-4**

**HF −3 dB BANDWIDTH ACCURACY**

| AM 502 HF −3 dB Switch Setting | Function Generator Output Frequency | Vertical Deflection in Divisions |
|---|---|---|
| .3 MHz | 300 kHz | 3.15 - 3.85 |
| .1 MHz | 100 kHz | 3.15 - 3.85 |
| 30 kHz | 30 kHz | 3.15 - 3.85 |
| 10 kHz | 10 kHz | 3.15 - 3.85 |
| 3 kHz | 3 kHz | 3.15 - 3.85 |
| 1 kHz | 1 kHz | 3.15 - 3.85 |
| .3 kHz | 300 Hz | 3.15 - 3.85 |
| .1 kHz | 100 Hz | 3.15 - 3.85 |

h. Set the HF −3 dB switch to 1 MHz.

## 18. Check LF −3 dB Bandwidth

a. Check—the LF −3 dB switch settings, using Table 3-5 as reference. (Adjust the time-base sweep rate as needed for lower frequency settings.) Obtain a 5 division display, dc coupled, on each range before proceeding to Step b.

**Table 3-5**

**LF −3 dB BANDWIDTH ACCURACY**

| AM 502 LF −3 dB Switch Setting | Function Generator Output Frequency | Vertical Deflection in Divisions |
|---|---|---|
| 10 kHz | 10 kHz | 3.15 - 3.85 |
| 1 kHz | 1 kHz | 3.15 - 3.85 |
| .1 kHz | .1 kHz | 3.15 - 3.85 |
| 10 Hz | 10 Hz | 3.15 - 3.85 |
| 1 Hz | 1 Hz | 3.15 - 3.85 |

*NOTE*

*The components used in the .1 Hz position are also used in the other positions of the switch; therefore, the tolerance of the .1 Hz position is checked.*

b. Press in the AM 502 + input AC pushbutton.

c. Check—the amplitude of the crt display for 3.15 to 3.85 divisions.

d. Disconnect the 50-ohm cable from the AM 502 + input connector and connect it to the − input connector.

e. Press in the AM 502 + input GND pushbutton and − input AC pushbutton. Press to release the − input GND pushbutton.

f. Check—the amplitude of the crt display for 3.15 to 3.85 divisions.

g. Set the LF −3 dB switch to the DC OFFSET position. Press in the AM 502 − input GND pushbutton.

h. Disconnect the 50-ohm cable from the AM 502 − input connector.



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### 19. Check Overall Noise (Tangentially Measured)

a. Set the AM 502 GAIN control to 100K; press in to release the + input AC and GND pushbutton, and the − input AC pushbutton.

b. Set the vertical amplifier deflection factor to 5 V/division. Set the time-base sweep rate to 10 μs/division and the trigger source switch to external.

c. Connect a 50-ohm termination to the AM 502 + input connector; connect four series-connected 10X attenuators to the 50-ohm termination.

d. Connect a 50-ohm cable from the calibration generator fast-rise output connector to the end of the attenuator string. Set the pulse duration control for 1 ms.

e. Adjust the AM 502 DC OFFSET controls (FINE and COARSE) until the OVER RANGE indicator light goes out.

f. Adjust the calibration generator pulse amplitude control and observe two noise bands as shown in Fig. 3-2A (remove one attenuator if necessary, to produce the desired display).

g. Decrease the calibration generator pulse amplitude until the noise bands just merge. See Fig. 3-2B.

h. Remove three of the attenuators and connect the signal through the 50-ohm attenuator (including the 50-ohm termination), to the vertical amplifier input and measure the pulse amplitude. Calculate the tangentially measured display noise as follows:

$$\text{Noise (in } \mu\text{V)} = \frac{\text{Signal level (measured in part h)}}{\text{Attenuation Removed}}$$

Typical figures are:

$$\frac{12 \text{ mV}}{10^{3}} = 12 \times 10^{-6} = 12 \ \mu\text{V of noise}$$

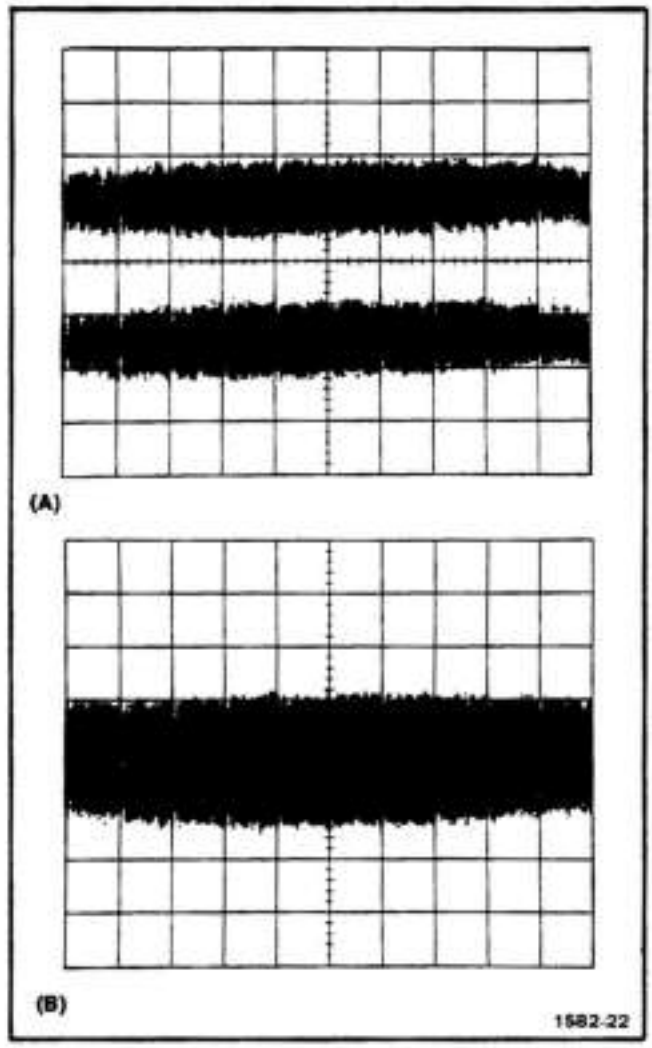



**Fig. 3-2. Typical display of (A) two noise bands and (B) noise bands merged.**

i. Disconnect all cables and equipment.

This completes the Adjustment procedure of the AM 502 Differential Amplifier.



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# MAINTENANCE AND INTERFACING INFORMATION

### Preventive Maintenance

There are no special preventive maintenance procedures that apply to the AM 502. Refer to the power module instruction manual for general preventive maintenance procedures and instructions.

### Corrective Maintenance

Refer to the power module instruction manual for general corrective maintenance procedures and instructions.

### Troubleshooting

Use the Performance Check, Adjustment Procedure, and Circuit Description as aids to locate trouble in the event of equipment failure. The test equipment listed in the Performance Check and Adjustment Procedure will prove useful in troubleshooting the AM 502.

### Functions Available at Rear Connector

A slot between pins 23 and 24 on the rear connector identifies the AM 502 as a member of the signal source family. Insert a barrier in the corresponding position of the power module jack to prevent other than signal source plug-ins from being used in that compartment; this protects the plug-in should specialized connections be made to that compartment. Consult the Building A System section of the power module manual for further information.

Signal outputs, or other specialized connections, are made to the rear interface connectors as shown in Fig. 4-1. The Signal In and Signal Ground are not factory wired. If Signal In connections are made, use coaxial cable. Connect one end to the pads as shown in Fig. 4-1 and the other end to the front panel bnc connector.

## REPACKAGING FOR SHIPMENT

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

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

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.



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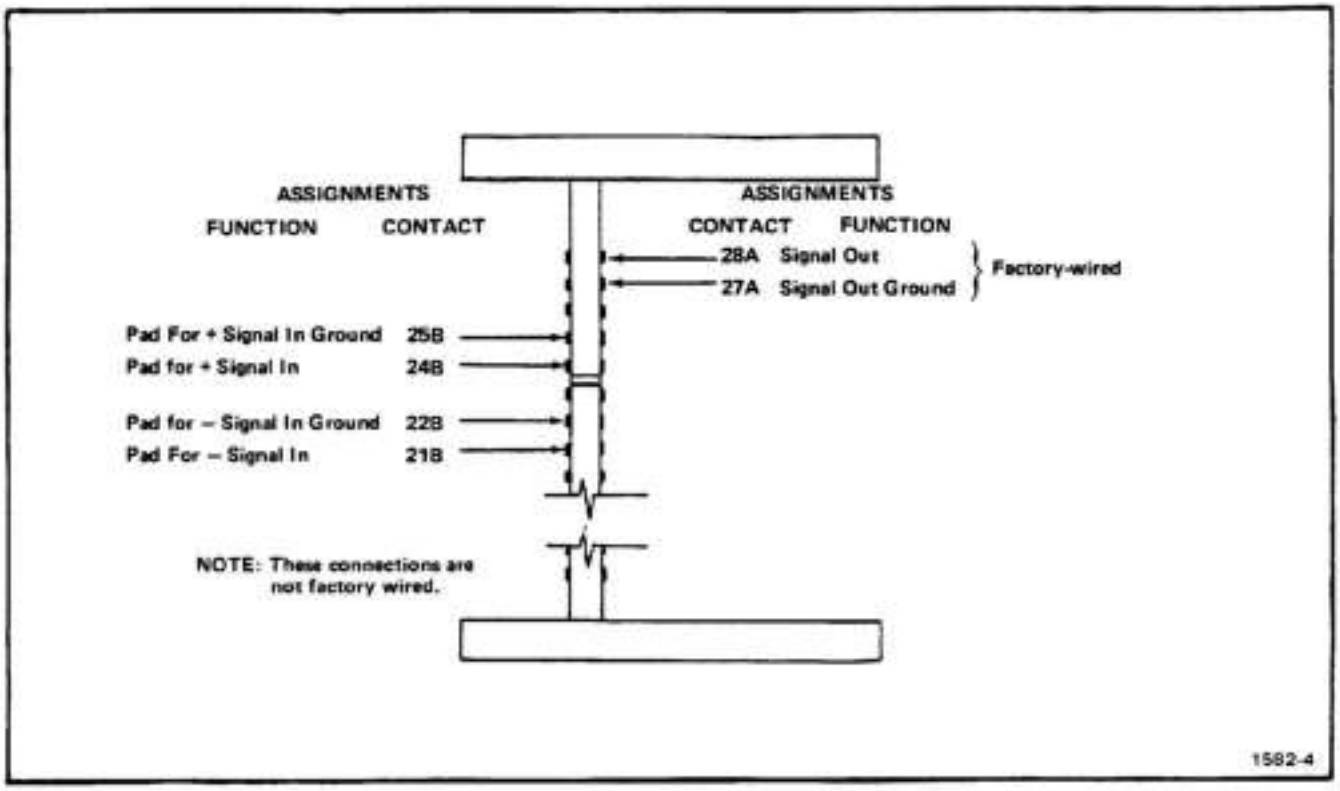



Fig. 4-1. Input/Output assignments at rear connector.



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# CIRCUIT DESCRIPTION

## Introduction

This section of the manual contains a description of the circuitry used in the AM 502 Differential Amplifier. Individual descriptions are separated into the following parts; Input Coupling, Input Attenuators, Input Overdrive Protection, Gate Current Compensation, Preamp, Floating Power Supply, Common Mode Rejection, Cross Neutralization, DC Offset, LF −3 dB Frequency Selector, Gain Switching Amplifier, HF −3 dB Frequency Selector, Variable Gain Stage, Output Amplifier, Overrange Indicator, and Power Supplies. The circuit titles correspond to those listed in the Block Diagram. The numbered diamond by each title refers to the corresponding circuit diagram in the Diagrams section of this manual.

## Input Coupling ◇1

A signal applied to the + or − input connector passes through the input-coupling selector switch to the input-attenuator circuit. The signals can be ac coupled, dc coupled or disconnected internally. The + and − inputs are identical except for circuit numbers. Except where needed for clarification, only the amplifier for the + input will be described in detail.

When the input-coupling switch is in the DC position, the input signal is coupled directly to the attenuator. In the AC position, the signal is coupled through capacitor C10. The capacitor prevents the dc component of the signal from passing to the attenuator. The GND position disconnects the input signal from the attenuators and connects it to ground through C10 and R10. This represents the same load to the signal source as was presented when the input switch was set in the AC mode. Thus, a ground reference to the input of the amplifier is provided without the need to remove the applied signal source. The PRECHG position limits the instantaneous current, caused by connecting a large signal to the input connector, by inserting R10 in series with C10.

## Input Attenuators ◇1

The input attenuators for the + and − inputs are identical and are conventional RC type attenuators. The attenuators are frequency-compensated voltage dividers that provide a straight-through or NORM position, or a ÷100 position. Resistor R30 provides the 1 megohm input resistance, while C28, C30, and stray capacitance make up the 47 picofarad input capacitance in the NORM position. In the ÷100 position, R35 in series with R38 comprise the 1 megohm input resistance, and also form the 100X divider for the dc component of the signal. The parallel combination of C32 and C34 in series with C38, comprise the ac 100X circuit. Each attenuator contains an adjustable capacitor to provide correct attenuation at high frequencies, and adjustable shunt capacitance to provide correct input capacitance.

## Input Overdrive Protection ◇1

Fuses F100 and F200, combined with diode clamps CR108, CR109, CR208, and CR209 provide overdrive protection for Q121A and B at the ±16.2 volt level. The ±16.2 volt level is set by zeners VR438 and VR448, through isolation diodes CR438 and CR448, and the clamp diodes. If the signal amplitude exceeds approximately 16.2 volts, depending on the duration of the excess voltage, the fuses will open.

## Gate Current Compensation ◇1

The leakage associated with the gates of the input Field-Effect Transistors (FET) may be as high as 100 picoamperes. This amount of leakage current (through 1 megohm, R30 or R50, to ground) will produce an offset of 100 microvolts, which at high gain settings, drives the output into overrange. To compensate for this effect, the gates of the input FET may be adjusted to zero volts by returning R107 and R106 through variable controls R105 and R205 to a slightly negative supply voltage.

Leakage current associated with the gates of the input FET and the overdrive protection diodes, increases rapidly with temperature, approximately doubling for every 10 degree Celsius. To compensate for this increase, a temperature sensitive input-current balancing network is included, using thermistors RT104 and RT203 as sensing elements.

As the gate current increases due to a temperature increase, the resistance of the thermistors decreases, thus maintaining a constant voltage difference as a function of temperature.

## Preamp ◇1

From the input attenuators, the signal is coupled to the preamp. The preamp consists of two identical feedback amplifiers connected in a differential configuration. Except where needed for clarification, only the amplifier for the + input will be described in detail.



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The supply voltages for the two amplifiers are obtained from a common power supply that is bootstrapped to the input to improve the common-mode rejection ratio of the preamp.

The feedback circuit for the + input consists of comparator Q121A, error amplifier Q131A and Q136, feedback modifier R125 and R126, and output load resistor R136. R126 is the gain-setting resistor for the amplifier. Diode CR131 connected between the base-emitter of Q131A protects the transistor against reverse-bias breakdown, and also provides negative feedback to stabilize the circuit at higher frequencies.

The last stage of the preamp consists of Q152A and Q152B. Zener diode VR252 provides the collector supply voltage for this stage. The gain of this stage is approximately 5.

STEP GAIN DC BAL control, R158, balances the dc level at the output and is adjusted for minimum dc level shift when the GAIN switch is rotated throughout its range.

## Floating Power Supply ◇1

Refer to Fig. 5-1. The supply voltages for the preamp and the dc offset circuit are derived from a series-connected resistor chain consisting of R431, R433, R435, two current sources, plus a current-setting transistor, Q443. The positive current source consists of Q410A and B, and Q416. The negative current source consists of Q422A and B, and Q426.

Any common-mode changes that occur in the input amplifier, except at the output, are coupled to the power supply through Q451, which is connected as an emitter follower. It acts as a X1 bootstrap amplifier whose gain is maintained very close to unity by the minimum loading presented to its output by the high collector impedance of Q121A and B, thus achieving good bootstrap efficiency.

Quiescently, approximately 13 milliamperes of current flows through Q422A and B. R421 shunts about 4 milliamperes of this current from Q422A, leaving a balance of 9 milliamperes flowing through the positive current source, Q410A, Q410B, and Q416. Approximately 12 milliamperes of current from the negative current source also flows from Q422B and Q426, and to the dc offset circuit, Q141A and B, and Q145A and B. In any mode except the dc offset, the 12 milliamperes of current splits equally and becomes the negative current source for Q121A and B. About 4 milliamperes is shunted through Q136 and Q236. This leaves the balance of 9 milliamperes of current to flow through Q121A and B, and to the summing point at the collector of Q416.

Resistors R440, R441, R442, and R443 set the base voltage of Q443, with CR441 providing the temperature compensation. Current through R445 divides between Q443 and Q445. The current through Q445 is the negative current source for Q131A and B. After flowing through Q131A and B, it returns and passes through emitter-follower Q431, then to the summing point at the collector of Q416.

The 1.9 milliamperes of current flowing from Q443 and through resistor chain R435, R433, and R431, continues to the summing point at the collector of Q416. The voltage drop across each resistor, in reference to the emitter of Q451, sets the "floating" power supplies. The difference in the 9 milliamperes of current needed to satisfy the current demand of the positive current source, and what flows into the summing point from Q433, Q431, and Q121A and B, will come from Q451.

## Common Mode Rejection ◇1

One of the primary functions of the preamp is to reject any common-mode component in the input signals, and amplify only the difference. In the extreme case of the inputs tied together and a common voltage applied, the output of the amplifier is ideally zero, and would actually be zero provided that the characteristics of all corresponding elements on the two sides of the amplifier (see Figs. 1-5 and 1-6) were exactly matched. In practice, any mismatch will cause a differential output. Even with perfect matching, there is still a common-mode output current resulting in an undesirable common-mode signal applied to the subsequent stages of the amplifier (common mode gain).

The floating power supply eliminates these difficulties and improves the common mode rejection. It can be seen that the entire power supply and amplifier moves an amount equal to the common-mode voltage, and that no change in voltage or current levels occur anywhere within the amplifier as a result of this common-mode voltage, except for Q136 and Q236 drain to gate voltage. Thus the only mismatch of importance is that of Q136, Q236 amplification factors. Being in the third stage of the amplifier at a point of relatively large differential signal level, this causes only a small degradation in common mode rejection.

At higher frequencies the stray capacitances from various points in the preamp to ground begin to inject significant current into the amplifier as a result of common mode signals. Differential capacitor C150, connected from a point in the floating power supply to the two output lines, is used to inject adjustable currents into the output to compensate for the change.



