

# WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING UNLESS YOU ARE QUALIFIED TO DO SO.

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

2215 OSCILLOSCOPE SERVICE

INSTRUCTION MANUAL

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

Serial Number \_\_\_

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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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diately accessible as one reads the markings, or a hazard to property, including the equipment itself.

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

### Symbols in This Manual



This symbol indicates where applicable cautionary or other information is to be found. For maximum input voltage see Table 1-1.

# Symbols as Marked on Equipment



DANGER - High voltage.



Protective ground (earth) terminal.



ATTENTION — Refer to manual.

### **Power Source**

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

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

### Use the Proper Power Cord

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

Use only a power cord that is in good condition.

For detailed information on power cords and connectors see Figure 2-1.

### Use the Proper Fuse

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

### Do Not Operate in Explosive Atmospheres

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

#### Do Not Remove Covers or Panels

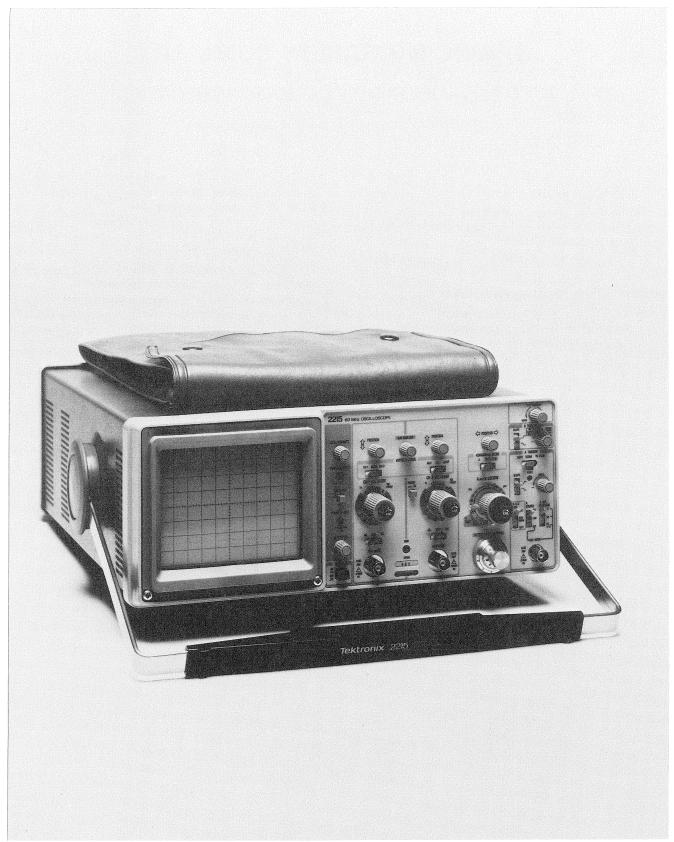
To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.



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3826-01

The 2215 Oscilloscope.

# **SPECIFICATION**

### INTRODUCTION

The TEKTRONIX 2215 Oscilloscope is a rugged, lightweight, dual-channel, 60-MHz instrument that features a bright, sharply defined trace on an 80- by 100-mm cathoderay tube (crt). Its vertical system provides calibrated deflection factors from 2 mV per division to 10 V per division. Trigger circuits enable stable triggering over the full bandwidth of the vertical system. The horizontal system provides calibrated sweep speeds from 0.5 s per division to 50 ns per division along with delayed-sweep features for accurate relative-time measurements. A X10 magnifier extends the maximum sweep speed to 5 ns per division.

### **ACCESSORIES**

The instrument is shipped with the following standard accessories:

- 1 Operators manual
- 2 Probe packages
- 1 Service manual
- 2 Probe grabber tips

For part numbers and further information about both standard and optional accessories, refer to the "Accessories" page at the back of this manual. Your Tektronix representative, your local Tektronix Field Office, or the Tektronix product catalog can also provide accessories information.

### PERFORMANCE CONDITIONS

The following electrical characteristics (Table 1-1) are valid for the 2215 when it has been adjusted at an ambient temperature between +20°C and +30°C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between 0°C and +50°C (unless otherwise noted).

Items listed in the "Performance Requirements" column are verifiable qualitative or quantitative limits, while items listed in the "Supplemental Information" column are either explanatory notes, calibration setup descriptions, performance characteristics for which no absolute limits are specified, or characteristics that are impractical to check.

Environmental characteristics are given in Table 1-2. The 2215 meets the requirements of MIL-T-28800B, Class 5 equipment, except where otherwise noted.

Physical characteristics of the instrument are listed in Table 1-3.

	2.5 to 1.	
Step Response		Measured with a vertically centered 5-division reference signal from a 50- $\Omega$ source driving a 50- $\Omega$ coaxial cable that is terminated in 50 $\Omega$ at the input connector, with the VOLTS/DIV Variable control in its CAL detent.
Rise Time		5.8 ns or less.
		Rise time is calculated from the formula:
		Rise Time = $\frac{0.35}{BW \text{ (in MHz)}}$
Bandwidth		Measured with a vertically centered 6-division reference signal from a 50- $\Omega$ source driving a $50_7\Omega$ coaxial cable that is terminated in $50~\Omega$ , both at the input connector and at the P6120 probe input, with the VOLTS/DIV Variable control in its CAL detent.
0°C to +40°C		
20 mV to 10 V per Division	Dc to at least 60 MHz.	
2 mV to 10 mV per Division	Dc to at least 50 MHz.	
+40°C to +50°C 2 mV to 10 V per Division	Dc to at least 50 MHz. <sup>a</sup>	
Chop Mode Repetition Rate		250 kHz ±30%.

### TRIGGER SYSTEM

A Trigger Sensitivity AUTO and NORM	0.4 division internal or 50 mV external to 2 MHz, increasing to 1.5 divisions internal or 250 mV external at 60 MHz.	External trigger signal from a 50- $\Omega$ source driving a 50- $\Omega$ coaxial cable that is terminated in 50 $\Omega$ at the input connector.  Will trigger on tv line sync components
AUTO Lowest Usable Frequency	20 Hz. <sup>a</sup>	in NORM only: ≥ 0.4 division internal or 50 mV p-p external.
TV FIELD	2.0 divisions of composite video or composite sync. <sup>a</sup>	
B Trigger Sensitivity Internal	0.4 division to 2 MHz, increasing to 2.0 divisions at 60 MHz.	
External Input  Maximum Input Voltage	400 V (dc + peak ac) or 800 V p-p ac at 1 kHz or less. <sup>a</sup>	
Input Resistance	1 MΩ ±2%. <sup>a</sup>	1
Input Capacitance	30 pF ±3 pF. <sup>a</sup>	1
AC Coupled	10 Hz or less at lower –3 dB point. <sup>a</sup>	7

<sup>&</sup>lt;sup>a</sup>Performance Requirement not checked in Service Manual.

owech usis			
Calibrated Range A Sweep	0.5 s per division to 0 in a 1-2-5 sequence. Sextends maximum sw per division.	X10 Magnifier	
B Sweep	50 ms per division to in a 1-2-5 sequence. Sextends maximum sw per division.	X10 Magnifier	
Accuracy	Unmagnified	Magnified	Sweep accuracy applies over the center
+20°C to +30°C	±3%	±5%	8 divisions. Exclude the first 25 ns of the sweep for both magnified and un-
0°C to +50°C	±4% <sup>a</sup>	±6% <sup>a</sup>	magnified sweep speeds and exclude anything beyond the 100th magnified division.
POSITION Control Range	Start of sweep to 100th division will position past the center vertical graticule line with X10 Magnifier.		
Variable Control Range	Continuously variable between calibrated settings. Extends both the A and B sweep speeds by at least a factor of 2.5.		
Delay Time  B DELAY TIME POSITION Control Range	Applies to sweep-speed settings of 0.5 μs per division and slower.  Less than 0.5 division to more than 10 divisions.		Delay time is functional but is not calibrated at sweep-speed settings above $0.5~\mu s$ per division.

<sup>&</sup>lt;sup>a</sup>Performance Requirement not checked in Service Manual.

0°C to +50°C	±6% <sup>a</sup>	±4% <sup>a</sup>		
Bandwidth	Dc to at least 2 MHz.		Measured with a 5-division reference	
X-Axis			signal.	
Y-Axis	Same as Vertical Deflection System.			
Phase Difference Between X- and Y-Axis Amplifiers	±3° from dc to 50 kHz.ª		With dc-coupled inputs.	
	PROE	BE ADJUST		
Signal at PROBE ADJUST Jack Voltage	0.5 V ±20%.			
Repetition Rate	1 kHz ±20%. <sup>a</sup>		1	
	Z-A)	KIS INPUT		
Sensitivity	5 V causes notices Positive-going inpi intensity.	able modulation. ut signal decreases		
Usable Frequency Range	Dc to 5 MHz.a			
Maximum Safe Input Voltage	30 V (dc + peak a 30 V p-p ac at 1 k			
Input Impedance	10 kΩ ±10%.a	, , , , , , , , , , , , , , , , , , , ,		

<sup>&</sup>lt;sup>a</sup>Performance Requirement not checked in Service Manual.