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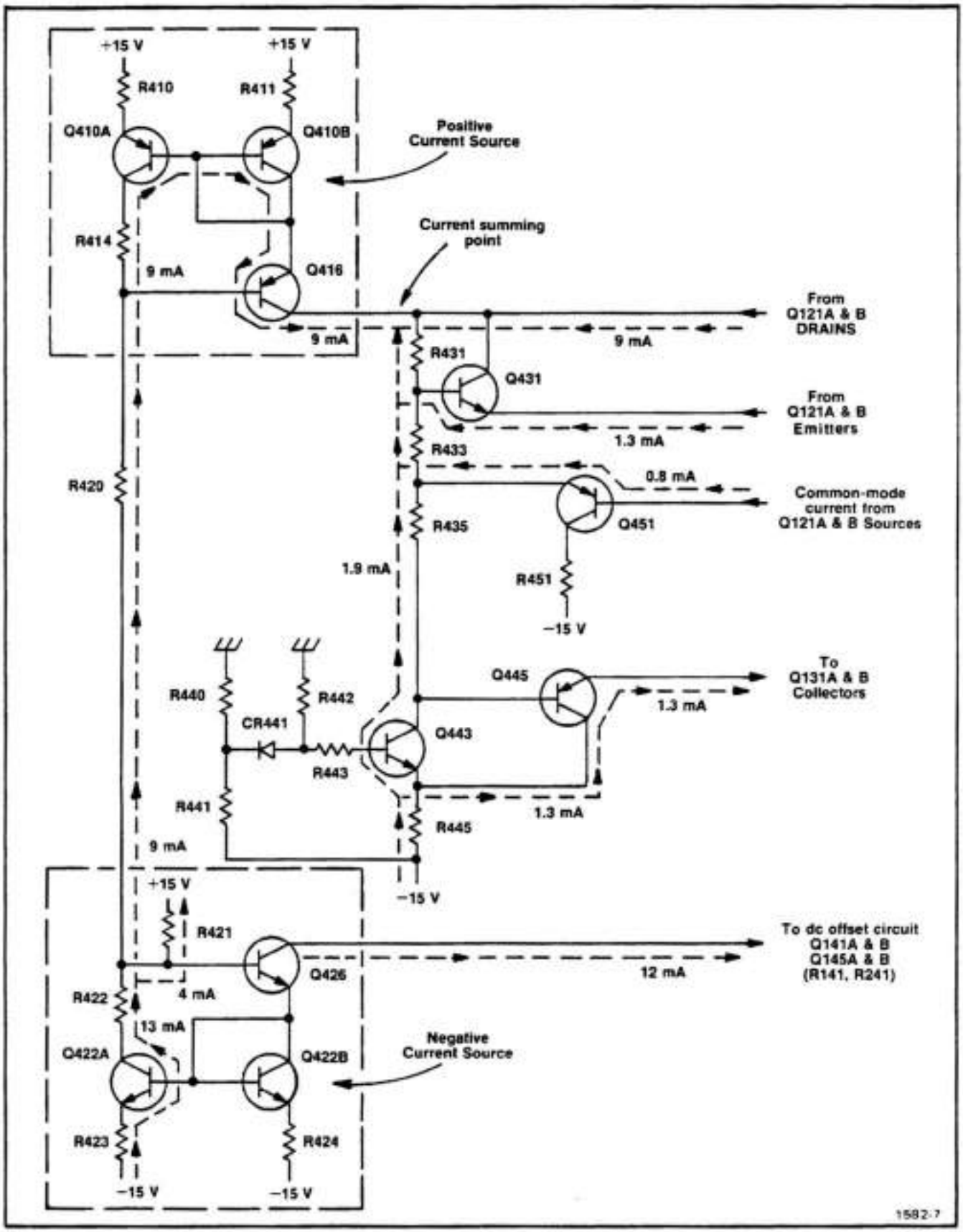



Fig. 5-1. Preamp floating power supply showing positive and negative current source.



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## Cross Neutralization ◇1

Refer to Fig. 5-2. The use of a common bootstrap power supply results in an undesirable capacitive coupling between the two inputs. Consider the effect of applying +1 volt to the + input of Q121A while keeping the − input of Q121B at zero volts.

The results are: an output current of $i_s$ of 4 milliamperes, and a shift of all supply voltages and several other voltage levels by +0.5 volt due to the divider action of R126 and R226, operating into the bootstrapped power supply system. Specifically, the drain of Q121B also rises +0.5 volt and injects current $i_s$ through the drain to gate capacitance, $C_{dg}$ of Q121B, and into the − input. If there is any impedance between the − input and ground, $i_s$ will develop a voltage across the impedance, and since it's applied to the − input, subtracts from the original + input, thereby causing an erroneous output (see Fig. 5-3).

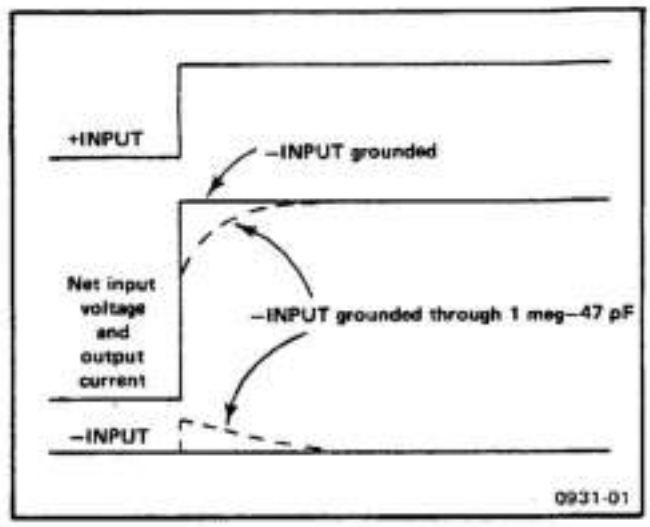



**Fig. 5-3. Effects of high impedance to ground in the − input.**

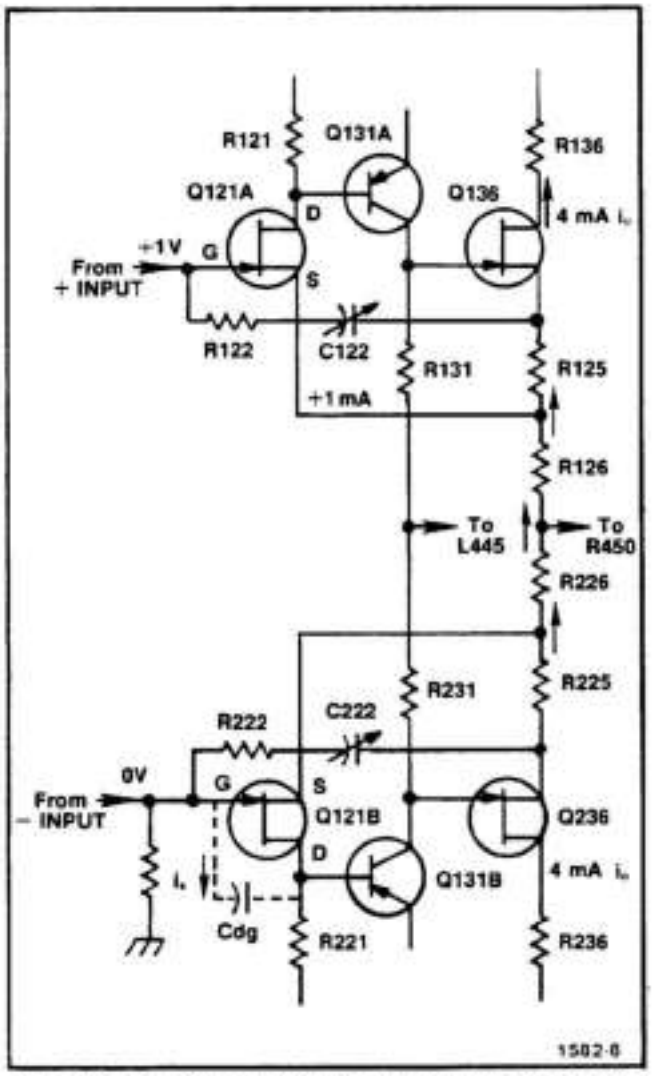



**Fig. 5-2. Simplified preamp circuit showing cross neutralization circuit.**

Capacitor C122, connected in the + input circuit, is adjusted to divert the undesirable capacitive current away from the input point, minimizing the unbalance. Capacitor C222 performs the same function for signals applied to the − input circuit.

## DC Offset ◇1

The purpose of the dc offset system is to allow a differential slide-back measurement; that is, to buck out small dc components of input signals and allow the amplifier to amplify only the varying components, while keeping the differential capability. This means that when a dc voltage is applied across the inputs, some means must be found to balance out the resultant output current.

The dc offset system, with zero input signal conditions and resultant currents is illustrated in Fig. 5-4. Source and output currents remain at 2 milliamperes and 5 milliamperes respectively, thereby producing a balanced output. The amplifier and dc offset system illustrated in Fig. 5-5 shows the current conditions when a 0.25 volt dc signal voltage is applied to the + input. This voltage causes an additional 1 milliampere of current to flow through R126 and R226. However, if a 1 milliampere offset current is supplied by the offset generator, the net output current will remain at its zero signal value.

When the dc offset is not used, the dc offset controls are switched by the LF −3 dB switch, to a fixed reference voltage divider R460, R461, and R462.



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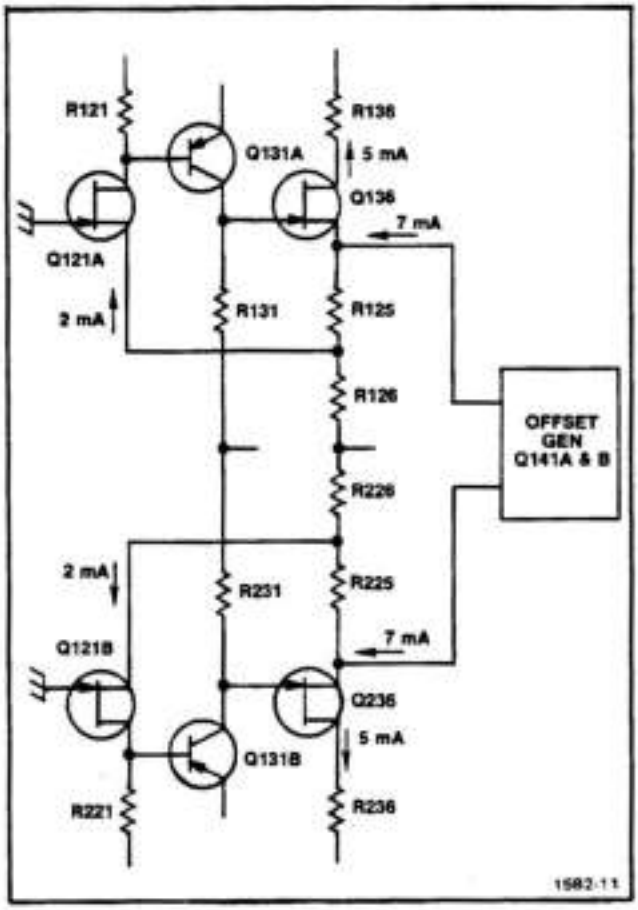



Fig. 5-4. Amplifier and dc offset system, showing balanced output conditions.

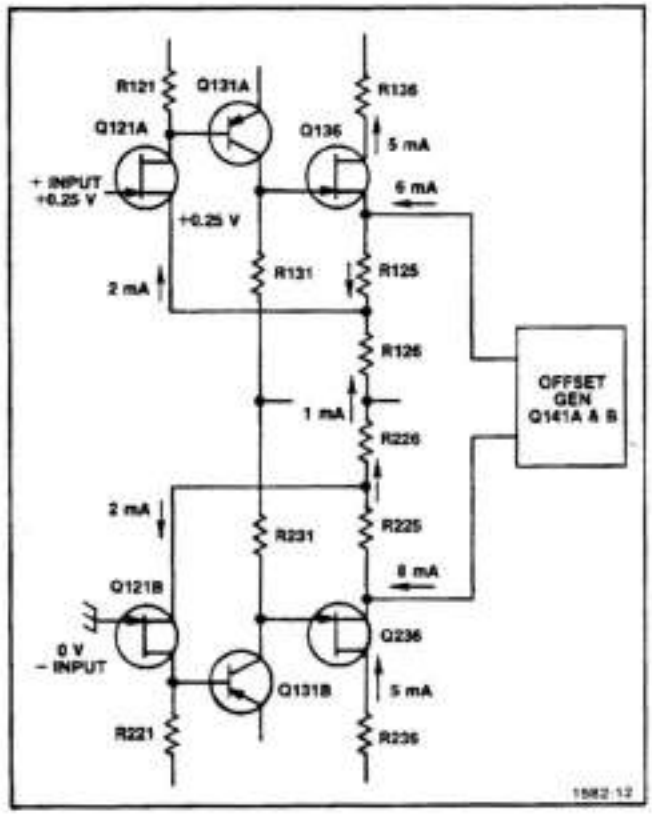



Fig. 5-5. Amplifier and dc offset system, showing a 0.25 volt dc offset and resultant current conditions.

## LF −3 dB Frequency Selector ③

This switch selects the low frequency −3 dB point of the amplifier and has a range of 0.1 Hz to 10 kHz in six decade steps. Selection is done by switching the resistor and capacitor of a pair of capacitor couplings in each side of the amplifier, between the pre-amp and the gain-switching amplifier. For 100 Hz to 10 kHz, C470 is used, and resistors R474, R478, and R470 are switched to the output in the following combinations:

| −3 dB frequency | 100 Hz | 1 kHz | 10 kHz |
|---|---|---|---|
| output resistors | R470 | R470 & R474 | R470 & R478 |

Whenever R474 or R478 is not used on the output side of C258, the resistance (R474 or R478) is placed across the input to keep the high frequency load resistance, as seen by the pre-amp, constant.

Capacitor C472 is switched across C470 for the lower three ranges (0.1 Hz, 1 Hz, and 10 Hz) and C258 is shorted out for dc coupling. Resistors R474, R478, and R470 are switched in the same combination for the lower three positions as they are for the three higher positions.

## Gain Switching Amplifier ②

The gain switching amplifier is a balanced differential configuration very similar to the preamp but with a fixed power supply. A gain of 0.48 to 480 is changed by switching different values of resistance with switch S480. Q162A, Q164A, and Q168 comprise the switching amplifier. Q167 and Q267 serve two functions; the base-emitter junctions serve as reverse bias protection for Q168 and Q268 and they drive the over range indicator circuitry to indicate a differential over range condition.

Step Gain AC Balance control, R161, is used to remove any initial unbalance in the gate-to-source voltages of Q162A and B, and sets the voltage across the gain-setting resistors when the differential input (gate-to-gate) voltage is zero.

Capacitors C164 and C264 are in the circuit for peaking at frequencies near 2 MHz. Inductors L164 and L264 reduce the gain at high frequencies, thus preventing oscillations.



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### HF −3 dB Frequency Selector ◇3

This switch selects the high frequency −3 dB point of the amplifier and has a range of 100 Hz through 1 MHz in nine steps of a 1-3 sequence. This is accomplished by simply switching different values of capacitance across the output of the gain-switched stage.

### Variable Gain Stage ◇2

The variable gain stage (Q171A, Q171B and Q181, Q281) is a feedback amplifier having a gain range of approximately 2.5:1, determined by CAL control R178. Feedback resistors R173 and R273, plus gain setting resistors R177, R277, and R178 set the overall gain of the stage at 10.

The common mode signal at the output of the feedback amplifier is compared to ground by comparator Q195 and Q196. A dc feedback loop is provided to feed back the output of the comparator to Q171A and B via emitter follower Q269 to maintain the junction of R175 and R275 at a zero volt level.

Variable Gain DC Balance R269 adjusts the input levels of Q171A and B so their source voltages will be equal. With the source levels equal, rotating the front panel VAR control causes no shift of the dc output level.

Output DC Level control R191 adjusts for a zero-volt dc level at the output of the amplifier. R191 and R193 act as a current source or sink to set the voltage difference across R175 and R275. Their common junction is at zero volts due to feedback action described earlier. Q185 and Q285 act as the negative current source for the variable gain stage.

Diodes CR181 and CR182 act as peak detectors, providing a signal to the over-range detector circuit (Q501 emitter). A voltage swing greater than +6 volts on the collector of Q181 or Q281 will produce an over range indication, lighting indicator lamp DS50.

### Output Amplifier ◇2

The output amplifier stage consists primarily of transistors Q561A and B and Q571A and B and provides a ±5 volt differential voltage swing with a zero-volt dc level. The output $R_o$ is 5 ohms or less. Transistors Q555 and Q558 comprise the positive and negative current sources respectively.

The output stage is short-circuit protected to ground. If the current in R571 causes the voltage at Q571B collector to fall below the level of Q555 emitter, CR555 conducts, taking current from Q555, thereby reducing the drive to Q571B, limiting the output current.

### Over Range Indicator ◇3

When the LF −3 dB switch is in a position other than DC, there is no on-screen indication of the dc conditions in the preamp or output amplifier, and it may be driven into non-linearity or overload by a dc component, leading to erroneous displays. The over range indicator circuit detects this condition and so indicates by means of indicator lamp DS50.

The over range circuit consists of three input transistors Q501, Q511, and Q521, monostable multivibrator Q532 and Q541, indicator lamp driver Q540. When any of the three input transistors become turned on by an over-range signal from the respective amplifiers, a turn-on current is supplied to the base of Q532. This starts the multivibrator action which has a minimum on time of approximately 200 milliseconds; thus the indicator lamp is held on for a minimum of 200 milliseconds regardless of the duration of the over-range signal. The timing components are C536, R536, and R531.

### Power Supplies ◇4

Regulation of the +15 volt and −15 volt supply is accomplished through the respective operational amplifier, U910 and U990. Zener diode VR910 sets the reference voltage for U910; the +15 volt supply sets the reference for U990. The operational amplifiers control the current to the AM 502 through series-pass transistors located in the power module. The inputs of both integrated circuits seek common levels by varying the current supplied to the unit. Should the power supply load increase, pin 2 of U990 goes more positive, causing pin 6 to go more negative. This action increases current flow in the series-pass transistor and restores the voltage to the initial level. The +15 volt supply operates in the same manner except the polarities are different.

Transistors Q910 and Q990 act as current sensing regulators. Should the current increase to a level that the voltage drop across R970 (R920) is great enough to cause Q990 (Q910) to conduct, current is taken from the series-pass transistor until it is turned off. This action limits the current available to the amplifier, should an overload or short circuit occur.

The +5 volt supply is comprised of Q940 and Q942. The base voltage level of Q942 is set by divider R945 and R946. The base-emitter drop of the transistors produce the −5 volt supply.



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# OPTIONS

No options are available at this time.



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# REPLACEABLE ELECTRICAL PARTS

## PARTS ORDERING INFORMATION

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

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

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

## SPECIAL NOTES AND SYMBOLS

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

### ITEM NAME

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

## ABBREVIATIONS

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



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## CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip Code |
|---|---|---|---|
| 00853 | SANGAMO WESTON INC<br>SANGAMO CAPACITOR DIV | SANGAMO RD<br>P O BOX 128 | PICKENS SC 29671 |
| 01121 | ALLEN-BRADLEY CO | 1201 SOUTH 2ND ST | MILWAUKEE WI 53204 |
| 02114 | AMPEREX ELECTRONIC CORP<br>FERROXCUBE DIV | 5083 KINGS HWY | SAUGERTIES NY 12477 |
| 03508 | GENERAL ELECTRIC CO<br>SEMI-CONDUCTOR PRODUCTS DEPT | M GENESEE ST | AUBURN NY 13021 |
| 04222 | AVX CERAMICS DIV OF AVX CORP | 19TH AVE SOUTH<br>P O BOX 867 | MYRTLE BEACH SC 29577 |
| 04713 | MOTOROLA INC<br>SEMICONDUCTOR GROUP | 5005 E MCDOWELL RD | PHOENIX AZ 85008 |
| 05397 | UNION CARBIDE CORP MATERIALS SYSTEMS DIV | 11901 MADISON AVE | CLEVELAND OH 44101 |
| 07716 | TRW INC<br>TRW ELECTRONICS COMPONENTS<br>TRW IRC FIXED RESISTORS/BURLINGTON | 2850 MT PLEASANT AVE | BURLINGTON IA 52601 |
| 13511 | AMPHENOL CADRE DIV BUNKER RAMO CORP | | LOS GATOS CA |
| 14193 | CAL-R INC | 1601 OLYMPIC BLVD | SANTA MONICA CA 90404 |
| 14433 | ITT SEMICONDUCTORS DIV | | WEST PALM BEACH FL |
| 14552 | MICRO/SEMICONDUCTOR CORP | 2830 S FAIRVIEW ST | SANTA ANA CA 92704 |
| 19396 | ILLINOIS TOOL WORKS INC<br>PAKTRON DIVISION | 900 FOLLIN LANE S E | VIENNA VA 22180 |
| 19701 | MEPCO/ELECTRA INC<br>A NORTH AMERICAN PHILIPS CO | P O BOX 760 | MINERAL WELLS TX 76067 |
| 24546 | CORNING GLASS WORKS | 550 HIGH ST | BRADFORD PA 16701 |
| 31918 | ITT SCHADOW INC | 8081 WALLACE RD | EDEN PRAIRIE MN 55343 |
| 32293 | INTERSIL INC | 10900 N TANTAU AVE | CUPERTINO CA 95014 |
| 32997 | BOURNS INC<br>TRIMPOT DIV | 1200 COLUMBIA AVE | RIVERSIDE CA 92507 |
| 33095 | SPECTRUM CONTROL INC | 8061 AVONIA RD | FAIRVIEW PA 16415 |
| 52763 | STETTNER ELECTRONICS INC | 6135 AIRWAYS BLVD<br>PO BOX 21947 | CHATTANOOGA TN 37421 |
| 54473 | MATSUSHITA ELECTRIC CORP OF AMERICA | ONE PANASONIC WAY | SECAUCUS NJ 07094 |
| 56289 | SPRAGUE ELECTRIC CO | 87 MARSHALL ST | NORTH ADAMS MA 01247 |
| 57668 | ROHN CORP | 16931 MILLIKEN AVE | IRVINE CA 92713 |
| 58854 | GTE PRODUCTS CORP<br>LIGHTING PRODUCTS GROUP | 60 BOSTON ST | SALEM MA 01970 |
| 59660 | TUSONIX INC | 2155 N FORBES BLVD | TUCSON, ARIZONA 85705 |
| 59821 | CENTRALAB INC<br>SUB NORTH AMERICAN PHILIPS CORP | 7158 MERCHANT AVE | EL PASO TX 79915 |
| 71400 | BUSSMANN MFG CO<br>MCGRAW EDISON CO | 114 OLD STATE RD<br>PO BOX 14460 | ST LOUIS MO 63178 |
| 71590 | GLOBE-UNION INC<br>CENTRALAB ELECTRONICS DIV | HWY 20 W<br>P O BOX 858 | FORT DODGE IA 50501 |
| 71744 | GENERAL INSTRUMENT CORP LAMP DIV | 4433 N RAVENSWOOD AVE | CHICAGO IL 60640 |
| 73138 | BECKMAN INSTRUMENTS INC HELIPOT DIV | 2500 HARBOR BLVD | FULLERTON CA 92634 |
| 74970 | JOHNSON E F CO | 299 10TH AVE S W | WASECA MN 56093 |
| 80009 | TEKTRONIX INC | 4900 S W GRIFFITH DR<br>P O BOX 500 | BEAVERTON OR 97077 |
| 84411 | TRW INC<br>TRW ELECTRONICS COMPONENTS DIV<br>TRW CAPACITORS | 301 WEST O ST | OGALLALA NE 69153 |
| 87034 | ILLUMINATED PRODUCTS INC | S MAIN ST | CRYSTAL LAKE IL 60014 |
| 91637 | DALE ELECTRONICS INC | P O BOX 609 | COLUMBUS NE 68601 |
| 91836 | KINGS ELECTRONICS CO INC | 40 MARBLEDALE ROAD | TUCKAHOE NY 10707 |
| TK1036 | E F JOHNSON CO | 299 10TH AVE SW | WASECA MN 56093 |
| TK1345 | ZWAN AND ASSOCIATES | 7833 S 180TH | KENT WA 98032 |