Table 1-2
Environmental Characteristics

Characteristics	Description		
	NOTE		
	The instrument meets all of the following MIL-T-28800B requirements for Class 5 equipment.		
Temperature			
Operating	0°C to +50°C (+32°F to +122°F).		
Nonoperating	-55°C to +75°C (-67°F to +167°F).		
Altitude			
Operating	To 4,500 m (15,000 ft). Maximum operating temperature decreased 1°C per 300 m (1,000 ft) above 1,500 m (5,000 ft).		
Nonoperating	To 15,000 m (50,000 ft).		
Humidity (Operating and Nonoperating)	5 cycles (120 hours) referenced to MIL-T-28800B, Class 5 instruments.		
Vibration (Operating)	15 minutes along each of 3 major axes at a total displacement of 0.015 inch p-p (2.4 g at 55 Hz), with frequency varied from 10 Hz to 55 Hz to 10 Hz in 1-minute sweeps. Hold for 10 minutes at 55 Hz. All major resonances must be above 55 Hz.		
Shock (Operating and Nonoperating)	30 g, half-sine, 11-ms duration; 3 shocks per axis each direction, for a total of 18 shocks.		

**1-6** @



without Front-Panel Cover	439 11111 (17.3 111).
With Handle Extended	511 mm (20.1 in).

### LINE VOLTAGE

The instrument is capable of continuous operation using ac-power-input voltages that range from 90 V to 250 V nominal at frequencies from 48 Hz to 62 Hz.

### POWER CORD

For the 120-V North American customer, the 2215 is delivered with a three-wire power cord permanently attached. At the end of the cord is a three-contact plug for connection to the power source and to protective ground. The plug's protective-ground contact connects (through the protective-ground conductor) to the accessible metal parts of the instrument. For electrical-shock protection, insert this plug only into a power-source outlet that has a securely grounded protective-ground contact.

### LINE FUSE

The instrument fuse holder is located on the rear panel (see Figure 2-2) and contains the line fuse. Verify that the proper fuse is installed by performing the following procedure:

- Unplug the power cord from the power-input source (if applicable).
- Press in and slightly rotate the fuse-holder cap counterclockwise to release it.
- 3. Pull out the cap from the fuse holder, with the fuse attached to the inside of the cap.
- Note fuse values and verify proper size (2 A, 250 V, fast-blow).
- 5. Reinstall the fuse and fuse-holder cap.

Figure 2-1. Power-input-voltage configurations.

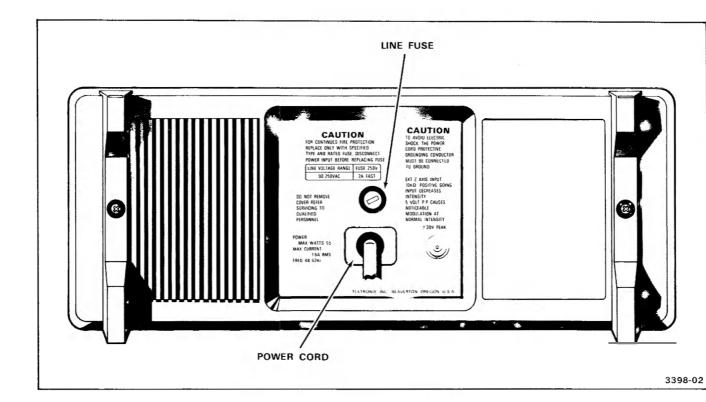


Figure 2-2. Line fuse and power cord.



3 AUTO FOCUS Control—Adjusts display for optimum definition. Once set, the focus of the crt display will

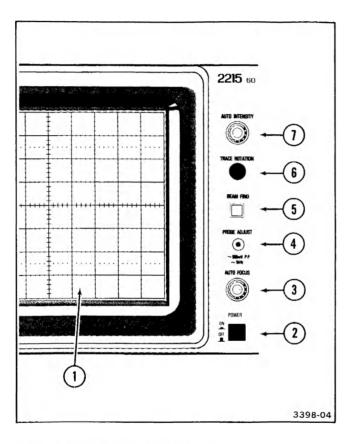


Figure 2-3. Power, display, and probe adjust controls, connector, and indicator.

- used to align the crt trace with the horizontal graticule lines.
- AUTO INTENSITY Control—Adjusts brightness of the crt display. This control has no effect when the BEAM FIND switch is pressed in. Once the control is set, intensity is automatically maintained at approximately the same level between SEC/DIV switch settings from 0.5 ms per division to 0.05  $\mu$ s per division.

# **VERTICAL**

Refer to Figure 2-4 for location of items 8 through 16.

- 8 SERIAL and Mod Slots—The SERIAL slot is imprinted with the instrument's serial number. The Mod slot contains the option number that has been installed in the instrument.
- 9 CH 1 OR X and CH 2 OR Y Connectors—Provide for application of external signals to the inputs of the vertical deflection system or for an X-Y display. In the X-Y mode, the signal connected to the CH 1 OR X connector provides horizontal deflection, and the signal connected to the CH 2 OR Y connector provides vertical deflection.
- (10) GND Connector—Provides direct connection to instrument chassis ground.



3398-05

Figure 2-4. Vertical controls and connectors.

Input Coupling (AC-GND-DC) Switches—Used to select the method of coupling input signals to the vertical deflection system.

AC—Input signal is capacitively coupled to the vertical amplifier. The dc component of the input signal is blocked. Low-frequency limit (-3 dB point) is approximately 10 Hz.

GND—The input of the vertical amplifier is grounded to provide a zero (ground) reference-voltage display (does not ground the input signal). This switch position allows precharging the input coupling capacitor.

DC-All frequency components of the input signal are coupled to the vertical deflection system.

(12) CH 1 VOLTS/DIV and CH 2 VOLTS/DIV Switches— Used to select the vertical deflection factor in a 1-2-5 sequence. To obtain a calibrated deflection factor, the VOLTS/DIV variable control must be in detent.

1X PROBE—Indicates the deflection factor selected when using either a 1X probe or a coaxial cable.

CH 1—Selects only the Channel 1 input signal for display.

BOTH—Selects both Channel 1 and Channel 2 input signals for display. The BOTH position must be selected for either ADD, ALT, or CHOP operation.

CH 2—Selects only the Channel 2 input signal for display.

ADD—Displays the algebraic sum of the Channel 1 and Channel 2 input signals.

ALT—Alternately displays Channel 1 and Channel 2 input signals. The alternation occurs during retrace at the end of each sweep. This mode is useful for viewing both input signals at sweep speeds from 0.05  $\mu$ s per division to 0.2 ms per division.

CHOP—The display switches between the Channel ·1 and Channel 2 input signals during the sweep. The switching rate is approximately 250 kHz. This mode is useful for viewing both Channel 1 and Channel 2 input signals at sweep speeds from 0.5 ms per division to 0.5 s per division.

(16) POSITION Controls—Used to vertically position the display on the crt. When the SEC/DIV switch is set to X-Y, the Channel 2 POSITION control moves the display vertically (Y-axis), and the Horizontal POSITION control moves the display horizontally (X-axis).

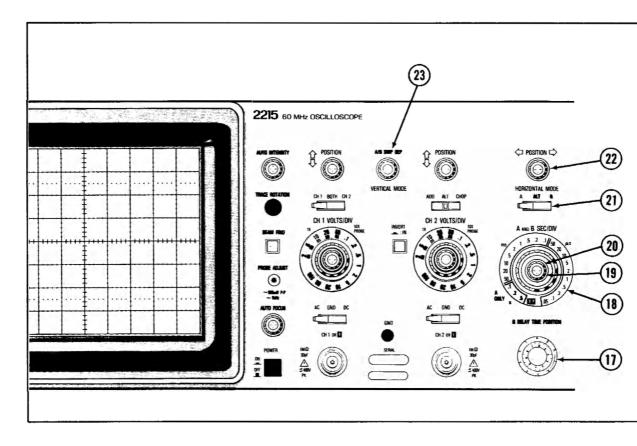


Figure 2-5. Horizontal controls.

3398-06

Sweep generator at a sweep speed determined by the setting of the B SEC/DIV switch. The start of the B Sweep is delayed from the start of the A Sweep by a time determined by the settings of both the A SEC/DIV switch and the B DELAY TIME POSITION control.

ALT—Alternates the horizontal displays between the A Sweep (with an intensified zone) and the B Delayed Sweep. The A Sweep speed is determined by the setting of the A SEC/DIV switch. The length of the intensified zone on the A Sweep (the B Sweep speed) is determined by the setting of the B SEC/DIV switch.

22 POSITION Control—Positions the display horizontally for the A Sweep and the B Sweep. In the X-Y mode, horizontally positions the X-axis.

23) A/B SWP SEP Control—Vertically positions the B Sweep trace with respect to the A Sweep trace when ALT HORIZONTAL MODE is selected.

signals.