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| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|
| A1 | 670-2733-00 | B010100 | B051720 | CIRCUIT BD ASSY:MAIN | 80009 | 670-2733-00 |
| A1 | 670-2733-01 | B051721 | B052349 | CIRCUIT BD ASSY:MAIN | 80009 | 670-2733-01 |
| A1 | 670-2733-02 | B052350 | B057429 | CIRCUIT BD ASSY:MAIN | 80009 | 670-2733-02 |
| A1 | 670-2733-03 | B057430 | B059999 | CIRCUIT BD ASSY:MAIN | 80009 | 670-2733-03 |
| A1 | 670-2733-04 | B060000 | B070609 | CIRCUIT BD ASSY:MAIN | 80009 | 670-2733-04 |
| A1 | 670-2733-05 | B070610 | B071449 | CIRCUIT BD ASSY:MAIN | 80009 | 670-2733-05 |
| A1 | 670-2733-06 | B071450 | B071936 | CIRCUIT BD ASSY:MAIN | 80009 | 670-2733-06 |
| A1 | 670-2733-07 | B071937 | | : | 80009 | 670-2733-07 |
| C10 | 295-0155-00 | | | CAP SET,MATCHED:(2) 0.1UF,MATCHED 1% | 80009 | 295-0155-00 |
| C20 | ----- ----- | | | (PART OF C10) | | |
| C28 | 281-0663-00 | | | CAP,FXD,CER DI:10.4PF,1%,500V | 52763 | 2R0PLZ007 10P4LC |
| C30 | 281-0081-00 | | | CAP,VAR,AIR DI:1.8-13PF,375VDC | 74970 | 189-0506-075 |
| C32 | 281-0081-00 | | | CAP,VAR,AIR DI:1.8-13PF,375VDC | 74970 | 189-0506-075 |
| C34 | 281-0645-00 | | | CAP,FXD,CER DI:8.2PF,+/-0.25PF,500V | 52763 | 2R0PLZ007 8P20CC |
| C35 | 281-0081-00 | | | CAP,VAR,AIR DI:1.8-13PF,375VDC | 74970 | 189-0506-075 |
| C38 | 283-0626-00 | | | CAP,FXD,MICA DI:1800PF,5%,500V | 00853 | D195F182J0 |
| C48 | 281-0663-00 | | | CAP,FXD,CER DI:10.4PF,1%,500V | 52763 | 2R0PLZ007 10P4LC |
| C50 | 281-0081-00 | | | CAP,VAR,AIR DI:1.8-13PF,375VDC | 74970 | 189-0506-075 |
| C52 | 281-0081-00 | | | CAP,VAR,AIR DI:1.8-13PF,375VDC | 74970 | 189-0506-075 |
| C54 | 281-0645-00 | | | CAP,FXD,CER DI:8.2PF,+/-0.25PF,500V | 52763 | 2R0PLZ007 8P20CC |
| C55 | 281-0081-00 | | | CAP,VAR,AIR DI:1.8-13PF,375VDC | 74970 | 189-0506-075 |
| C58 | 283-0626-00 | | | CAP,FXD,MICA DI:1800PF,5%,500V | 00853 | D195F182J0 |
| C107 | 283-0005-00 | | | CAP,FXD,CER DI:0.01UF,+100-0%,250V | 04222 | SR303E103ZAA |
| C122 | 281-0093-00 | B010100 | B039999 | CAP,VAR,CER DI:5.5-18PF,350V | 52763 | 302322237 |
| C122 | 281-0092-00 | B040000 | | CAP,VAR,CER DI:9-35PF,200V | 33095 | 53-717-001 09-35 |
| C131 | 281-0612-00 | | | CAP,FXD,CER DI:5.6PF,+/-0.5PF,500V | 52763 | 2R0PLZ007 5P600C |
| C146 | 283-0177-00 | | | CAP,FXD,CER DI:1UF,+80-20%,25V | 04222 | SR302E105ZAATR |
| C150 | 281-0114-00 | | | CAP,VAR,AIR DI:1.3-5.4PF,425V | TK1036 | 189-0752-075 |
| C164 | 281-0523-00 | | | CAP,FXD,CER DI:100PF,20%,350V | 52763 | 2R0PLZ007 100PMU |
| C176 | 281-0618-00 | | | CAP,FXD,CER DI:4.7PF,+/-0.5PF,500V | 52763 | 2R0PLZ007 4P700C |
| C195 | 281-0518-00 | | | CAP,FXD,CER DI:47PF,+/-9.4PF,500V | 52763 | 2R0PLZ007 47P0MU |
| C207 | 283-0005-00 | | | CAP,FXD,CER DI:0.01UF,+100-0%,250V | 04222 | SR303E103ZAA |
| C222 | 281-0093-00 | B010100 | B039999 | CAP,VAR,CER DI:5.5-18PF,350V | 52763 | 302322237 |
| C222 | 281-0092-00 | B040000 | | CAP,VAR,CER DI:9-35PF,200V | 33095 | 53-717-001 09-35 |
| C231 | 281-0612-00 | | | CAP,FXD,CER DI:5.6PF,+/-0.5PF,500V | 52763 | 2R0PLZ007 5P600C |
| C252 | 290-0512-00 | B052350 | B059999 | CAP,FXD,ELCTLT:22UF,20%,15V | 05397 | T368B226M015AS |
| C252 | 290-0745-00 | B060000 | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| C264 | 281-0523-00 | | | CAP,FXD,CER DI:100PF,20%,350V | 52763 | 2R0PLZ007 100PMU |
| C276 | 281-0618-00 | | | CAP,FXD,CER DI:4.7PF,+/-0.5PF,500V | 52763 | 2R0PLZ007 4P700C |
| C431 | 290-0527-00 | B010100 | B059999 | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| C431 | 290-0745-00 | B060000 | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| C433 | 290-0527-00 | B010100 | B059999 | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| C433 | 290-0745-00 | B060000 | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| C435 | 290-0527-00 | B010100 | B059999 | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| C435 | 290-0745-00 | B060000 | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| C438 | 283-0177-00 | | | CAP,FXD,CER DI:1UF,+80-20%,25V | 04222 | SR302E105ZAATR |
| C443 | 290-0527-00 | B010100 | B059999 | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| C443 | 290-0745-00 | B060000 | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| C448 | 283-0177-00 | | | CAP,FXD,CER DI:1UF,+80-20%,25V | 04222 | SR302E105ZAATR |
| C450 | 281-0613-00 | B010100 | B051720 | CAP,FXD,CER DI:10PF,1%,500V | 59660 | 374-018C0G0100F |
| C450 | 281-0629-00 | B051721 | | CAP,FXD,CER DI:33PF,5%,600V | 52763 | 2R0PLZ007 33P0JC |
| C470 | 283-0594-00 | | | CAP,FXD,MICA DI:0.001UF,1%,100V | 00853 | D151F102F0 |
| C471 | 283-0594-00 | | | CAP,FXD,MICA DI:0.001UF,1%,100V | 00853 | D151F102F0 |
| C472 | 285-0809-00 | | | CAP,FXD,PLASTIC:1UF,10%,50V | 56289 | LP66A10105K |
| C473 | 285-0809-00 | | | CAP,FXD,PLASTIC:1UF,10%,50V | 56289 | LP66A10105K |
| C490 | 281-0511-00 | | | CAP,FXD,CER DI:22PF,+/-2.2PF,500V | 52763 | 2R0PLZ007 22P0KC |
| C491 | 281-0721-00 | | | CAP,FXD,CER DI:72PF,5%,500V | 52763 | 2R0PLZ007 72P0JU |
| C493 | 283-0604-00 | | | CAP,FXD,MICA DI:304PF,2%,500V | 00853 | D155F304GG0 |



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| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|
| C494 | 283-0594-00 | | | CAP,FXD,MICA DI:0.001UF,1%,100V | 00853 | 0151F102F0 |
| C495 | 285-0627-00 | | | CAP,FXD,PLASTIC:0.0033UF,5%,100V | 07716 | TEK44-33251 |
| C496 | 285-0598-00 | | | CAP,FXD,PLASTIC:0.01UF,5%,100V | 19396 | 0U490B103J |
| C497 | 285-0702-00 | | | CAP,FXD,PLASTIC:0.033UF,5%,100V | 19396 | 0U591/74-16903 |
| C498 | 285-0703-00 | | | CAP,FXD,PLASTIC:0.1UF,5%,100V | 19396 | 104J01PT605 |
| C499 | 285-0633-00 | | | CAP,FXD,PLASTIC:0.22UF,10%,100V | 84411 | 663UM-22491 |
| C530 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C536 | 290-0534-00 | | | CAP,FXD,ELCTLT:1UF,20%,35V | 05397 | T368B105M035AZ |
| C552 | 281-0511-00 | | | CAP,FXD,CER DI:22PF,+/-2.2PF,500V | 52763 | 2RDPLZ007 22P0KC |
| C560 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C570 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C910 | 290-0512-00 | B010100 | B059999 | CAP,FXD,ELCTLT:22UF,20%,15V | 05397 | T368B226M015AS |
| C910 | 290-0745-00 | B060000 | | CAP,FXD,ELCTLT:22UF,+50-10%,25V | 54473 | ECE-A25V22L |
| C922 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C924 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C926 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C930 | 290-0527-00 | | | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| C942 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C960 | 290-0527-00 | | | CAP,FXD,ELCTLT:15UF,20%,20V | 05397 | T368B156M020AS |
| C964 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C966 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| C968 | 283-0111-00 | | | CAP,FXD,CER DI:0.1UF,20%,50V | 05397 | C330C104M5U1CA |
| CR108 | 152-0323-00 | | | SEMICOND DVC,DI:SM,SI,35V,0.1A,DO-7 | 14433 | MG1518 |
| CR109 | 152-0323-00 | | | SEMICOND DVC,DI:SM,SI,35V,0.1A,DO-7 | 14433 | MG1518 |
| CR131 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR150 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR181 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR208 | 152-0323-00 | | | SEMICOND DVC,DI:SM,SI,35V,0.1A,DO-7 | 14433 | MG1518 |
| CR209 | 152-0323-00 | | | SEMICOND DVC,DI:SM,SI,35V,0.1A,DO-7 | 14433 | MG1518 |
| CR231 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR250 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR281 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR438 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR441 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR448 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR531 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR555 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR558 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR560 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR561 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR570 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| CR571 | 152-0141-02 | | | SEMICOND DVC,DI:SM,SI,30V,150MA,30V | 03508 | DA2527 (1N4152) |
| DS50 | 150-0107-00 | B010100 | B052349 | LAMP,INCAND:12V,0.04A,#2278S25,WIRE LD | 87034 | 2278S25 |
| DS50 | 150-0048-01 | B052350 | | LAMP,INCAND:5V,0.06A,#683,AGED & SEL | 58854 | 6838S15 |
| DS900 | 150-0107-00 | B010100 | B052349 | LAMP,INCAND:12V,0.04A,#2278S25,WIRE LD | 87034 | 2278S25 |
| DS900 | 150-0109-00 | B052350 | | LAMP,INCAND:18V,0.026A,#CM7220,WIRE LD | 71744 | CM7220 |
| F100 | 159-0024-00 | | | FUSE,CARTRIDGE:3AG,0.062A,250V,0.35EC | 71400 | MGB 1/16 |
| F200 | 159-0024-00 | | | FUSE,CARTRIDGE:3AG,0.062A,250V,0.35EC | 71400 | MGB 1/16 |
| J10 | 131-0955-00 | | | CONN,RCPT,ELEC:BNC,FEMALE | 13511 | 31-279 |
| J15 | 129-0103-00 | | | POST,BDG,ELEC:ASSEMBLY | 80009 | 129-0103-00 |
| J20 | 131-0955-00 | | | CONN,RCPT,ELEC:BNC,FEMALE | 13511 | 31-279 |
| J550 | 131-0818-00 | | | CONN,RCPT,ELEC:BNC,FEMALE | 91836 | KC-19-153 |
| L164 | 108-0409-00 | | | COIL,RF:FIXED,17.5UH | TK1345 | 108-0409-00 |
| L264 | 108-0409-00 | | | COIL,RF:FIXED,17.5UH | TK1345 | 108-0409-00 |
| L416 | 276-0507-00 | | | SHLD BEAD,ELEK:FERRITE | 02114 | 56-590-658/38 |
| L426 | 276-0507-00 | | | SHLD BEAD,ELEK:FERRITE | 02114 | 56-590-658/38 |
| L445 | 276-0507-00 | | | SHLD BEAD,ELEK:FERRITE | 02114 | 56-590-658/38 |
| Q121 | 151-1027-00 | | | TRANSISTOR:FET,N-CHAN,SI,TO-71 | 80009 | 151-1027-00 |
| Q131 | 151-0261-00 | | | TRANSISTOR:PNP,SI,TO-77 | 04713 | SD441 |



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| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|
| Q136 | 151-1025-00 | B010100 | B059999 | TRANSISTOR:FET,N-CHAN,SI,TO-92 | 04713 | SPF3036 |
| Q136 | 151-1042-00 | B060000 | | SEMICOND DVC SE:FET,SI,TO-92 | 04713 | SPF627N2 |
| Q141 | 151-0176-00 | | | TRANSISTOR:NPN,SI,TO-78 | 04713 | SD555 |
| Q145 | 151-0261-00 | | | TRANSISTOR:PNP,SI,TO-77 | 04713 | SD441 |
| Q152 | 153-0586-00 | B010100 | B057429 | SEMICOND DVC SE:MATCHED PAIR | 80009 | 153-0586-00 |
| Q152 | 151-0354-00 | B057430 | | TRANSISTOR:PNP,SI,TO-78 | 32293 | ITS-1200-A |
| Q162 | 151-1036-00 | | | TRANSISTOR:FET,N-CHAN,SI,TO-71 | 80009 | 151-1036-00 |
| Q164 | 153-0586-00 | B010100 | B057429 | SEMICOND DVC SE:MATCHED PAIR | 80009 | 153-0586-00 |
| Q164 | 151-0354-00 | B057430 | | TRANSISTOR:PNP,SI,TO-78 | 32293 | ITS-1200-A |
| Q167 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q168 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q171 | 151-1029-00 | | | TRANSISTOR:FET,N-CHAN,SI,TO-71 | 80009 | 151-1029-00 |
| Q181 | 151-0188-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0188-00 |
| Q185 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q195 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q196 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q236 | 151-1025-00 | B010100 | B059999 | TRANSISTOR:FET,N-CHAN,SI,TO-92 (PART OF Q136) | 04713 | SPF3036 |
| Q267 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q268 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q269 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q281 | 151-0188-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0188-00 |
| Q285 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q410 | 153-0586-00 | B010100 | B071449 | SEMICOND DVC SE:MATCHED PAIR | 80009 | 153-0586-00 |
| Q410 | 151-0354-00 | B071450 | | TRANSISTOR:PNP,SI,TO-78 | 32293 | ITS-1200-A |
| Q416 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q422 | 153-0587-00 | B010100 | B071449 | SEMICOND DVC SE:MATCHED PAIR | 80009 | 153-0587-00 |
| Q422 | 151-0236-00 | B071450 | | TRANSISTOR:NPN,SI,DUAL,TO-77 | 32293 | ITS1074 |
| Q426 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q431 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q443 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q445 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q451 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q501 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q511 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q521 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q532 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q540 | 151-0260-00 | | | TRANSISTOR:NPN,SI,TO-39 | 04713 | ST1083 |
| Q541 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q555 | 151-0220-00 | | | TRANSISTOR:PNP,SI,TO-92 | 80009 | 151-0220-00 |
| Q558 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q561 | 151-0307-00 | | | TRANSISTOR:PNP,SI,TO-78 | 04713 | ZN3726 |
| Q571 | 151-0309-00 | | | TRANSISTOR:NPN,SI,TO79 | 04713 | SD3167 |
| Q810 | 151-0301-00 | B010100 | B040389 | TRANSISTOR:PNP,SI,TO-18 | 04713 | ST898 |
| Q810 | 151-0302-00 | B040390 | | TRANSISTOR:NPN,SI,TO-18 | 04713 | ST899 |
| Q940 | 151-0334-00 | | | TRANSISTOR:NPN,SI,TO-126,SEL | 04713 | SJE914 |
| Q942 | 151-0190-00 | | | TRANSISTOR:NPN,SI,TO-92 | 80009 | 151-0190-00 |
| Q990 | 151-0302-00 | B010100 | B040389 | TRANSISTOR:NPN,SI,TO-18 | 04713 | ST899 |
| Q990 | 151-0301-00 | B040390 | | TRANSISTOR:PNP,SI,TO-18 | 04713 | ST898 |
| R10 | 315-0105-00 | | | RES,FXD,FILM:1M OHM,5%,0.25M | 19701 | 5043CX1M000J |
| R20 | 315-0105-00 | | | RES,FXD,FILM:1M OHM,5%,0.25M | 19701 | 5043CX1M000J |
| R30 | 322-0687-07 | | | RES,FXD,FILM:1.005MEG OHM,0.1%,0.25M,TC=T9 | 19701 | 5043RE1M005B |
| R35 | 322-0624-07 | | | RES,FXD,FILM:990K OHM,0.1%,0.25M,TC=T9 | 19701 | 5043RE990K00B |
| R38 | 321-0289-03 | | | RES,FXD,FILM:10.0K OHM,0.25%,0.125M,TC=T2 | 07716 | CEAC10001C |
| R40 | 311-1586-00 | B010100 | B052349 | RES,VAR,NONWM:TRMR,200 OHM,0.5M | 32997 | 3352T-1-201 |
| R40 | 311-1588-00 | B052350 | | RES,VAR,NONWM:TRMR,50 OHM,0.5M | 32997 | 3352T-1-500 |
| R50 | 322-0687-07 | | | RES,FXD,FILM:1.005MEG OHM,0.1%,0.25M,TC=T9 | 19701 | 5043RE1M005B |
| R55 | 322-0624-07 | | | RES,FXD,FILM:990K OHM,0.1%,0.25M,TC=T9 | 19701 | 5043RE990K00B |