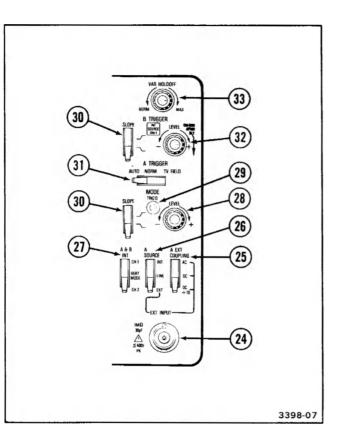


Figure 2-6. Trigger controls, connector, and indicator.

**EXT**—Permits triggering on signals applied to the EXT INPUT connector.

(27) A & B INT Switch—Selects the source of the triggering signal when the A SOURCE switch is set to INT.

CH 1—The signal applied to the CH 1 OR X input connector is the source of the trigger signal.

VERT MODE—The internal trigger source is determined by the signals selected for display by the VERTICAL MODE switches.

CH 2—The signal applied to the CH 2 OR Y input connector is the source of the trigger signal.

28) A TRIGGER LEVEL Control—Selects the amplitude point on the trigger signal at which the sweep is triggered.

repetition rates of at least 20 Hz. Sweep free-runs in the absence of an adquate trigger signal or when the repetition rate is below 20 Hz. The range of the A TRIGGER LEVEL control is automatically set to the peak-to-peak range of the trigger level.

NORM—Sweep is initiated when an adequate trigger signal is applied. In the absence of a trigger signal, no baseline trace will be present. Triggering on television lines is accomplished in this mode.

**TV FIELD**—Permits triggering on television field signals (refer to TV Signal Displays at the end of Section 2).

- 32 B TRIGGER LEVEL Control—Selects the amplitude point on the trigger signal at which the sweep is triggered. When fully clockwise (CW-RUN AFTER DLY), the B Sweep circuit runs immediately following the delay time selected by the A SEC/DIV switch and the B DELAY TIME POSITION control.
- VAR HOLDOFF Control—Provides continuous control of holdoff time between sweeps. Increases the holdoff time by at least a factor of four. This control improves the ability to trigger on aperiodic signals (such as complex digital waveforms).

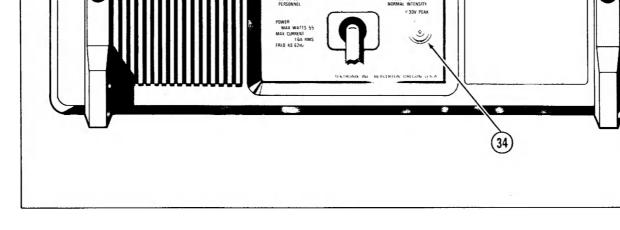


Figure 2-7. Rear-panel connector.



# GROUNDING

The most reliable signal measurements are made when the 2215 and the unit under test are connected by a common reference (ground lead), in addition to the signal lead or probe. The probe's ground lead provides the best grounding method for signal interconnection and ensures the maximum amount of signal-lead shielding in the probe cable. A separate ground lead can also be connected from the unit under test to the oscilloscope GND connector located on the front panel.

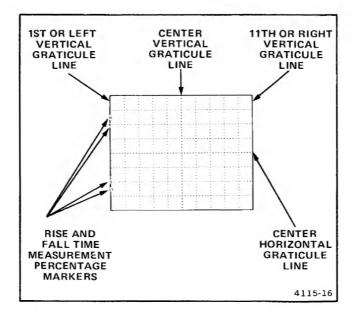


Figure 2-8. Graticule measurement markings.

# INPUT COUPLING CAPACITOR PRECHARGING

When the input coupling switch is set to GND, the input signal is connected to ground through the input coupling capacitor in series with a 1-M $\Omega$  resistor to form a precharging network. This network allows the input coupling capacitor to charge to the average dc-voltage level of the signal applied to the probe. Thus, any large voltage transients that may accidentally be generated will not be applied to the amplifier input when the input coupling switch is moved from GND to AC. The precharging network also provides a measure of protection to the external circuitry by reducing the current levels that can be drawn from the external circuitry during capacitor charging.

The following procedure should be used whenever the probe tip is connected to a signal source having a different dc level than that previously applied, especially if the dc-level difference is more than 10 times the VOLTS/DIV switch setting:

- 1. Set the AC-GND-DC switch to GND before connecting the probe tip to a signal source.
- 2. Insert the probe tip into the oscilloscope GND connector.

then plug the power cord into an approved ac-power-source outlet.

#### BASELINE TRACE

First obtain a baseline trace.

1. Preset the instrument front-panel controls as follows:

# Display

AUTO INTENSITY

Fully counterclockwise

(minimum)

**AUTO FOCUS** 

Midrange

#### Vertical (Both Channels)

AC-GND-DC

AC

VOLTS/DIV

50 m (1X) CAL detent

VOLTS/DIV Variable

(fully clockwise)

VERTICAL MODE

CH<sub>1</sub>

INVERT POSITION Off (button out)

Midrange

#### Horizontal

A and B SEC/DIV

A and B SEC/DIV

Variable

Locked together at 0.5 ms

CAL detent (fully clockwise)

HORIZONTAL MODE

X10 Magnifier POSITION

B DELAY TIME

**POSITION** 

A/B SWP SEP

Α Off (variable knob in)

Midrange

Fully counterclockwise

Midrange

A EXT COUPLING AC A SOURCE INT

A & B INT VERT MODE

# **B** Trigger

- 2. Press in the POWER switch button (ON) and allow the instrument to warm up for 20 minutes.
- 3. Adjust the AUTO INTENSITY control for desired display brightness.
- 4. Adjust the Vertical and Horizontal POSITION controls to center the trace on the screen.

### SIGNAL DISPLAY

- 1. Obtain a baseline trace.
- 2. Apply a signal to either vertical-channel input connector and set the VERTICAL MODE switch to display the channel used. To display two time-related input signals use both vertical-channel input connectors and select BOTH VERTICAL MODE; then select either ALT or CHOP, depending on the frequency of input signals.

### **MAGNIFIED-SWEEP DISPLAY**

- 1. Obtain a Signal Display (see preceding instructions).
- Adjust the Horizontal POSITION control to move the trace area that is to be magnified to the center of the crt graticule (0.5 division on each side of the center vertical graticule line). Change the A SEC/DIV switch setting as required.
- 3. Pull out the A and B SEC/DIV Variable knob (X10) to obtain sweep magnification.
- 4. Adjust the Horizontal POSITION control for precise positioning of the magnified display.
- To calculate the magnified sweep speed, divide the A SEC/DIV switch setting by 10.

#### **DELAYED-SWEEP DISPLAY**

- 1. Obtain a Signal Display.
- 2. Select ALT HORIZONTAL MODE. Adjust the appropriate channel POSITION control and the A/B SWP SEP control to display the A trace above the B trace.

SEP control to display the A trace above the B trace.

- 3. Adjust the AUTO INTENSITY control as needed to make the intensified zone distinguishable from the remainder of the display. Set the B SEC/DIV switch until the intensified zone is the desired length.
- 4. Adjust the B DELAY TIME POSITION control to move the intensified zone to the leading edge of the first pulse of interest; then fine adjust until the rising portion is centered at any convenient vertical graticule line.
- Record the B DELAY TIME POSITION control dial setting.
- 6. Adjust the B DELAY TIME POSITION control clockwise until the rising portion of the second pulse of interest is positioned to the same vertical reference line selected in step 4.
- 7. Record the B DELAY TIME POSITION control dial setting.
- 8. Use the following formula to calculate the time difference:

Time Difference = 
$$\begin{pmatrix} second & first \\ dial & - & dial \\ setting & setting \end{pmatrix}$$
  $\begin{pmatrix} A SEC/DIV \\ switch setting \\ (delay time) \end{pmatrix}$ 

The display obtained when sinusoidal signals are applied to the X- and Y-axis is called a Lissajous figure. This display is commonly used to compare the frequency and phase relationships of two input signals. The frequency relationship of the two input signals determines the pattern seen. The pattern will be stable only if a common divisor exists between the two frequencies.

#### TV SIGNAL DISPLAYS

Displaying a TV Line-rate Signal

- Perform the steps and set the controls as outlined under Baseline Trace and Signal Display to obtain a basic display of the desired TV signal.
- 2. Set A SEC/DIV to 10  $\mu$ s, and A & B INT to CH 1 or CH 2 as appropriate for applied signal.
- Set A TRIGGER SLOPE for a positive-going signal (lever up) if the applied TV signal sync pulses are positivegoing, or for a negative-going signal (lever down) if the TV sync pulses are negative-going.

the applied signal.

- Perform Step 3 and 4 under Displaying a TV Line-rate Signal.
- 4. To display either Field 1 or Field 2 individually at faster sweep rates (displays of less than one full field), set VERTI-CAL MODE to BOTH and ALT simulataneously. This synchronizes the Channel 1 display to one field and the Channel 2 display to the other field.