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| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|
| R58 | 321-0289-03 | | | RES,FXD,FILM:10.0K OHM,0.25%,0.125W,TC=T2 | 07716 | CEAC10001C |
| R103 | 321-0281-00 | B010100 | B059999 | RES,FXD,FILM:8.25K OHM,1%,0.125W,TC=T0 | 19701 | 5043ED8K250F |
| R103 | 321-0239-00 | B060000 | | RES,FXD,FILM:3.01K OHM,1%,0.125W,TC=T0 | 19701 | 5043ED3K010F |
| R105 | 311-1559-00 | | | RES,VAR,NONWW:TRMR,10K OHM,0.5W | 32997 | 3352T-1-103 |
| R106 | 315-0107-00 | | | RES,FXD,FILM:100W OHM,5%,0.25W | 01121 | CB1075 |
| R107 | 315-0107-00 | | | RES,FXD,FILM:100W OHM,5%,0.25W | 01121 | CB1075 |
| R120 | 315-0101-00 | | | RES,FXD,FILM:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| R121 | 321-0222-00 | | | RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0 | 19701 | 5033ED2K00F |
| R122 | 315-0512-00 | | | RES,FXD,FILM:5.1K OHM,5%,0.25W | 57668 | NTR25J-E05K1 |
| R125 | 321-0114-00 | | | RES,FXD,FILM:150 OHM,1%,0.125 W,TC=T0 | 19701 | 5033ED150R0F |
| R126 | 321-0927-07 | | | RES,FXD,FILM:125 OHM,0.1%,0.125W,TC=T9 | 19701 | 5033RE125R0B |
| R131 | 321-0251-00 | | | RES,FXD,FILM:4.02K OHM,1%,0.125W,TC=T0 | 19701 | 5033ED4K020F |
| R136 | 321-0199-06 | | | RES,FXD,FILM:1.15K OHM,0.25%,0.125W,TC=T9 | 07716 | CEAE11500C |
| R137 | 315-0101-00 | | | RES,FXD,FILM:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| R141 | 321-0813-07 | | | RES,FXD,FILM:495 OHM,0.1%,0.125W,TC=T9 | 19701 | 5033RE495OB |
| R145 | 321-0353-00 | | | RES,FXD,FILM:46.4K OHM,1%,0.125W,TC=T0 | 07716 | CEA046401F |
| R146 | 321-0272-00 | | | RES,FXD,FILM:6.65K OHM,1%,0.125W,TC=T0 | 19701 | 5043ED6K650F |
| R152 | 321-0222-00 | | | RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0 | 19701 | 5033ED2K00F |
| R154 | 321-0225-06 | | | RES,FXD,FILM:2.15K OHM,0.25%,0.125W,T=T9WI | 07716 | CEAE21500C |
| R155 | 321-0154-00 | B010100 | B039999 | RES,FXD,FILM:392 OHM,1%,0.125W,TC=T0 | 07716 | CEA039200F |
| R155 | 321-0150-00 | B040000 | | RES,FXD,FILM:357 OHM,1%,0.125W,TC=T0 | 07716 | CEA0357R0F |
| R157 | 315-0564-00 | B010100 | B059999 | RES,FXD,FILM:560K OHM,5%,0.25W | 19701 | 5043CX560K0J |
| R157 | 321-0457-00 | B060000 | | RES,FXD,FILM:562K 1%,0.125 W,TC=T0 | 19701 | 5043ED562K0F |
| R158 | 311-0467-00 | | | RES,VAR,NONWW:PNL,100K OHM,0.5W | 01121 | M7705B |
| R159 | 311-1567-00 | B010100 | B039999 | RES,VAR,NONWW:TRMR,100 OHM,0.5W | 32997 | 3352T-1-101 |
| R159 | 311-1566-00 | B040000 | | RES,VAR,NONWW:TRMR,200 OHM,0.5W | 32997 | 3352T-1-201 |
| R160 | 315-0102-00 | | | RES,FXD,FILM:1K OHM,5%,0.25W | 57668 | NTR25JE01K0 |
| R161 | 311-1564-00 | B010100 | B059999 | RES,VAR,NONWW:TRMR,500 OHM,0.5W | 32997 | 3352T-CX5501 |
| R161 | 311-1307-00 | B060000 | | RES,VAR,NONWW:TRMR,500 OHM,0.5W | 32997 | 3299W-RZ7-501 |
| R162 | 321-0240-00 | | | RES,FXD,FILM:3.09K OHM,1%,0.125W,TC=T0 | 07716 | CEA030900F |
| R164 | 321-0309-00 | | | RES,FXD,FILM:16.2K OHM,1%,0.125W,TC=T0 | 19701 | 5033ED16K20F |
| R166 | 321-0143-00 | | | RES,FXD,FILM:301 OHM,1%,0.125W,TC=T0 | 07716 | CEA0301R0F |
| R168 | 321-0224-00 | | | RES,FXD,FILM:2.10K OHM,1%,0.125W,TC=T0 | 07716 | CEA021000F |
| R170 | 315-0102-00 | | | RES,FXD,FILM:1K OHM,5%,0.25W | 57668 | NTR25JE01K0 |
| R171 | 321-0277-00 | | | RES,FXD,FILM:7.50K OHM,1%,0.125W,TC=T0 | 24546 | NA55D7501F |
| R173 | 321-0239-07 | | | RES,FXD,FILM:3.01K OHM,0.1%,0.125W,TC=T9WI | 07716 | CEAE301000 |
| R175 | 321-0289-07 | | | RES,FXD,FILM:10.0K OHM,0.1%,0.125W,TC=T9 | 19701 | 5033RE10K00B |
| R176 | 321-1267-03 | | | RES,FXD,FILM:5.97K OHM,0.25%,0.125W,TC=T2 | 19701 | 5033RC5K971C |
| R177 | 321-0147-00 | | | RES,FXD,FILM:332 OHM,1%,0.125W,TC=T0 | 07716 | CEA033200F |
| R178 | 311-1494-00 | | | RES,VAR,NONWW:PNL,2K OHM,1M,M/SM (PART OF S170) | 01121 | 11M187 |
| R181 | 321-0187-00 | | | RES,FXD,FILM:866 OHM,1%,0.125W,TC=T0 | 07716 | CEA0866R0F |
| R184 | 321-0297-00 | | | RES,FXD,FILM:12.1K OHM,1%,0.125W,TC=T0 | 07716 | CEA012101F |
| R185 | 321-0236-00 | | | RES,FXD,FILM:2.80K OHM,1%,0.125W,TC=T0 | 07716 | CEA028000F |
| R191 | 311-1555-00 | | | RES,VAR,NONWW:TRMR,100K OHM,0.5W | 32997 | 3352T-1-104 |
| R193 | 315-0474-00 | | | RES,FXD,FILM:470K OHM,5%,0.25W | 19701 | 5043CX470K0J92U |
| R195 | 315-0512-00 | | | RES,FXD,FILM:5.1K OHM,5%,0.25W | 57668 | NTR25J-E05K1 |
| R196 | 315-0682-00 | | | RES,FXD,FILM:6.8K OHM,5%,0.25W | 57668 | NTR25J-E06K8 |
| R198 | 315-0472-00 | | | RES,FXD,FILM:4.7K OHM,5%,0.25W | 57668 | NTR25J-E04K7 |
| R205 | 311-1559-00 | | | RES,VAR,NONWW:TRMR,10K OHM,0.5W | 32997 | 3352T-1-103 |
| R206 | 315-0107-00 | | | RES,FXD,FILM:100W OHM,5%,0.25W | 01121 | CB1075 |
| R207 | 315-0107-00 | | | RES,FXD,FILM:100W OHM,5%,0.25W | 01121 | CB1075 |
| R220 | 315-0101-00 | | | RES,FXD,FILM:100 OHM,5%,0.25W | 57668 | NTR25J-E 100E |
| R221 | 321-0222-00 | | | RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0 | 19701 | 5033ED2K00F |
| R222 | 315-0512-00 | | | RES,FXD,FILM:5.1K OHM,5%,0.25W | 57668 | NTR25J-E05K1 |
| R225 | 321-0114-00 | | | RES,FXD,FILM:150 OHM,1%,0.125 W,TC=T0 | 19701 | 5033ED150R0F |
| R226 | 321-0927-07 | | | RES,FXD,FILM:125 OHM,0.1%,0.125W,TC=T9 | 19701 | 5033RE125R0B |
| R231 | 321-0251-00 | | | RES,FXD,FILM:4.02K OHM,1%,0.125W,TC=T0 | 19701 | 5033ED4K020F |



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| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|
| R236 | 321-0199-06 | | | RES,FXD,FILM:1.15K OHM,0.25%,0.125M,TC=T9 | 07716 | CEAE11500C |
| R237 | 315-0101-00 | | | RES,FXD,FILM:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| R241 | 321-0813-07 | | | RES,FXD,FILM:495 OHM,0.1%,0.125M,TC=T9 | 19701 | 5033RE49508 |
| R245 | 321-0353-00 | | | RES,FXD,FILM:46.4K OHM,1%,0.125M,TC=T0 | 07716 | CEA046401F |
| R246 | 321-0272-00 | | | RES,FXD,FILM:6.65K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED6K650F |
| R252 | 321-0222-00 | | | RES,FXD,FILM:2.00K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED2K00F |
| R254 | 321-0225-06 | | | RES,FXD,FILM:2.15K OHM,0.25%,0.125M,T=T9MI | 07716 | CEAE21500C |
| R255 | 321-0154-00 | B010100 | B039999 | RES,FXD,FILM:392 OHM,1%,0.125M,TC=T0 | 07716 | CEA039200F |
| R255 | 321-0150-00 | B040000 | | RES,FXD,FILM:357 OHM,1%,0.125M,TC=T0 | 07716 | CEA035700F |
| R260 | 315-0102-00 | | | RES,FXD,FILM:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| R261 | 321-0239-00 | | | RES,FXD,FILM:3.01K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED3K010F |
| R262 | 321-0240-00 | | | RES,FXD,FILM:3.09K OHM,1%,0.125M,TC=T0 | 07716 | CEA030900F |
| R264 | 321-0309-00 | | | RES,FXD,FILM:16.2K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED16K20F |
| R266 | 321-0143-00 | | | RES,FXD,FILM:301 OHM,1%,0.125M,TC=T0 | 07716 | CEA0301R0F |
| R268 | 321-0224-00 | | | RES,FXD,FILM:2.10K OHM,1%,0.125M,TC=T0 | 07716 | CEA021000F |
| R269 | 311-1564-00 | B010100 | B059999 | RES,VAR,NONWM:TRMR,500 OHM,0.5M | 32997 | 3352T-0K5501 |
| R269 | 311-1307-00 | B060000 | | RES,VAR,NONWM:TRMR,500 OHM,0.5M | 32997 | 3299W-R27-501 |
| R270 | 315-0102-00 | | | RES,FXD,FILM:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| R271 | 321-0277-00 | | | RES,FXD,FILM:7.50K OHM,1%,0.125M,TC=T0 | 24546 | NA55D7501F |
| R273 | 321-0239-07 | | | RES,FXD,FILM:3.01K OHM,0.1%,0.125M,TC=T9MI | 07716 | CEAE301008 |
| R275 | 321-0289-07 | | | RES,FXD,FILM:10.0K OHM,0.1%,0.125M,TC=T9 | 19701 | 5033RE10K008 |
| R276 | 321-1267-03 | | | RES,FXD,FILM:5.97K OHM,0.25%,0.125M,TC=T2 | 19701 | 5033RC5K971C |
| R277 | 321-0147-00 | | | RES,FXD,FILM:332 OHM,1%,0.125M,TC=T0 | 07716 | CEA0332R0F |
| R284 | 321-0314-00 | | | RES,FXD,FILM:18.2K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED18K20F |
| R285 | 321-0236-00 | | | RES,FXD,FILM:2.80K OHM,1%,0.125M,TC=T0 | 07716 | CEA028000F |
| R410 | 321-0068-00 | | | RES,FXD,FILM:49.9 OHM,0.5%,0.125M,TC=T0 | 91637 | CMF55116G49R9OF |
| R411 | 321-0068-00 | | | RES,FXD,FILM:49.9 OHM,0.5%,0.125M,TC=T0 | 91637 | CMF55116G49R9OF |
| R414 | 315-0680-00 | B010100 | B071936 | RES,FXD,FILM:68 OHM,5%,0.25M | 57668 | NTR25J-E68ED |
| R414 | 315-0470-00 | B071937 | | RES,FXD,FILM:47 OHM,5%,0.25M | 57668 | NTR25J-E47ED |
| R420 | 322-0238-00 | | | RES,FXD,FILM:2.94K OHM,1%,0.25M,TC=T0 | 19701 | 5043R02K940F |
| R421 | 321-0274-00 | | | RES,FXD,FILM:6.98K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED6K980F |
| R422 | 315-0470-00 | | | RES,FXD,FILM:47 OHM,5%,0.25M | 57668 | NTR25J-E47ED |
| R423 | 321-0068-00 | | | RES,FXD,FILM:49.9 OHM,0.5%,0.125M,TC=T0 | 91637 | CMF55116G49R9OF |
| R424 | 321-0068-00 | | | RES,FXD,FILM:49.9 OHM,0.5%,0.125M,TC=T0 | 91637 | CMF55116G49R9OF |
| R431 | 321-0182-00 | | | RES,FXD,FILM:768 OHM,1%,0.125M,TC=T0 | 07716 | CEA0768R0F |
| R433 | 321-0179-00 | | | RES,FXD,FILM:715 OHM,1%,0.125M,TC=T0 | 07716 | CEA0715R0F |
| R435 | 321-0233-00 | | | RES,FXD,FILM:2.61K OHM,1%,0.125M,TC=T0 | 07716 | CEA026100F |
| R436 | 315-0472-00 | | | RES,FXD,FILM:4.7K OHM,5%,0.25M | 57668 | NTR25J-E04K7 |
| R438 | 315-0222-00 | | | RES,FXD,FILM:2.2K OHM,5%,0.25M | 57668 | NTR25J-E02K2 |
| R440 | 321-0268-00 | | | RES,FXD,FILM:6.04K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED6K040F |
| R441 | 321-0247-00 | | | RES,FXD,FILM:3.65K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED3K650F |
| R442 | 321-0400-00 | | | RES,FXD,FILM:143K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED143K0F |
| R443 | 315-0471-00 | | | RES,FXD,FILM:470 OHM,5%,0.25M | 57668 | NTR25J-E470E |
| R445 | 321-0218-00 | | | RES,FXD,FILM:1.82K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED1K82F |
| R446 | 315-0472-00 | | | RES,FXD,FILM:4.7K OHM,5%,0.25M | 57668 | NTR25J-E04K7 |
| R448 | 315-0222-00 | | | RES,FXD,FILM:2.2K OHM,5%,0.25M | 57668 | NTR25J-E02K2 |
| R450 | 315-0222-00 | | | RES,FXD,FILM:2.2K OHM,5%,0.25M | 57668 | NTR25J-E02K2 |
| R451 | 315-0101-00 | | | RES,FXD,FILM:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| R460 | 321-0229-00 | | | RES,FXD,FILM:2.37K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED2K37F |
| R461 | 311-1566-00 | B010100 | B059999 | RES,VAR,NONWM:TRMR,200 OHM,0.5M | 32997 | 3352T-1-201 |
| R461 | 311-1036-00 | B060000 | | RES,VAR,NONWM:TRMR,200 OHM,0.5M | 32997 | 3299W-R27-201 |
| R462 | 321-0229-00 | | | RES,FXD,FILM:2.37K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED2K37F |
| R464 | 321-0204-00 | | | RES,FXD,FILM:1.30K OHM,1%,0.125M,TC=T0 | 19701 | 5033ED1K300F |
| R466 | 315-0105-00 | | | RES,FXD,FILM:1M OHM,5%,0.25M | 19701 | 5043CX1M000J |
| R467 | 311-1057-00 | | | RES,VAR,MM:PNL,5K OHM,2M | 73138 | 7266-371-1 |
| R468 | 311-0887-00 | | | RES,VAR,NONWM:PNL,50K OHM,10%,0.5M | 71590 | 8902520017 |
| R470 | 316-0155-00 | | | RES,FXD,CMPSN:1.5M OHM,10%,0.25M | 01121 | CB1551 |
| R471 | 316-0155-00 | | | RES,FXD,CMPSN:1.5M OHM,10%,0.25M | 01121 | CB1551 |
| R474 | 321-0408-00 | | | RES,FXD,FILM:174K OHM,1%,0.125M,TC=T0 | 07716 | CEA0174G2F |



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| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|
| R475 | 321-0408-00 | | | RES,FXD,FILM:174K OHM,1%,0.125M,TC=T0 | 07716 | CEA017402F |
| R478 | 321-0303-00 | | | RES,FXD,FILM:14.0K OHM,1%,0.125M,TC=T0 | 07716 | CEA0 14001F |
| R479 | 321-0303-00 | | | RES,FXD,FILM:14.0K OHM,1%,0.125M,TC=T0 | 07716 | CEA0 14001F |
| R480 | 321-0289-03 | | | RES,FXD,FILM:10.0K OHM,0.25%,0.125M,TC=T2 | 07716 | CEAC10001C |
| R481 | 321-0816-07 | | | RES,FXD,FILM:5K OHM,0.1%,0.125M,TC=T9 | 19701 | 5033RE5K000B |
| R482 | 321-0222-03 | | | RES,FXD,FILM:2.0K OHM,0.25%,0.125M,TC=T2 | 19701 | 5033RC2K000C |
| R483 | 321-0193-03 | | | RES,FXD,FILM:1K OHM,0.25%,0.125M,TC=T2 | 07716 | CEAC10000C |
| R484 | 321-0612-03 | | | RES,FXD,FILM:500 OHM,0.25%,0.125M,TC=T2 | 19701 | 5033RC500R0C |
| R485 | 321-0126-03 | | | RES,FXD,FILM:200 OHM,0.25%,0.125M | 19701 | 5033RC200R0C |
| R486 | 321-0097-03 | | | RES,FXD,FILM:100 OHM,0.25%,0.125M,TC=T0 | 91637 | CMF55116D100R0C |
| R487 | 321-0751-06 | | | RES,FXD,FILM:50 OHM,0.25%,0.125M,TC=T9 | 91637 | CMF55116C50R00C |
| R488 | 321-0030-02 | | | RES,FXD,FILM:20.0 OHM,0.5%,0.125M,TC=T2 | 91637 | CMF55116D20R00D |
| R489 | 321-0001-01 | | | RES,FXD,FILM:10.0 OHM,0.5%,0.125M,TC=T0 | 19701 | 5033RD10R00D |
| R501 | 316-0225-00 | | | RES,FXD,CMPSN:2.2M OHM,10%,0.25M | 01121 | CB2251 |
| R503 | 321-0452-00 | | | RES,FXD,FILM:499K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED499K0F |
| R504 | 321-0423-00 | | | RES,FXD,FILM:249K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED249K0F |
| R507 | 315-0473-00 | | | RES,FXD,FILM:47K OHM,5%,0.25M | 57668 | NTR25J-E47K0 |
| R510 | 315-0104-00 | | | RES,FXD,FILM:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| R511 | 315-0104-00 | | | RES,FXD,FILM:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| R513 | 315-0104-00 | | | RES,FXD,FILM:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| R521 | 316-0276-00 | | | RES,FXD,CMPSN:27M OHM,10%,0.25M | 01121 | CB2761 |
| R523 | 321-0423-00 | | | RES,FXD,FILM:249K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED249K0F |
| R524 | 321-0452-00 | | | RES,FXD,FILM:499K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED499K0F |
| R527 | 315-0104-00 | | | RES,FXD,FILM:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| R531 | 315-0224-00 | | | RES,FXD,FILM:220K OHM,5%,0.25M | 57668 | NTR25J-E220K |
| R532 | 315-0103-00 | | | RES,FXD,FILM:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| R533 | 315-0103-00 | | | RES,FXD,FILM:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| R536 | 315-0104-00 | | | RES,FXD,FILM:100K OHM,5%,0.25M | 57668 | NTR25J-E100K |
| R541 | 315-0681-00 | | | RES,FXD,FILM:680 OHM,5%,0.25M | 57668 | NTR25J-E680E |
| R542 | 315-0103-00 | | | RES,FXD,FILM:10K OHM,5%,0.25M | 19701 | 5043CX10K00J |
| R550 | 315-0682-00 | | | RES,FXD,FILM:6.8K OHM,5%,0.25M | 57668 | NTR25J-E06KB |
| R551 | 315-0153-00 | | | RES,FXD,FILM:15K OHM,5%,0.25M | 19701 | 5043CX15K00J |
| R552 | 315-0102-00 | | | RES,FXD,FILM:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| R553 | 315-0682-00 | | | RES,FXD,FILM:6.8K OHM,5%,0.25M | 57668 | NTR25J-E06KB |
| R555 | 315-0302-00 | | | RES,FXD,FILM:3K OHM,5%,0.25M | 57668 | NTR25J-E03K0 |
| R558 | 315-0302-00 | | | RES,FXD,FILM:3K OHM,5%,0.25M | 57668 | NTR25J-E03K0 |
| R559 | 315-0202-00 | | | RES,FXD,FILM:2K OHM,5%,0.25M | 57668 | NTR25J-E 2K |
| R560 | 315-0101-00 | | | RES,FXD,FILM:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| R561 | 315-0181-00 | | | RES,FXD,FILM:180 OHM,5%,0.25M | 57668 | NTR25J-E180E |
| R562 | 307-0104-00 | | | RES,FXD,CMPSN:3.3 OHM,5%,0.25M | 01121 | CB3305 |
| R570 | 315-0101-00 | | | RES,FXD,FILM:100 OHM,5%,0.25M | 57668 | NTR25J-E 100E |
| R571 | 315-0181-00 | | | RES,FXD,FILM:180 OHM,5%,0.25M | 57668 | NTR25J-E180E |
| R572 | 307-0104-00 | | | RES,FXD,CMPSN:3.3 OHM,5%,0.25M | 01121 | CB3305 |
| R900 | 304-0102-00 | B010100 | B029999 | RES,FXD,CMPSN:1K OHM,10%,1M | 01121 | GB1021 |
| R900 | 303-0511-00 | B030000 | B052349 | RES,FXD,CMPSN:510 OHM,5%,1M | 01121 | GB5115 |
| R900 | 303-0751-00 | B052350 | | RES,FXD,CMPSN:750 OHM,5%,1M | 01121 | GB7515 |
| R910 | 315-0821-00 | | | RES,FXD,FILM:820 OHM,5%,0.25M | 19701 | 5043CX820R0J |
| R915 | 321-0285-00 | | | RES,FXD,FILM:9.09K OHM,1%,0.125M,TC=T0 | 07716 | CEA090900F |
| R916 | 321-0268-00 | | | RES,FXD,FILM:6.04K OHM,1%,0.125M,TC=T0 | 19701 | 5043ED6K040F |
| R920 | 307-0105-00 | | | RES,FXD,CMPSN:3.9 OHM,5%,0.25M | 01121 | CB 3905 |
| R922 | 315-0100-00 | | | RES,FXD,FILM:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| R924 | 315-0100-00 | | | RES,FXD,FILM:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| R926 | 315-0100-00 | | | RES,FXD,FILM:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| R940 | 307-0106-00 | | | RES,FXD,CMPSN:4.7 OHM,5%,0.25M | 01121 | CB 4705 |
| R942 | 315-0102-00 | | | RES,FXD,FILM:1K OHM,5%,0.25M | 57668 | NTR25JE01K0 |
| R945 | 315-0912-00 | | | RES,FXD,FILM:9.1K OHM,5%,0.25M | 57668 | NTR25J-E09K1 |
| R946 | 315-0622-00 | | | RES,FXD,FILM:6.2K OHM,5%,0.25M | 19701 | 5043CX6K200J |
| R964 | 315-0100-00 | | | RES,FXD,FILM:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| R966 | 315-0100-00 | | | RES,FXD,FILM:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |



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| Component No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|
| R968 | 315-0100-00 | | | RES,FXD,FILM:10 OHM,5%,0.25M | 19701 | 5043CX10RR00J |
| R970 | 307-0105-00 | | | RES,FXD,CMPSN:3.9 OHM,5%,0.25M | 01121 | CB 3905 |
| R989 | 315-0561-00 | | | RES,FXD,FILM:560 OHM,5%,0.25M | 19701 | 5043CX560R0J |
| R990 | 315-0102-00 | | | RES,FXD,FILM:1K OHM,5%,0.25M | 57668 | NTR25JED1K00 |
| R994 | 321-0306-00 | | | RES,FXD,FILM:15.0K OHM,1%,0.125M,TC=TO | 19701 | 5033ED15J00F |
| R995 | 321-0306-00 | | | RES,FXD,FILM:15.0K OHM,1%,0.125M,TC=TO | 19701 | 5033ED15J00F |
| RT104 | 307-0181-00 | | | RES,THERMAL:100K OHM,10%,NTC | 14193 | K10-100002K |
| RT203 | 307-0181-00 | | | RES,THERMAL:100K OHM,10%,NTC | 14193 | K10-100002K |
| S10 | 260-1207-00 | | | SWITCH,PUSH:DPDT,28VDC,PUSH-PUSH | 59821 | ORDER BY DESCR |
| S20 | 260-1207-00 | | | SWITCH,PUSH:DPDT,28VDC,PUSH-PUSH | 59821 | ORDER BY DESCR |
| S30 | 260-1209-00 | | | SWITCH,PUSH:18UTTON,4 POLE,DISPLAY | 31918 | 601347 |
| S178 | ----- ----- | | | (PART OF R178) | | |
| S470 | 263-1004-00 | | | SW CAM ACTR AS:LF-3DB POINT | 80009 | 263-1004-00 |
| S480 | 263-1005-00 | | | SW CAM ACTR AS:GAIN | 80009 | 263-1005-00 |
| S490 | 263-1003-00 | | | SW CAM ACTR AS:HF-3DB POINT | 80009 | 263-1003-00 |
| U910 | 156-0057-00 | | | MICROCKT,LINEAR:OPNL AMPL,SEL | 04713 | MC1741CP1 |
| U990 | 156-0057-00 | | | MICROCKT,LINEAR:OPNL AMPL,SEL | 04713 | MC1741CP1 |
| VR252 | 152-0169-00 | | | SEMICOND DVC,DI:ZEN,SI,12V,5%,0.4M,DO-7638 | 14552 | TD331689 |
| VR438 | 152-0243-00 | | | SEMICOND DVC,DI:ZEN,SI,15V,5%,0.4M,DO-7 | 04713 | SZ13203 (1N965B) |
| VR448 | 152-0243-00 | | | SEMICOND DVC,DI:ZEN,SI,15V,5%,0.4M,DO-7 | 04713 | SZ13203 (1N965B) |
| VR910 | 152-0123-00 | | | SEMICOND DVC,DI:ZEN,SI,9V,5%,0.5M,DO-7 | 04713 | SZ11530RL |



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# 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 (μF).

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.

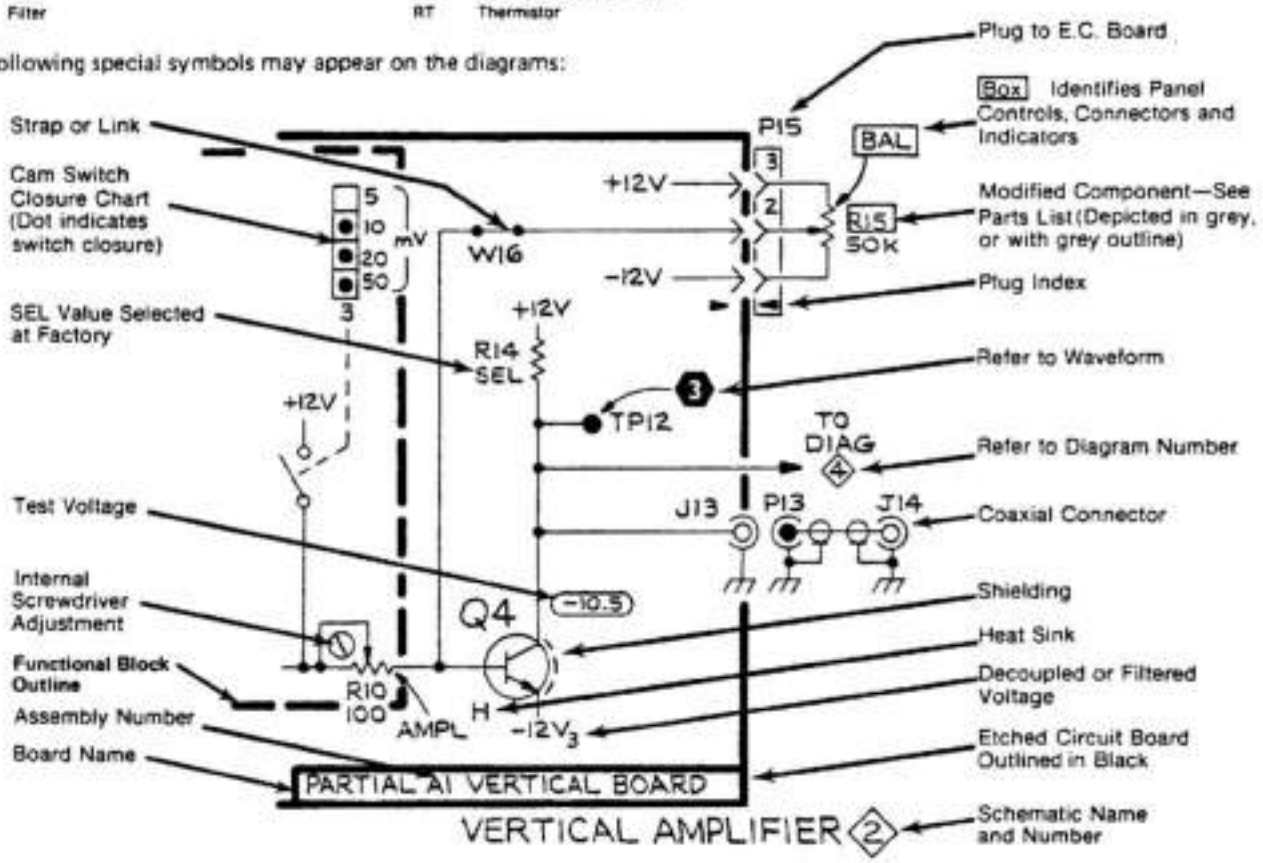
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

| | |
|---|---|
| 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. |

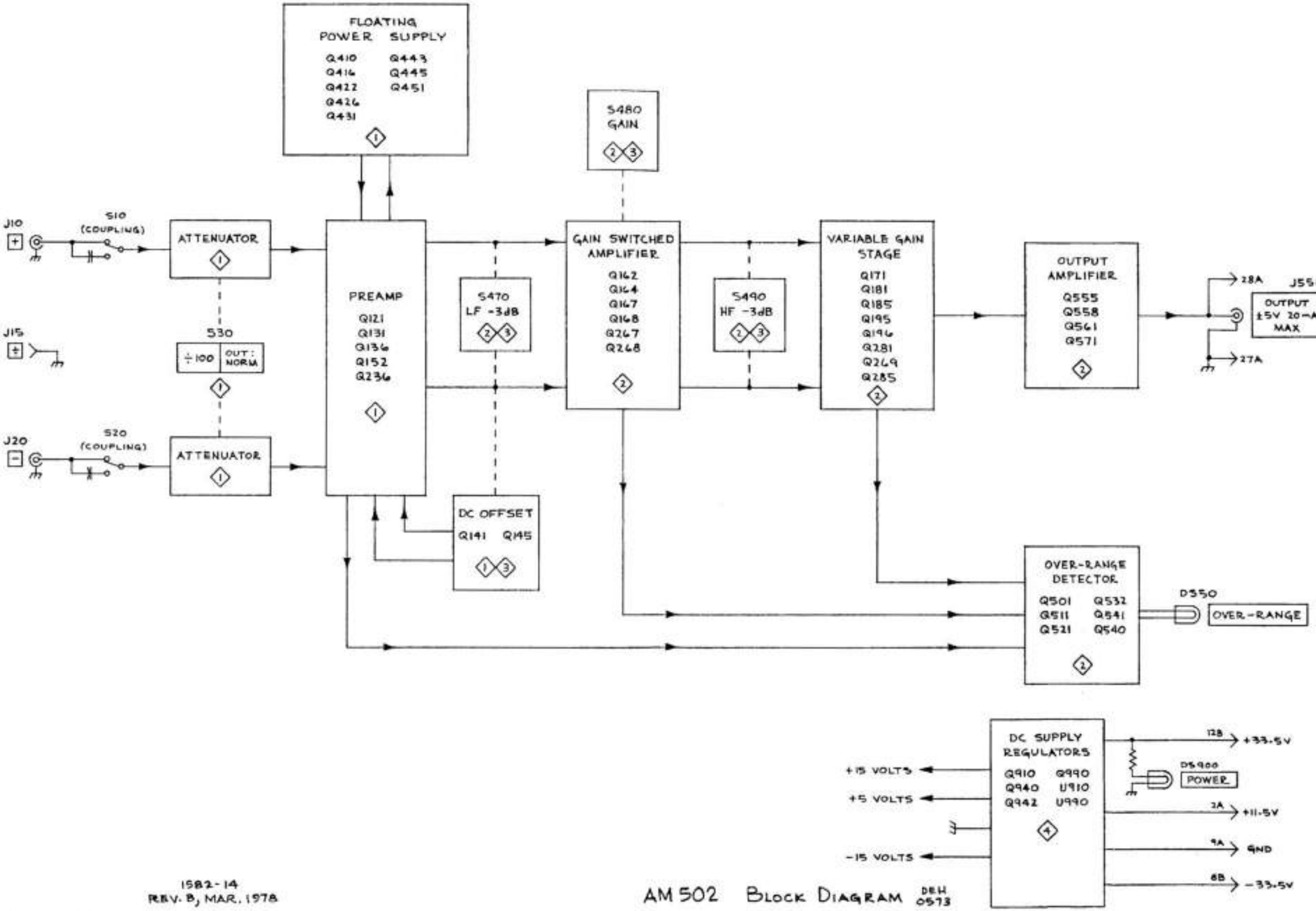
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

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

The following special symbols may appear on the diagrams:



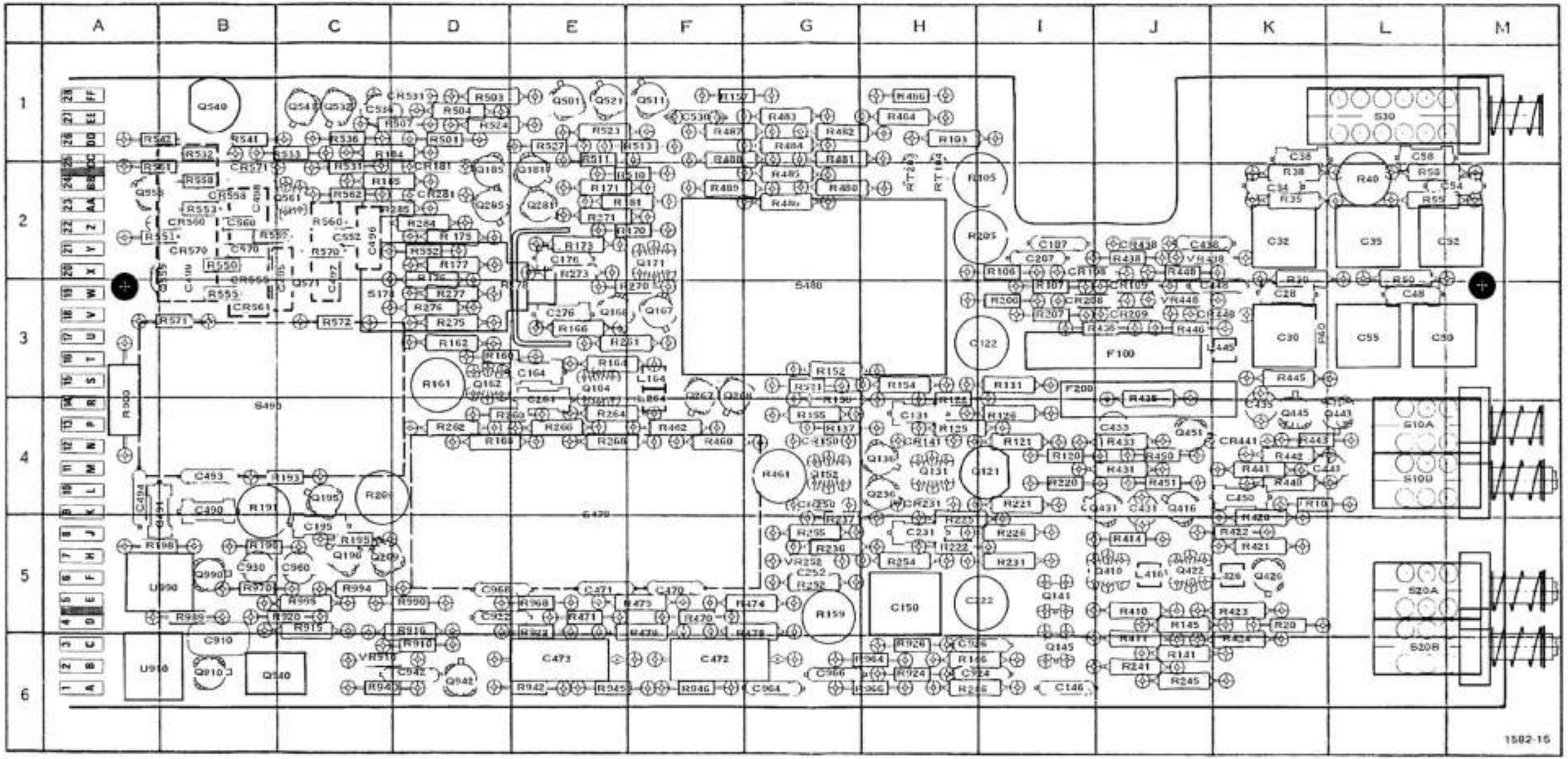

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1582-14
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AM 502 BLOCK DIAGRAM DEH 0573

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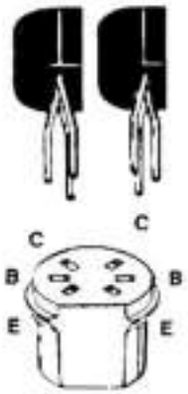



A1 Main Circuit Board 'A' side.

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† Back of board.