To change the field that is displayed, interrupt the triggering by repeatedly setting the AC GND DC switch to GND or disconnecting the signal from the applied signal input until the other field is displayed. To display both fields simultaneously, apply the input signal to both the CH 1 and CH 2 inputs via two probes, two cables, or through a dual-input coupler.

To examine either a TV Field-rate or Line-rate signal in more detail, either the X10 Magnifier or HORIZONTAL MODE functions may be employed as described for other signals elsewhere in this manual.

5. To display a selected horizontal line, first trigger the sweep on a vertical (field-rate) sync pulse, then use the delayed sweep to delay out to that line for close examination. This procedure is useful for examining VITS signals.

the interconnections between parts of the circuitry, to indicate circuit components, and to identify interrelationships with the front-panel controls.

Schematic diagrams and the overall block diagram are located in the tabbed "Diagrams" section at the back of this manual. The schematic diagram associated with each description is identified in the text and indicated on the tab of the appropriate foldout page by a numbered diamond symbol. For best understanding of the circuit being described, refer to both the appropriate schematic diagram and the functional block diagram.

convention. Positive logic is a system of notation whereby the more positive of two levels is the TRUE (or 1) state; the more negative level is the FALSE (or 0) state. In this logic description the TRUE state is referred to as HI, and the FALSE state is referred to as LO. The specific voltages which constitute a HI or a LO state vary between specific devices. For specific device characteristics, refer to the manufacturer's data book.

#### **Linear Devices**

The functioning of individual linear integrated circuit devices in this section use waveforms or other techniques such as voltage measurement and simplified diagrams to illustrate their operation.

charging prevents large trace shifts of the display when switching from GND to AC coupling.

Each channel output signal from the Attenuator circuitry is applied to the Vertical Preamplifier circuitry for further amplification. The Channel 2 Preamplifier includes an Invert feature that allows the operator to invert the Channel 2 signal display on the cathode-ray tube (crt). Trigger Pickoff Amplifiers in each channel supply an internal trigger signal from either channel signal or from both channels to the Internal Trigger Amplifier in the Trigger circuitry.

Each channel signal is selected for display in turn by the Channel Switching Logic circuit under control of the front-panel VERTICAL MODE switches. The output signal from the Channel Switching Logic circuit is applied to a Diode Gate circuit. The Diode Gate circuit switches either channel signal (or both signals for ADD) to a Delay Line Driver stage that supplies the proper drive and impedance match to the Delay Line. The Delay Line produces approximately 100 ns of delay in the vertical signal to allow the Horizontal circuitry time to produce the necessary sweep to display the signal.

Final amplification of the vertical signal is supplied by the Vertical Output Amplifier. The Vertical Output Amplifier supplies the required signal levels necessary to produce vertical deflection of the electron beam in the crt.

The A/B Sweep Separation circuitry supplies a dc-offset current to the Vertical Output signal which is used to

television-signal vertical-sync pulses. I riggering at the television line rate is accomplished when either AUTO or NORM MODE is used.

The Sweep Logic circuit controls the generation of the sweep and the unblanking of the Z-Axis Amplifier for the A Sweep display. When the A TRIGGER MODE switch is set to either AUTO or TV FIELD and no trigger signal is present, the Auto Baseline circuit causes the Sweep Logic circuit to produce a sweep after a period of time. In the NORM position of the A TRIGGER MODE switch the Auto Baseline circuit is disabled, and a sweep will not be generated until a triggering signal is received.

A gate signal produced by the A Sweep Logic circuit is applied to the A Miller Sweep circuit. This circuit produces a linear sweep output with a run-up time that is controlled by the A SEC/DIV switch. The sweep signal is applied to the Horizontal Preamplifier for initial amplification. Final amplification of the sweep signal to drive the crt horizontal deflection plates is provided by the Horizontal Output Amplifier.

The Horizontal Preamplifier gain is increased by a factor of 10 when the X10 Magnifier feature is used. Horizontal positioning of the display is also accomplished in the Horizontal Preamplifier circuit,

In the X-Y Mode of operation the CH 1 signal, via the Internal Trigger circuitry, is applied to the XY Amplifier where it is amplified for application to the Horizontal Preamplifier. In this operating mode, the CH 1 Internal