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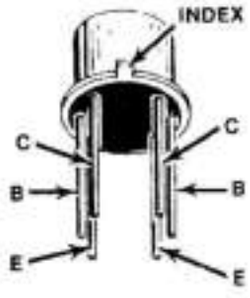



Q152 (SN B057429 & BELOW), Q410, Q422




Q416, Q426, Q431 Q443, Q445, Q451

DUAL




Q121, Q131, Q141, Q145, Q152, Q410, Q422




Q135, Q236

AM502

15B2-16

REV OCT 1986

PREAMP 1 CJH

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# Component Reference Chart

| CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C28 | K3 | CR108 | I2 | Q501 | E1 | R185 | C2 | R451 | J4 | R926 | H6 |
| C30 | K3 | CR109 | J3 | Q511 | F1 | R191 | B4 | R460 | F4 | R940 | C6 |
| C32 | K2 | CR141 | H4 | Q521 | E1 | R193 | C4 | R461 | G4 | R942 | E6 |
| C34 | K2 | CR150 | G4 | Q532 | C1 | R195 | C5 | R462 | F4 | R945 | E6 |
| C35 | L2 | CR181 | D2 | Q540 | B1 | R196 | B5 | R464 | H1 | R946 | F6 |
| C38 | K1 | CR208 | I3 | Q541 | C1 | R198 | A5 | R466 | H1 | R964 | H6 |
| C48 | L3 | CR209 | J3 | Q555 | B3 | R205 | I2 | R470 | F5 | R966 | H6 |
| C50 | L3 | CR231 | H4 | Q558 | A2 | R206 | I3 | R471 | E5 | R968 | E5 |
| C54 | M2 | CR250 | G4 | Q561 | C2 | R207 | I3 | R474 | G5 | R970 | B5 |
| C55 | L3 | CR281 | D2 | Q571 | C3 | R220 | I4 | R475 | F5 | R989 | B5 |
| C58 | L1 | CR438 | J2 | Q910 | B6 | R221 | I4 | R478 | G6 | R990 | D5 |
| C107 | I2 | CR441 | K4 | Q940 | B6 | R222 | H5 | R479 | F6 | R994 | C5 |
| C122 | I3 | CR448 | K3 | Q942 | D6 | R225 | H5 | R480 | G2 | R995 | C5 |
| C131 | H4 | CR531 | D1 | Q990 | B5 | R226 | I5 | R481 | G1 | RT104 | H2 |
| C146 | I6 | CR555 | B3 | | | R231 | I5 | R482 | G1 | RT203 | H2 |
| C150 | H5 | CR558 | B2 | R10 | K4 | R236 | G5 | R483 | G1 | | |
| C164 | E3 | CR560 | B2 | R20 | K5 | R237 | G5 | R484 | G1 | S10A | L4 |
| C176 | E2 | CR561 | B3 | R30 | K3 | R241 | J6 | R485 | G2 | S10B | L4 |
| C195 | C5 | CR570 | B2 | R35 | K2 | R245 | J6 | R486 | G2 | S20A | L5 |
| C207 | I2 | CR571 | B2 | R38 | K2 | R246 | H6 | R487 | F1 | S20B | L6 |
| C222 | I5 | | | R40 | L2 | R252 | G5 | R488 | F1 | S30 | L1 |
| C231 | H5 | F100 | J3 | R50 | L2 | R254 | H5 | R489 | F2 | S178 | C3 |
| C252 | G5 | F200 | I3 | R55 | L2 | R255 | G5 | | | S470 † | E5 |
| C264 | E4 | | | R58 | L2 | R260 | D4 | R501 | D1 | S480 | G3 |
| C276 | E3 | L164 | F3 | R103 | H1 | R261 | E3 | R503 | D1 | S490 † | B4 |
| C431 | J4 | L264 | F4 | R105 | I2 | R262 | D4 | R504 | D1 | | |
| C433 | J4 | L416 | J5 | R106 | I2 | R264 | E4 | R507 | D1 | U910 | A6 |
| C435 | K4 | L426 | K5 | R107 | I3 | R266 | E4 | R510 | F2 | U990 | A5 |
| C438 | J2 | L445 | K3 | R120 | I4 | R268 | E4 | R511 | E1 | | |
| C443 | L4 | P40 | K3 | R121 | I4 | R269 | C4 | R513 | F1 | VR252 | G5 |
| C448 | K3 | Q121 | I4 | R122 | H4 | R270 | F3 | R521 | G3 | VR438 | J2 |
| C450 | K4 | Q131 | H4 | R125 | H4 | R271 | E2 | R523 | E1 | VR448 | J3 |
| C470 | F5 | Q136 | H4 | R126 | I4 | R273 | E2 | R524 | D1 | VR910 | C6 |
| C471 | E5 | Q141 | I5 | R131 | I3 | R275 | D3 | R527 | E1 | | |
| C472 | F6 | Q145 | I6 | R136 | G4 | R276 | D3 | R532 | B1 | | |
| C473 | E6 | Q152 | G4 | R137 | G4 | R277 | D3 | R533 | C1 | | |
| C490 | B4 | Q162 | D3 | R141 | J6 | R284 | D2 | R536 | C1 | | |
| C491 | A4 | Q164 | E3 | R145 | J5 | R285 | C2 | R541 | B1 | | |
| C493 | B4 | Q167 | F3 | R146 | H6 | R410 | J5 | R542 | A1 | | |
| C494 | A4 | Q168 | E3 | R152 | G3 | R411 | J6 | R550 | B2 | | |
| C495 † | C2 | Q171 | F2 | R154 | H3 | R414* | J5 | R551 | A2 | | |
| C496 † | C2 | Q181 | E2 | R155 | G4 | R420 | K5 | R552 | D2 | | |
| C497 † | C2 | Q185 | D2 | R157 | F1 | R421 | K5 | R553 | B2 | | |
| C498 † | B2 | Q195 | C4 | R159 | G5 | R422 | K5 | R555 | B3 | | |
| C499 † | B2 | Q196 | C5 | R160 | D3 | R423 | K5 | R558 | B2 | | |
| C530 | F1 | Q236 | H4 | R161 | D3 | R424 | K6 | R559 | B2 | | |
| C536 | C1 | Q267 | F3 | R162 | D3 | R431 | J4 | R560 | C2 | | |
| C552 | C2 | Q268 | F3 | R164 | E3 | R433 | J4 | R561 | A2 | | |
| C560 | B2 | Q269 | C5 | R166 | E3 | R435 | J4 | R562 | C2 | | |
| C570 | B2 | Q281 | E2 | R168 | D4 | R436 | J3 | R570 | C2 | | |
| C910 | B6 | Q285 | D2 | R170 | F2 | R438 | J2 | R571 | B3 | | |
| C922 | D5 | Q410* | J5 | R171 | E2 | R440 | K4 | R572 | C3 | | |
| C924 | H6 | Q416 | J4 | R173 | E2 | R441 | K4 | R900 | A4 | | |
| C926 | H6 | Q422* | J5 | R175 | D2 | R442 | K4 | R910 | D6 | | |
| C930 | B5 | Q426 | K5 | R176 | D3 | R443 | K4 | R915 | C5 | | |
| C942 | D6 | Q431 | J4 | R177 | D2 | R445 | K3 | R916 | D6 | | |
| C960 | C5 | Q443 | L4 | R178 | E3 | R446 | J3 | R920 | C5 | | |
| C964 | G6 | Q445 | K4 | R181 | E2 | R448 | J2 | R922 | E5 | | |
| C966 | G6 | Q451 | J4 | R184 | C1 | R450 | J4 | R924 | H6 | | |
| C968 | D5 | | | | | | | | | | |

*See Parts List for serial number ranges.

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# VOLTAGE AND WAVEFORM CONDITIONS

**WARNING**

*Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect the power source before replacing parts.*

The voltages and waveforms shown on the diagram 1 and 2 were taken with the AM 502 front panel controls set as follows:

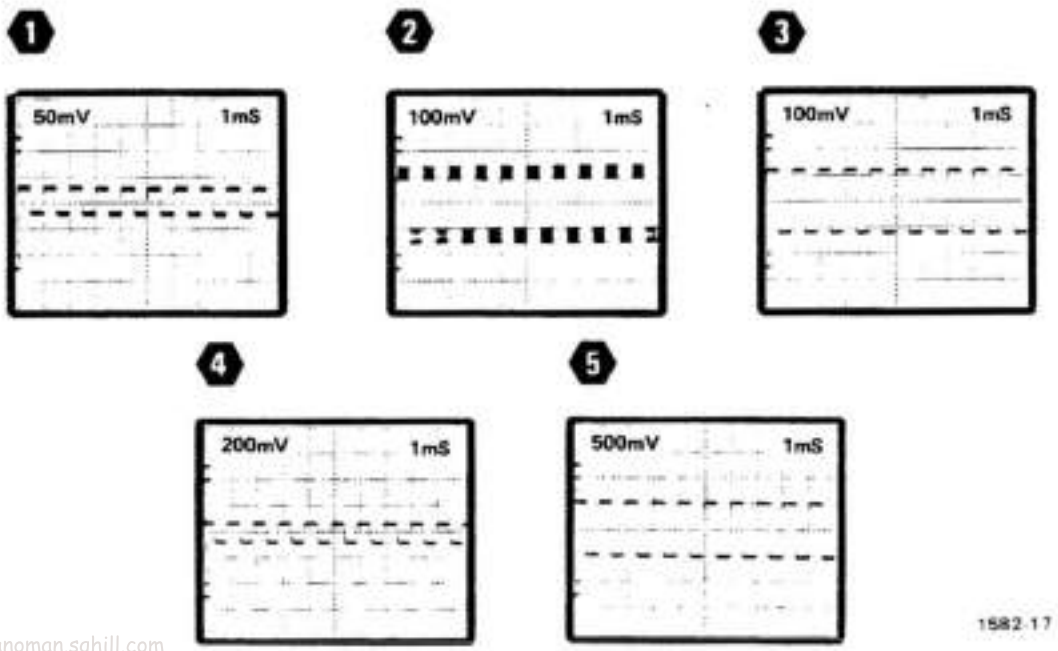
| VOLTAGES | | WAVEFORMS* | |
|---|---|---|---|
| GAIN | 100 | GAIN | 100 |
| ÷100 | pushbutton out | ÷100 | pushbutton out |
| HF −3 dB switch | 1 MHz | HF −3 dB switch | 1 MHz |
| LF −3 dB switch | DC | LF −3 dB switch | DC |
| + input AC | pushbutton out | + input AC | pushbutton out |
| GND | pushbutton in | GND | pushbutton out |
| − input AC | pushbutton out | − input AC | pushbutton out |
| GND | pushbutton in | GND | pushbutton in |
| STEP GAIN | centered | STEP GAIN | centered |
| DC BAL | | DC BAL | |
| DC OFFSET (COURSE - FINE) | centered | DC OFFSET (COURSE- FINE) | centered |

***Ground reference: center horizontal graticule line**

The waveforms shown were taken with a 50 mV square-wave input signal applied to the − input connector of the AM 502.

**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 10 megohm input impedance (TEKTRONIX DM 501 Digital Multimeter or TEKTRONIX 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

**Waveform Conditions.** The waveforms shown are actual waveform photographs taken with a Tektronix Oscilloscope Camera System and Projected Graticule. Vertical deflection factor shown on the waveform is the actual deflection factor from the probe tip. Voltages and waveforms on the diagrams are not absolute and may vary between instruments because of component tolerances, internal calibration, or front-panel settings. Readouts are simulated in larger-than-normal type.




1582-17

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# VOLTAGE AND WAVEFORM CONDITIONS

**WARNING**

*Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect the power source before replacing parts.*

The voltages and waveforms shown on the diagram 1 and 2 were taken with the AM 502 front panel controls set as follows:

| VOLTAGES | | WAVEFORMS* | |
|---|---|---|---|
| GAIN | 100 | GAIN | 100 |
| ÷100 | pushbutton out | ÷100 | pushbutton out |
| HF −3 dB switch | 1 MHz | HF −3 dB switch | 1 MHz |
| LF −3 dB switch | DC | LF −3 dB switch | DC |
| + input AC | pushbutton out | + input AC | pushbutton out |
| GND | pushbutton in | GND | pushbutton out |
| − input AC | pushbutton out | − input AC | pushbutton out |
| GND | pushbutton in | GND | pushbutton in |
| STEP GAIN | centered | STEP GAIN | centered |
| DC BAL | | DC BAL | |
| DC OFFSET (COURSE - FINE) | centered | DC OFFSET (COURSE- FINE) | centered |

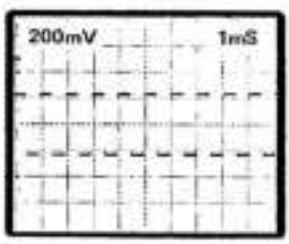
***Ground reference: center horizontal graticule line**

The waveforms shown were taken with a 50 mV square-wave input signal applied to the + input connector of the AM 502.

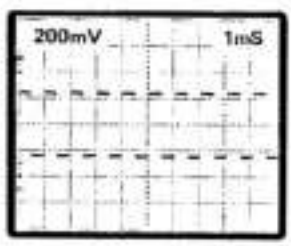
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 10 megohm input impedance (TEKTRONIX DM 501 Digital Multimeter or TEKTRONIX 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

**Waveform Conditions.** The waveforms shown are actual waveform photographs taken with a Tektronix Oscilloscope Camera System and Projected Graticule. Vertical deflection factor shown on the waveform is the actual deflection factor from the probe tip. Voltages and waveforms on the diagrams are not absolute and may vary between instruments because of component tolerances, internal calibration, or front-panel settings. Readouts are simulated in larger-than-normal type.

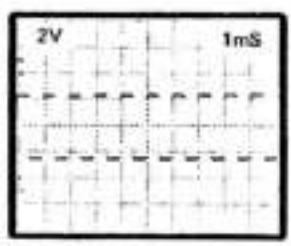
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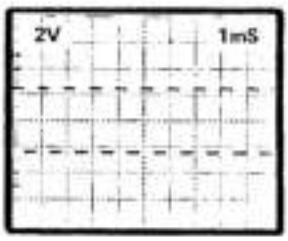

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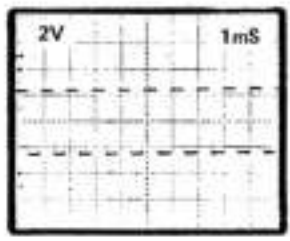

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9

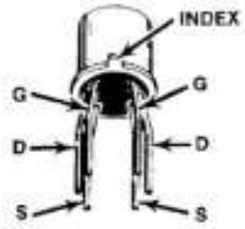



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1482-18

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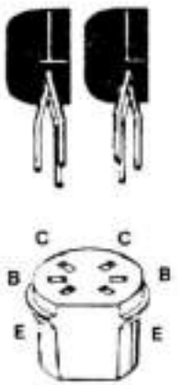

Q162, Q171




Q501, Q511, Q521, Q532
Q541, Q555, Q558

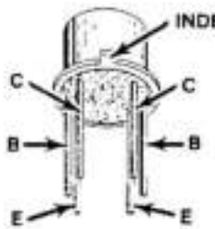



Q540




Q164 (SN 8057429 & BELOW)

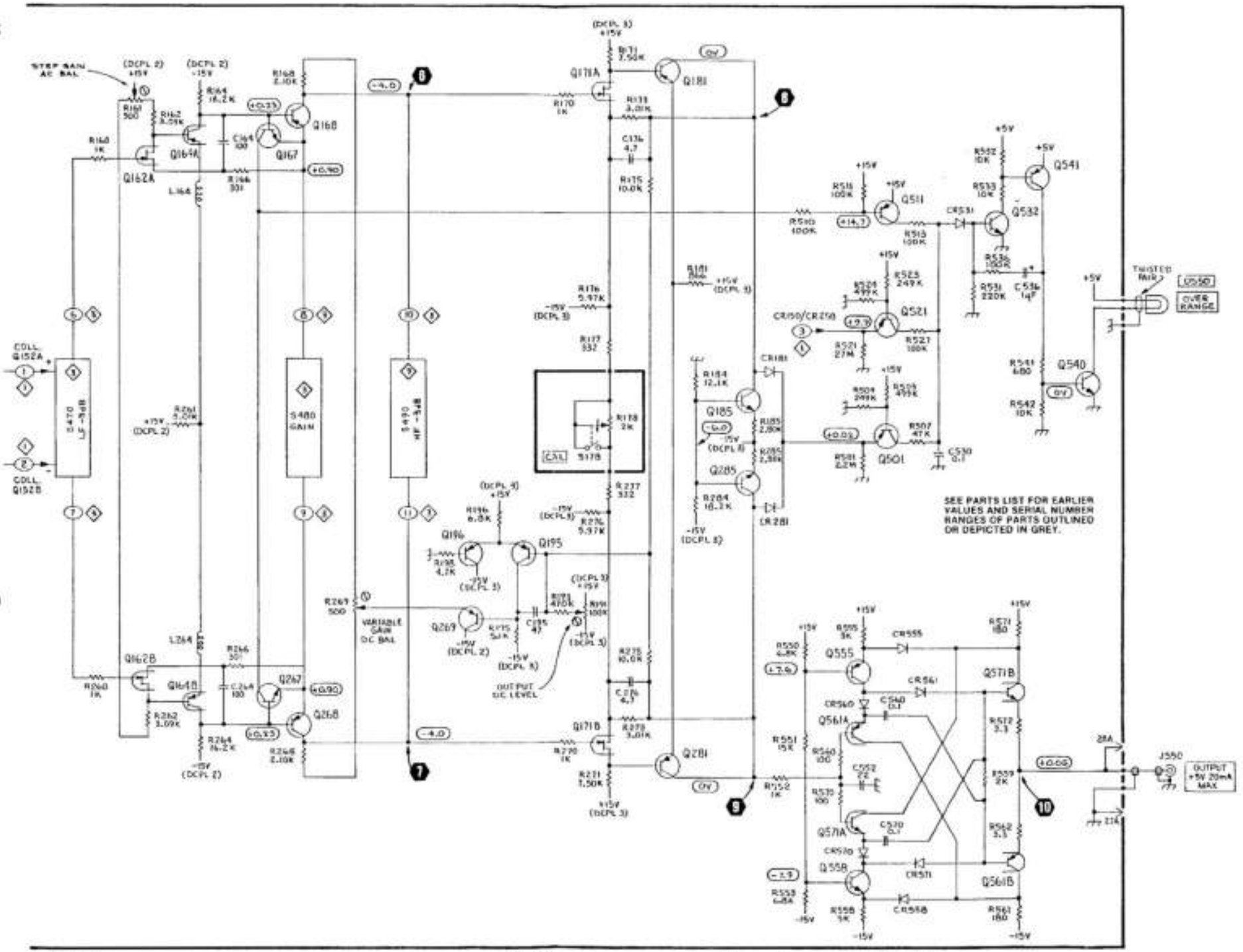
DUAL




Q164, Q561, Q571

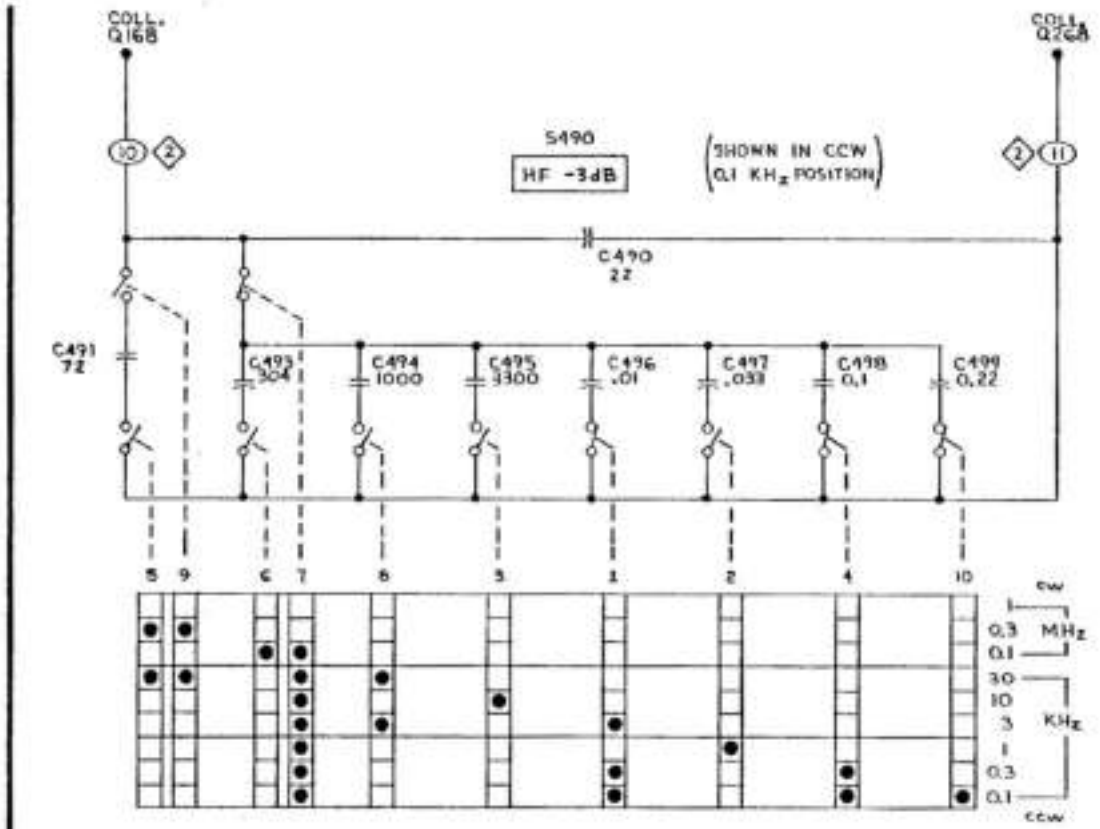


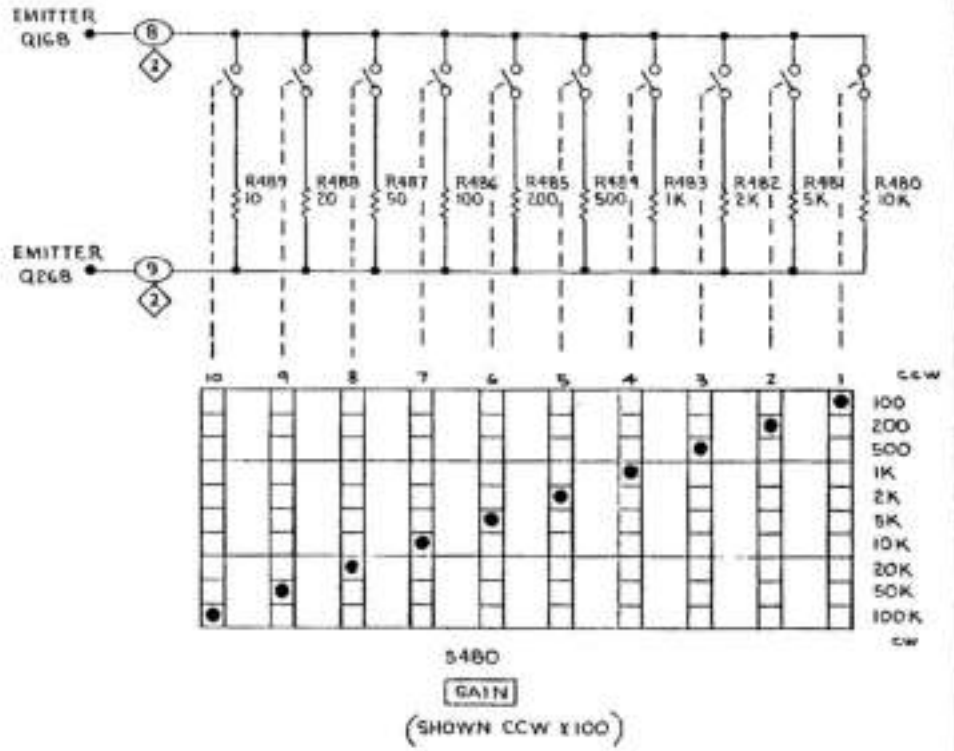

Q167, Q168, Q181, Q185
Q195, Q196, Q267, Q268
Q269, Q281, Q285

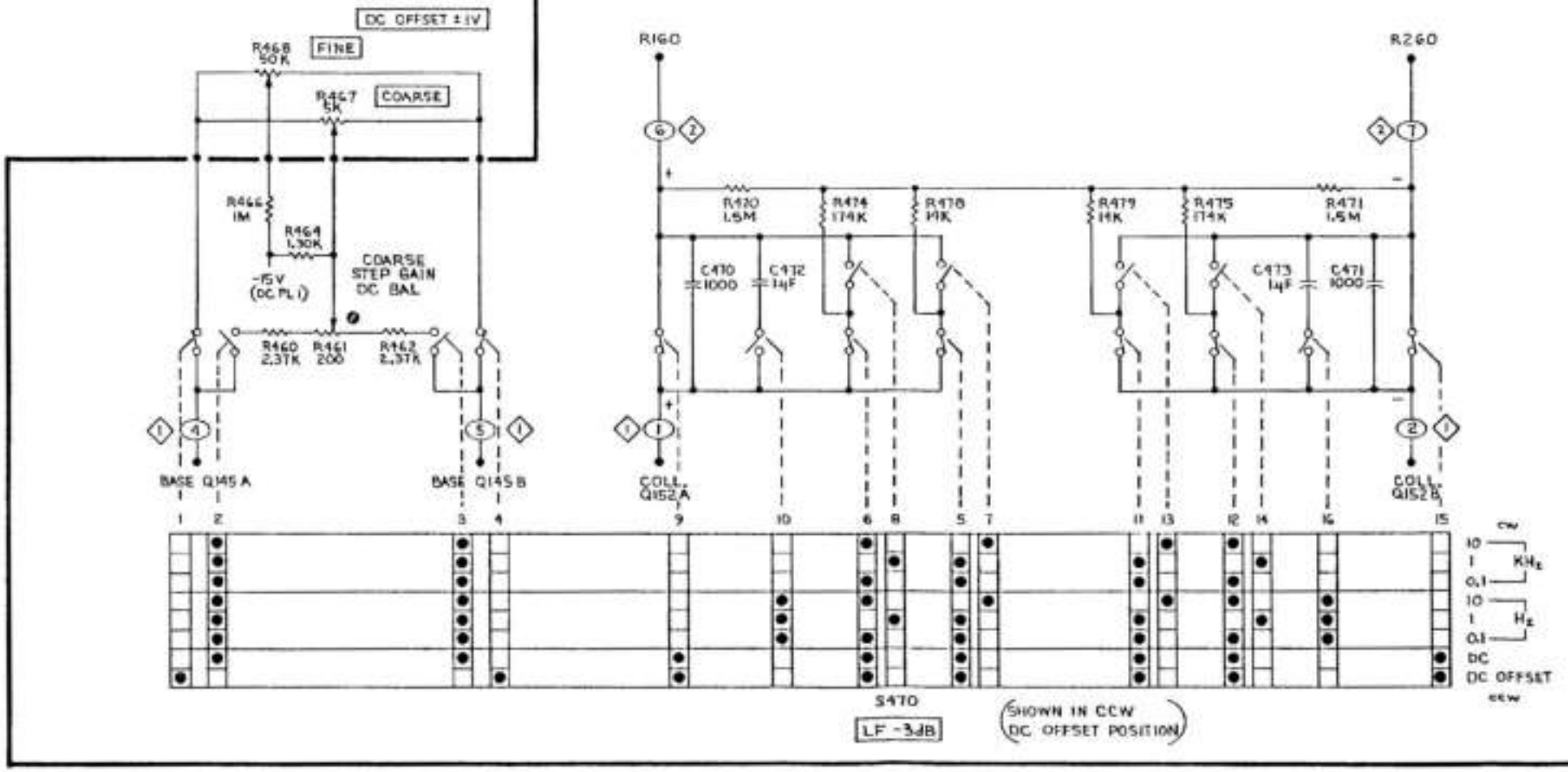





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COLL. Q16B
COLL Q26B
S490
HF -3dB
(SHOWN IN CCW 0.1 KHz POSITION)
C490 22
C491 72
C493 304
C494 1000
C495 3300
C496 .01
C497 .033
C498 0.1
C499 0.22
5 9 6 7 8 3 1 2 4 10
CW
0.3 MHz
0.1
30
10
3 KHz
1
0.3
0.1
CCW


EMITTER Q16B
EMITTER Q26B
R489 10
R488 20
R487 50
R486 100
R485 200
R484 500
R483 1K
R482 2K
R481 5K
R480 10K
10 9 8 7 6 5 4 3 2 1
CCW
100
200
500
1K
2K
5K
10K
20K
50K
100K
CW
S480
GAIN
(SHOWN CCW X100)


DC OFFSET ±1V
R468 50K FINE
R467 5K COARSE
R466 1M
R464 1.30K
-15V (DC PL1)
COARSE STEP GAIN DC BAL
R460 2.37K
R461 200
R462 2.37K
BASE Q145A
BASE Q145B
R160
R470 1.5M
R474 174K
R478 11K
C470 1000
C472 1μF
R479 11K
R475 174K
R471 1.5M
C473 1μF
C471 1000
COLL. Q152A
COLL. Q152B
1 2 3 4 9 10 6 8 5 7 11 13 12 14 16 15
CW
10
1 KHz
0.1
10
1 Hz
0.1
DC
DC OFFSET
CCW
S470
LF -3dB
(SHOWN IN CCW DC OFFSET POSITION)

# VOLTAGE CONDITIONS

**WARNING**

*Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect the power source before replacing parts.*

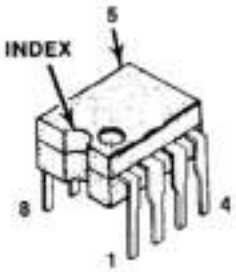
The voltages shown on the diagram were taken with the AM 502 front panel controls set as follows:

**VOLTAGES**

| | |
|---|---|
| Gain | 100 |
| ÷100 | pushbutton out |
| HF −3 dB switch | 1 MHz |
| LF −3 dB switch | DC |
| + input AC | pushbutton out |
| GND | pushbutton in |
| − input AC | pushbutton out |
| GND | pushbutton in |
| STEP GAIN | centered |
| DC BAL | |
| DC OFFSET (COURSE - FINE) | centered |

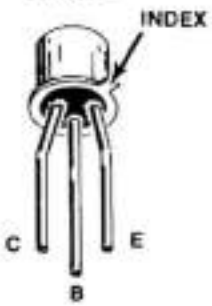
**Voltage Conditions.** The voltages shown on the diagram were obtained using a digital multimeter with a 10 megohm input impedance (TEKTRONIX DM 501 Digital Multimeter or TEKTRONIX 7D13 Digital Multimeter used with readout equipped, 7000-series oscilloscope).

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U910, U990

SINGLE




Q910, Q990



Q940




Q942

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

1582-21
REV. B, MAR 1976



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# REPLACEABLE MECHANICAL PARTS

## PARTS ORDERING INFORMATION

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

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

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

## SPECIAL NOTES AND SYMBOLS

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

## FIGURE AND INDEX NUMBERS

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

## INDENTATION SYSTEM

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

```
1 2 3 4 5                    Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
    - - - * - - -
  Detail Part of Assembly and/or Component
  Attaching parts for Detail Part
    - - - * - - -
    Parts of Detail Part
    Attaching parts for Parts of Detail Part
    - - - * - - -
```

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

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

## ITEM NAME

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

## ABBREVIATIONS

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



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## CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip Code |
|---|---|---|---|
| 02107 | SPARTA MFG CO | 5200 N MOOSTER RD<br>P O BOX 449 | DOVER OH 44622 |
| 09822 | BURNDY CORP | RICHARDS AVE | NORWALK CT 06852 |
| 12327 | FREEMAY CORP | 9301 ALLEN DR | CLEVELAND OH 44125 |
| 13511 | AMPHENOL CADRE DIV BUNKER RAMO CORP | | LOS GATOS CA |
| 22526 | DU PONT E I DE NEMOURS AND CO INC<br>DU PONT CONNECTOR SYSTEMS | 30 HUNTER LANE | CAMP HILL PA 17011 |
| 28520 | HEYCO MOLDED PRODUCTS | 147 MICHIGAN AVE<br>P O BOX 160 | KENILWORTH NJ 07033 |
| 45722 | USM CORP., PARKER-KALON FASTENER DIV<br>. | | CAMPBELLSVILLE, KY 42718 |
| 56878 | SPS TECHNOLOGIES INC | HIGHLAND AVE | JENKINTOWN PA 19046 |
| 71159 | BRISTOL SOCKET SCREW CO | | WATERBURY CT |
| 71785 | TRW INC<br>TRW CINCH CONNECTORS | 1501 MORSE AVE | ELK GROVE VILLAGE IL 60007 |
| 73743 | FISCHER SPECIAL MFG CO | 446 MORGAN ST | CINCINNATI OH 45206 |
| 74445 | HOLO-KROME CO | 31 BROOK ST | WEST HARTFORD CT 06110 |
| 77900 | SHAKEPROOF<br>DIV OF ILLINOIS TOOL WORKS | SAINT CHARLES RD | ELGIN IL 60120 |
| 78189 | ILLINOIS TOOL WORKS INC<br>SHAKEPROOF DIVISION | ST CHARLES ROAD | ELGIN IL 60120 |
| 79136 | WALDES KOHINOOR INC | 47-16 AUSTEL PLACE | LONG ISLAND CITY NY 11101 |
| 80009 | TEKTRONIX INC | 4900 S W GRIFFITH DR<br>P O BOX 500 | BEAVERTON OR 97077 |
| 83385 | MICRODOT MANUFACTURING INC<br>GREER-CENTRAL DIV | 3221 W BIG BEAVER RD | TROY MI 48098 |
| 86928 | SEASTROM MFG CO INC | 701 SONORA AVE | GLENDALE CA 91201 |
| 91836 | KINGS ELECTRONICS CO INC | 40 MARBLEDALE ROAD | TUCKAHOE NY 10707 |
| 93907 | TEXTRON INC<br>CAMCAR DIV | 600 18TH AVE | ROCKFORD IL 61101 |
| TK0392 | NORTHWEST FASTENER SALES INC | 7923 SW CIRRUS DRIVE | BEAVERTON OR 97005 |
| TK0435 | LEWIS SCREW CO | 4114 S PEORIA | CHICAGO IL 60609 |
| TK0507 | O HARA METAL PRODUCTS CO | 542 BRANNAN ST | SAN FRANCISCO CA 94107 |



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| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Qty | 12345 Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|---|
| 1-1 | 337-1399-01 | B010100 | B130524 | 2 | SHIELD,ELEC:SIDE | 80009 | 337-1399-01 |
| | 337-1399-01 | B130525 | | 1 | SHIELD,ELEC:SIDE | 80009 | 337-1399-01 |
| -2 | 337-1399-00 | B130525 | | 1 | SHIELD,ELEC:SIDE | 80009 | 337-1399-00 |
| -3 | 366-0494-00 | | | 1 | KNOB:GRAY WITH SETSCREW | 80009 | 366-0494-00 |
| | 213-0153-00 | | | 1 | .SETSCREW:5-40 X 0.125,STL | TK0392 | ORDER BY DESCR |
| -4 | 366-1518-00 | B010100 | B040799 | 1 | KNOB:GY,0.083 ID X 0.392 OD X 0.4 H | 80009 | 366-1518-00 |
| | 213-0153-00 | B010100 | B040799 | 1 | .SETSCREW:5-40 X 0.125,STL | TK0392 | ORDER BY DESCR |
| | 366-1084-00 | B040800 | B049999 | 1 | KNOB:GY,0.08 ID X 0.392 OD X 0.4 H | 80009 | 366-1084-00 |
| | 213-0725-00 | B040800 | B049999 | 1 | .SETSCREW:3-48 X 0.094,STL | 56878 | ORDER BY DESCR |
| | 366-1023-00 | B050000 | | 1 | KNOB:GY,0.127 ID X 0.392 OD X 0.531 H | 80009 | 366-1023-00 |
| | 213-0246-00 | B050000 | | 1 | .SETSCREW:5-40 X 0.094,STL | 71159 | ORDER BY DESCR |
| -5 | 366-1101-00 | | | 1 | KNOB:GY,0.127 ID X 0.706 OD X 0.6 H | 80009 | 366-1101-00 |
| | 213-0153-00 | | | 1 | .SETSCREW:5-40 X 0.125,STL | TK0392 | ORDER BY DESCR |
| -6 | 366-1317-00 | | | 1 | KNOB:RED,CAL,0.127 ID X 0.5 OD X 0.531 H | 80009 | 366-1317-00 |
| | 213-0153-00 | | | 1 | .SETSCREW:5-40 X 0.125,STL | TK0392 | ORDER BY DESCR |
| -7 | 366-1001-00 | | | 1 | KNOB:GY,0.252 ID X 0.925 OD X 0.67 | 80009 | 366-1001-00 |
| | 213-0153-00 | | | 2 | .SETSCREW:5-40 X 0.125,STL | TK0392 | ORDER BY DESCR |
| -8 | 366-1163-00 | | | 2 | KNOB:GY,0.127 ID X 0.392 OD X 0.466 H | 80009 | 366-1163-00 |
| | 213-0153-00 | | | 1 | .SETSCREW:5-40 X 0.125,STL | TK0392 | ORDER BY DESCR |
| -9 | 366-1257-11 | | | 2 | PUSH BUTTON:SIL GY,AC PRE | 80009 | 366-1257-11 |
| -10 | 366-1257-12 | | | 2 | PUSH BUTTON:SIL GY,CHG GND | 80009 | 366-1257-12 |
| -11 | 366-1489-31 | | | 1 | PUSH BUTTON:SIL GY,DIVIDE BY 10 | 80009 | 366-1489-31 |
| -12 | 426-0681-00 | | | 5 | FRAME,PUSH BTN: | 80009 | 426-0681-00 |
| | 214-1840-00 | B010100 | B053579 | 1 | PIN,KNOB SECRG:0.12 L X 0.094-0.1 OD,ACETAL | 80009 | 214-1840-00 |
| -13 | 366-1422-01 | B010100 | B053579 | 1 | KNOB:LATCH | 80009 | 366-1422-01 |
| | 366-1690-00 | B053580 | | 1 | KNOB,LATCH:SIL GY,0.53 X 0.23 X 1.059 | 80009 | 366-1690-00 |
| -14 | 129-0103-00 | | | 1 | POST,BOG,ELEC:ASSEMBLY<br>(ATTACHING PARTS) | 80009 | 129-0103-00 |
| -15 | 210-0455-00 | | | 1 | NUT,PLAIN,HEX:0.25-28 X 0.375,BRS NP | 73743 | 3089-402 |
| -16 | 210-0223-00 | | | 1 | TERMINAL,LUG:0.26 ID,LOCKING,BRZ TIN PL<br>(END ATTACHING PARTS) | 86928 | 5441-37 |
| | 200-0103-00 | | | 1 | .NUT,PLAIN,KNURL:0.25-28 X 0.375"OD BRASS | 80009 | 200-0103-00 |
| | 129-0077-00 | | | 1 | .STUD,SHOULDERED:0.938 L X 0.375,0.250-28 | 80009 | 129-0077-00 |
| -17 | 131-0955-00 | | | 2 | CONN,RCPT,ELEC:BNC,FEMALE | 13511 | 31-279 |
| -18 | 131-0818-00 | | | 1 | CONN,RCPT,ELEC:BNC,FEMALE | 91836 | KC-19-153 |
| -19 | 384-1221-00 | B010100 | B049999 | 1 | EXTENSION SHAFT:3.0 L X 0.081 OD,SST | 80009 | 384-1221-00 |
| | 384-0415-01 | B050000 | | 1 | EXTENSION SHAFT:3.18 L X 0.081 OD,STEEL | 80009 | 384-0415-01 |
| -20 | ------ ------ | | | 1 | RESISTOR,VARIABLE:(SEE R460 REPL)<br>(ATTACHING PARTS) | | |
| -21 | 210-0583-00 | | | 1 | NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL | 73743 | ZX-20319-402 |
| -22 | 210-0940-00 | | | 1 | WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL<br>(END ATTACHING PARTS) | 12327 | ORDER BY DESCR |
| -23 | ------ ------ | | | 1 | RESISTOR,VARIABLE:(SEE R158 REPL)<br>(ATTACHING PARTS) | | |
| -24 | 210-0583-00 | | | 1 | NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL | 73743 | ZX-20319-402 |
| -25 | 210-0940-00 | | | 1 | WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL<br>(END ATTACHING PARTS) | 12327 | ORDER BY DESCR |
| -26 | 358-0378-00 | B010100 | B054649 | 2 | BUSHING,SLEEVE:0.131 ID X 0.18 OD X 0.125 L | 80009 | 358-0378-00 |
| | 358-0599-00 | B054650 | | 2 | BUSHING,SLEEVE:0.125 ID X 0.25 OD X 0.234 | 28520 | B-187-125 |
| -27 | 358-0029-00 | | | 1 | BSHG,MACH THD:0.375-32 X 0.5 HEX,BRS NP<br>(ATTACHING PARTS) | 80009 | 358-0029-00 |
| -28 | 210-0590-00 | | | 1 | NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL | 73743 | 28269-402 |
| -29 | 210-0978-00 | | | 1 | WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL<br>(END ATTACHING PARTS) | 12327 | ORDER BY DESCR |
| -30 | 333-1711-00 | | | 1 | PANEL,FRONT: | 80009 | 333-1711-00 |
| -31 | 214-1513-01 | B010100 | B053579 | 1 | LCH,PL-IN RTNG:PLASTIC | 80009 | 214-1513-01 |
| | 105-0719-00 | B053580 | | 1 | LATCH,RETAINING:PLUG-IN<br>(ATTACHING PARTS) | 80009 | 105-0719-00 |
| -32 | 213-0254-00 | | | 1 | SCREW,TPG,TF:2-32 X 0.25,TYPE B,FLH,100 DEG | 45722 | ORDER BY DESCR |
| -33 | 105-0718-00 | B053580 | B054529 | 1 | BAR,LATCH RLSE: | 80009 | 105-0718-00 |
| | 105-0718-01 | B054530 | | 1 | BAR,LATCH RLSE:<br>(END ATTACHING PARTS) | 80009 | 105-0718-01 |
| -34 | 200-0935-00 | | | 2 | BASE,LAMPHOLDER:0.29 OD X 0.19 L,BK PLSTC | 80009 | 200-0935-00 |
| -35 | 378-0602-01 | | | 1 | LENS,LIGHT:AMBER | 80009 | 378-0602-01 |
| -36 | 378-0602-00 | | | 1 | LENS,LIGHT:GREEN | 80009 | 378-0602-00 |
| -37 | 352-0157-00 | | | 2 | LAMPHOLDER:(1)T-2 UNBASED,WHITE | 80009 | 352-0157-00 |
| -38 | 386-2529-00 | B010100 | B049999 | 1 | SUBPANEL,FRONT: | 80009 | 386-2529-00 |



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| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Qty | 12345 Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|---|
| 1- | 386-2529-01 | B050000 | | 1 | SUBPANEL,FRONT: | 80009 | 386-2529-01 |
| | | | | | (ATTACHING PARTS) | | |
| -39 | 213-0229-00 | B010100 | B054759 | 4 | SCREW,TPG,TF:6-20 X 0.375,TYPE B,FLH,STL | 93907 | ORDER BY DESCR |
| | 213-0123-00 | B054760 | | 4 | SCREW,TPG,TF:6-32 X 0.375,SPCL TYPE,FLH | 93907 | 234-21940-026 |
| | | | | | (END ATTACHING PARTS) | | |
| -40 | 337-1782-00 | B010100 | B049999 | 1 | SHIELD,ELEC:REAR PANEL | 80009 | 337-1782-00 |
| | 337-1782-01 | B050000 | | 1 | SHIELD,ELEC:REAR | 80009 | 337-1782-01 |
| -41 | 214-1061-00 | | | 1 | CONTACT,ELEC:GROUNDING,CU BE | 80009 | 214-1061-00 |
| -42 | 426-0725-00 | | | 1 | FR SECT,PLUG-IN:TOP | 80009 | 426-0725-00 |
| | | | | | (ATTACHING PARTS) | | |
| -43 | 213-0148-00 | | | 2 | SCREW,TPG,TF:6-20 X 0.312,TYPE B,PNH,STL | 83385 | ORDER BY DESCR |
| | | | | | (END ATTACHING PARTS) | | |
| -44 | 386-3657-00 | B053580 | B055259 | 2 | SUPPORT,PLUG-IN: | 80009 | 386-3657-00 |
| | 386-3657-01 | B055260 | | 2 | SUPPORT,PLUG-IN: | 93907 | ORDER BY DESCR |
| -45 | 210-1270-00 | B053580 | | 2 | WASHER,FLAT:0.141 ID X 0.219 OD X 0.04,AL | 80009 | 210-1270-00 |
| -46 | 426-0724-00 | | | 1 | FR SECT,PLUG-IN:BOTTOM | 80009 | 426-0724-00 |
| | | | | | (ATTACHING PARTS) | | |
| -47 | 213-0146-00 | | | 1 | SCREW,TPG,TF:6-20 X 0.312,TYPE B,PNH,STL | 83385 | ORDER BY DESCR |
| -48 | 211-0012-00 | | | 1 | SCREW,MACHINE:4-40 X 0.375,PNH,STL | TK0435 | ORDER BY DESCR |
| -49 | 210-0406-00 | | | 1 | NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL | 73743 | 12161-50 |
| | | | | | (END ATTACHING PARTS) | | |
| -50 | 376-0039-00 | | | 1 | CPLG,SHAFT,RGD:0.082 & 0.128 ID,AL | 80009 | 376-0039-00 |
| | 213-0075-00 | | | 2 | .SETSCREW:4-40 X 0.094,STL | 74445 | ORDER BY DESCR |
| -51 | ----- ----- | | | 1 | CKT BOARD ASSY:MAIN(SEE A1 REPL) | | |
| -52 | ----- ----- | | | 1 | .TRANSISTOR:(SEE A10940 REPL) | | |
| -53 | 210-1122-00 | | | 1 | ..WASHER,LOCK:0.12 ID,DISHED,0.025 THK,STL | 86928 | ORDER BY DESCR |
| -54 | 210-0910-00 | | | 1 | ..WASHER,FLAT:0.19 OD X 0.281 OD X 0.048 | 02107 | S-47-11 |
| -55 | 131-0604-00 | | | 36 | .CONTACT,ELEC:CKT BD SM,SPR,CU BE | 80009 | 131-0604-00 |
| -56 | 136-0252-04 | B010100 | B030294 | 72 | .SOCKET,PIN TERM:U/M 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| | 136-0252-04 | B030295 | | 56 | .SOCKET,PIN TERM:U/M 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| | 136-0514-00 | B030295 | B058919 | 2 | .SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP | 09922 | DIL88P-108 |
| -57 | 200-0687-01 | | | 1 | .COVER,XSTR:TO-5,ACETAL | 80009 | 200-0687-01 |
| | 131-0608-00 | | | 4 | .TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL | 22526 | 48283-036 |
| -58 | 136-0235-00 | | | 1 | .SKT,PL-IN ELEK:TRANSISTOR,6 CONTACT | 71785 | 133-96-12-062 |
| -59 | ----- ----- | | | 1 | .RESISTOR,VARIABLE:(SEE A10467 REPL) | | |
| | | | | | .(ATTACHING PARTS) | | |
| -60 | 210-0583-00 | | | 1 | .NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL | 73743 | 2X-20319-402 |
| -61 | 210-0046-00 | | | 1 | .WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL | 77900 | 1214-05-00-0541C |
| -62 | 210-1025-00 | B010100 | B059999 | 2 | .WASHER,FLAT:0.312 ID X 0.469 OD X 0.031,BR | 12327 | ORDER BY DESCR |
| | | | | | .S | | |
| | 210-0465-00 | B060000 | | 1 | .NUT,PLAIN,HEX:0.25-32 X 0.375,BRS CD PL | 73743 | 3095-402 |
| | | | | | .(END ATTACHING PARTS) | | |
| -63 | 407-1337-00 | | | 1 | .BRACKET,VAR RES:STEEL | 80009 | 407-1337-00 |
| | | | | | .(ATTACHING PARTS) | | |
| -64 | 211-0008-00 | | | 2 | .SCREW,MACHINE:4-40 X 0.25,PNH,STL | 93907 | ORDER BY DESCR |
| -65 | 210-0551-00 | | | 2 | .NUT,PLAIN,HEX:4-40 X 0.25,ST CD PL | TK0435 | ORDER BY DESCR |
| | | | | | .(END ATTACHING PARTS) | | |
| -66 | 337-1883-00 | | | 2 | .SHIELD,ELEC:PUSHBUTTON,CTR | 80009 | 337-1883-00 |
| -67 | ----- ----- | | | 2 | .SWITCH,PUSH:(SEE A1S10 AND A1S20 REPL) | | |
| -68 | 361-0385-00 | B010100 | B052349 | 8 | .SPACER,PB SW:0.164 L,GREEN POLYCARBONATE | 80009 | 361-0385-00 |
| | 361-0384-00 | B052350 | | 8 | .SPACER,PB SW:0.133 L,RED POLYCARBONATE | 80009 | 361-0384-00 |
| -69 | ----- ----- | | | 1 | .SWITCH,PUSH:(SEE A1S30 REPL) | | |
| -70 | 361-0383-00 | | | 2 | .SPCR,PB SW:0.33 L,CHARCOAL,POLYCARBONATE | 80009 | 361-0383-00 |
| -71 | 344-0154-00 | | | 4 | .CLIP,ELECTRICAL:FUSE,CKT BD MT | 80009 | 344-0154-00 |
| | 198-2155-00 | | | 1 | .WIRE SET,ELEC: | 80009 | 198-2155-00 |
| -72 | 175-0825-00 | | | 1 | ..CABLE,SP,ELEC:2,26 AWG,STRD,PVC JKT,RBN | 80009 | 175-0825-00 |
| -73 | 175-0826-00 | | | 1 | ..CABLE,SP,ELEC:3,26 AWG,STRD,PVC JKT,RBN | 80009 | 175-0826-00 |
| -74 | 131-0707-00 | | | 4 | ..CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL | 22526 | 47439-000 |
| -75 | 352-0162-02 | | | 1 | ..HLDR,TERM CONN:4 WIRE,RED | 80009 | 352-0162-02 |
| -76 | 179-2029-00 | | | 1 | .WIRING HARNESS:MAIN | 80009 | 179-2029-00 |
| | 175-3112-00 | | | 1 | .CABLE ASSY,RF:50 OHM COAX,0.958 L | 80009 | 175-3112-00 |
| -77 | 384-0173-00 | | | 1 | EXTENSION SHAFT:6.438 L X 0.125 STEP OD,STL | 80009 | 384-0173-00 |
| -78 | 384-0348-01 | | | 1 | EXTENSION SHAFT:9.161 L X 0.125 STEP OD | 80009 | 384-0348-01 |
| | 263-1004-00 | | | 1 | SM CAM ACTR AS:LF-308 POINT | 80009 | 263-1004-00 |
| | | | | | (ATTACHING PARTS) | | |
| -79 | 211-0116-00 | B010100 | B057469 | 4 | SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP | 77900 | ORDER BY DESCR |
| | 211-0292-00 | B057470 | | 4 | SCR,ASSEM WSHR:4-40 X 0.28,PNH,BRS NI PL | 78189 | 51-040445-01 |

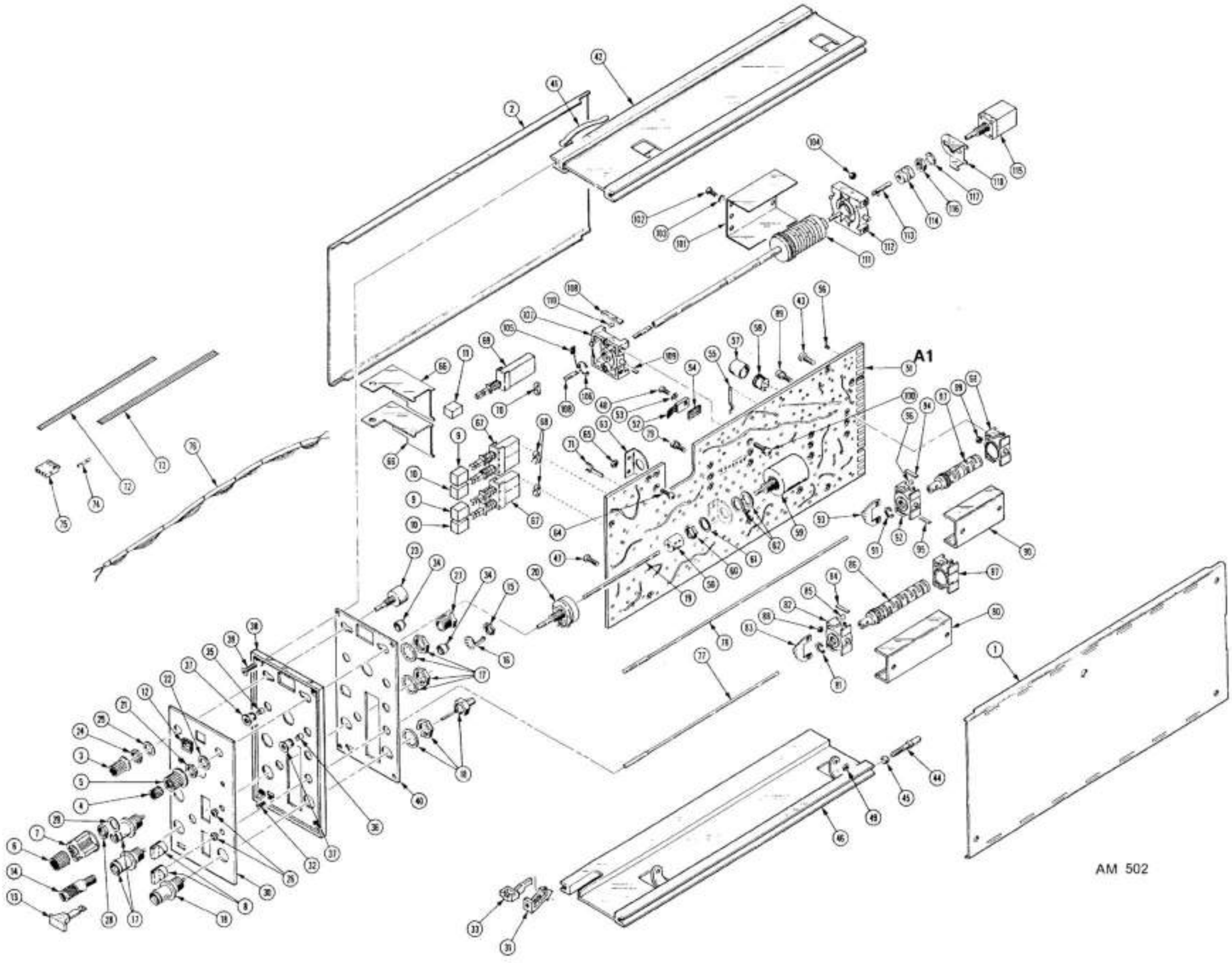


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| Fig. & Index No. | Tektronix Part No. | Serial/Assembly No. Effective | Dscont | Qty | 12345 Name & Description | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|---|---|
| 1- | | | | | (END ATTACHING PARTS) | | |
| -80 | 200-1598-00 | | | 1 | .COVER,CAM SM:16 ELEMENTS | 80009 | 200-1598-00 |
| -81 | 354-0219-00 | | | 1 | .RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA | 79136 | 5103-25-S-ZD-R |
| -82 | 401-0155-00 | | | 1 | .BEARING,CAM SM:FRONT,0.454 DIA CAM | 80009 | 401-0155-00 |
| -83 | 131-0840-00 | | | 1 | .CONTACT,ELEC:GROUNDING,NI BE | 80009 | 131-0840-00 |
| -84 | 214-1704-01 | | | 2 | .SPRING,FLAT:0.52 X 0.125 X 0.008,CU BE | 80009 | 214-1704-01 |
| -85 | 214-1127-00 | | | 2 | .ROLLER,DETENT:0.125 DIA X 0.125,SST | 80009 | 214-1127-00 |
| -86 | 105-0498-00 | | | 1 | .ACTUATOR,CAM SM:LF-30B | 80009 | 105-0498-00 |
| -87 | 401-0156-00 | | | 1 | .BEARING,CAM SM:REAR,0.454 DIA CAM | 80009 | 401-0156-00 |
| -88 | 210-0406-00 | | | 4 | .NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL | 73743 | 12161-50 |
| | 213-0075-00 | | | 2 | .SETSCREW:4-40 X 0.094,STL | 74445 | ORDER BY DESCR |
| | 263-1003-00 | | | 1 | SM CAM ACTR AS:HF-30B POINT | 80009 | 263-1003-00 |
| | | | | | (ATTACHING PARTS) | | |
| -89 | 211-0116-00 | | | 4 | SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP | 77900 | ORDER BY DESCR |
| | | | | | (END ATTACHING PARTS) | | |
| -90 | 200-1597-00 | | | 1 | .COVER,CAM SM:10 ELEMENTS | 80009 | 200-1597-00 |
| -91 | 354-0219-00 | | | 1 | .RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA | 79136 | 5103-25-S-ZD-R |
| -92 | 401-0155-00 | | | 1 | .BEARING,CAM SM:FRONT,0.454 DIA CAM | 80009 | 401-0155-00 |
| -93 | 131-1248-00 | | | 1 | .CONTACT,ELEC:SHAFT GND,NI BE | 80009 | 131-1248-00 |
| -94 | 214-1704-00 | | | 1 | .SPRING,FLAT:0.52 X 0.125 X 0.008,CU BE | 80009 | 214-1704-00 |
| -95 | 214-1704-01 | | | 1 | .SPRING,FLAT:0.52 X 0.125 X 0.008,CU BE | 80009 | 214-1704-01 |
| -96 | 214-1127-00 | | | 2 | .ROLLER,DETENT:0.125 DIA X 0.125,SST | 80009 | 214-1127-00 |
| -97 | 105-0502-00 | | | 1 | .ACTUATOR,CAM SM:HF-30B | 80009 | 105-0502-00 |
| -98 | 401-0156-00 | | | 1 | .BEARING,CAM SM:REAR,0.454 DIA CAM | 80009 | 401-0156-00 |
| -99 | 210-0406-00 | | | 4 | .NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL | 73743 | 12161-50 |
| | 213-0075-00 | | | 2 | .SETSCREW:4-40 X 0.094,STL | 74445 | ORDER BY DESCR |
| | 263-1005-00 | | | 1 | SM CAM ACTR AS:GAIN | 80009 | 263-1005-00 |
| | | | | | (ATTACHING PARTS) | | |
| -100 | 211-0116-00 | | | 4 | SCR,ASSEM WSHR:4-40 X 0.312,PNH,BRS,NP | 77900 | ORDER BY DESCR |
| | | | | | (END ATTACHING PARTS) | | |
| -101 | 200-1596-00 | | | 1 | .COVER,CAM SM:10 ELEMENTS | 80009 | 200-1596-00 |
| | | | | | .(ATTACHING PARTS) | | |
| -102 | 211-0008-00 | | | 4 | .SCREW,MACHINE:4-40 X 0.25,PNH,STL | 93907 | ORDER BY DESCR |
| -103 | 210-0004-00 | | | 4 | .WASHER,LOCK:#4 INTL,0.015 THK,STL | 77900 | 1204-00-00-0541C |
| -104 | 210-0406-00 | | | 3 | .NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL | 73743 | 12161-50 |
| -105 | 131-0963-00 | | | 1 | .CONTACT,ELEC:GROUNDING,PH BRZ,W/BRACKET | TK0507 | ORDER BY DESCR |
| | | | | | .(END ATTACHING PARTS) | | |
| -106 | 354-0391-00 | | | 1 | .RING,RETAINING:EXT,U/O 0.438 DIA SFT | 80009 | 354-0391-00 |
| -107 | 401-0081-02 | | | 1 | .BEARING,CAM SM:FRONT W/O MOUNTING BOSSES | 80009 | 401-0081-02 |
| -108 | 214-1139-03 | | | 1 | .SPRING,FLAT:0.085 X 0.156 CU BE RED CLR | 80009 | 214-1139-03 |
| -109 | 214-1139-02 | | | 1 | .SPRING,FLAT:0.085 X 0.156 CU BE GRN CLR | 80009 | 214-1139-02 |
| -110 | 214-1127-00 | | | 2 | .ROLLER,DETENT:0.125 DIA X 0.125,SST | 80009 | 214-1127-00 |
| -111 | 105-0503-00 | | | 1 | .ACTUATOR,CAM SM:GAIN | 80009 | 105-0503-00 |
| -112 | 401-0115-00 | | | 1 | .BEARING,CAM SM:CNTR,0.83 DIA CAM,DBL BO | 80009 | 401-0115-00 |
| | 210-0406-00 | | | 3 | .NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL | 73743 | 12161-50 |
| | 131-0963-00 | | | 1 | .CONTACT,ELEC:GROUNDING,PH BRZ,W/BRACKET | TK0507 | ORDER BY DESCR |
| -113 | 384-1220-00 | | | 1 | EXTENSION SHAFT:8.038 L X 0.125 OD,AL | 80009 | 384-1220-00 |
| -114 | 376-0029-00 | B010100 | B059999 | 1 | CPLG,SHAFT,RGD:0.128 ID X 0.312 OD,AL | 80009 | 376-0029-00 |
| | 376-0051-00 | B060000 | B070609 | 1 | CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD | 80009 | 376-0051-00 |
| | 376-0051-01 | B070610 | | 1 | CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD | 80009 | 376-0051-01 |
| | 213-0075-00 | | | 2 | .SETSCREW:4-40 X 0.094,STL | 74445 | ORDER BY DESCR |
| -115 | ------ ------ | | | 1 | RESISTOR,VARIABLE:(SEE R178/S178 REPL) | | |
| | | | | | (ATTACHING PARTS) | | |
| -116 | 210-0583-00 | | | 1 | NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL | 73743 | 2X-20319-402 |
| -117 | 210-0046-00 | | | 2 | WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL | 77900 | 1214-05-00-0541C |
| -118 | 407-0803-00 | | | 1 | BRACKET,ELEC SM:BRASS | 80009 | 407-0803-00 |
| | | | | | (END ATTACHING PARTS) | | |
| | | | | | STANDARD ACCESSORIES | | |
| | 070-1582-01 | | | 1 | MANUAL,TECH:INSTRUCTION | 80009 | 070-1582-01 |



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