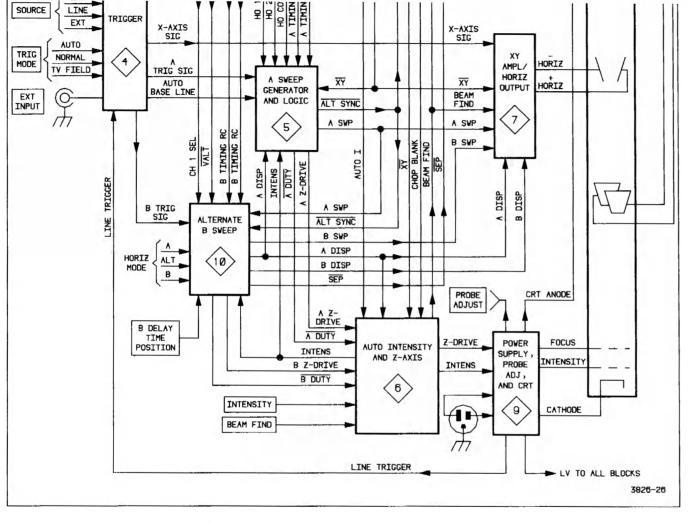


Figure 3-1. Basic block diagram of the 2215 Oscilloscope.

The DC Restoration circuit raises the output level of the Z-Axis Amplifier to allow it to be coupled to the crt control grid. Direct coupling is not employed due to the amplitude of the voltage levels applied to the crt elements.

A front-panel PROBE ADJUST output is provided for use in adjusting probe compensation. The voltage at the PROBE ADJUST connector is a negative-going square wave that has a peak-to-peak amplitude of approximately 0.5 V and a repetition rate of approximately 1 kHz.

# DETAILED CIRCUIT DESCRIPTION

#### **VERTICAL ATTENUATORS**

Both the Channel 1 and Channel 2 Attenuator circuits, shown in Diagram 1, are identical in operation. In the following discussion, only the Channel 1 Attenuator circuit is described. The matching components in the Channel 2 Attenuator circuit perform the same function.

The Attenuator circuit (see Figure 3-2) provides control of input coupling, vertical deflection factor, and variable volts-per-division balance. Input signals for crt vertical deflection may be connected to either or both the CH 1 OR X and the CH 2 OR Y input connectors. In the X-Y Mode of operation, the signal applied to the CH 1 OR X connector provides horizontal (X-Axis) deflection for the display, and the signal applied to the CH 2 OR Y connector provides the vertical (Y-Axis) deflection for the display.

# Input Coupling

The signal applied to the CH 1 OR X input connector can be ac-coupled, dc-coupled, or internally disconnected from the input of the High-Z Input Attenuator circuit. Signals applied to the CH 1 input connector are routed through resistor R101 to Input Coupling switch S101. When S101 is set for dc coupling, the CH 1 signal is applied directly to the input of the High-Z Attenuator stage. When ac-coupled, the input signal passes through R100 and dc-blocking capacitor C102. The blocking capacitor prevents the dc component of the input signal from being applied to the Attenuator circuit. When \$101 is set to GND, the direct signal path is opened and the input of the attenuator is connected to ground. This provides a ground reference without the need to disconnect the applied signal from the input connector. The coupling capacitor is allowed to precharge through R102, a high-resistance component, which is connected across Input Coupling switch S101 in the GND position.

X			∠ mv	X		
Х			5 mV		X	
Χ			10 mV			X
х			20 mV	X		
Х			50 mV		X	
Х			100 mV			X
	X		200 mV	X		
	×		500 mV		X	
	x		1 V			X
		Х	2 V	X		
		X	5 V		X	
		X	1Ø V			Х
	X X X	x x x x x x x x x	x x x x x x x x x	X	X X X 10 mV 10 mV X 20 mV X 50 mV X 100 mV X 50 mV X 100 mV X 50 mV X X X X 500 mV X 500 mV X X X X 500 mV X 500 mV X X X X 5 5 V	X X X 10 mV X 10 mV X X 20 mV X X X 100 mV X X 100 mV X X 100 mV X X X X X X X X X X X X X X X X X X

2 mV		X I
5 mV		X
10 mV		X
20 mV	Х	
50 mV	X	
100 mV	X	
200 mV	X	
500 mV	X	
1 V	X	
2 V	X	
5 V	X	
10 V	X	

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Figure 3-2. Detailed block diagram of the Channel 1 attenuator and attenuator switching tables.

#### High-Z Attenuator

The first section of attenuator switch S105A directs the input signal to one of three paths: directly through R103 (no attenuation); through a 10X attenuator consisting of C105, C107, R105, R106, R107, and R108; or through a 100X attenuator consisting of C111, C112, R110, R111, R112, R114, and R115. Medium-frequency normalization of the input capacitance is accomplished by C104 in the 10X attenuator and by C110 in the 100X attenuator. Switch S105B connects the appropriate attenuator output to the input of the Buffer Amplifier.

#### Buffer Amplifier and Low-Z Attenuator

The Buffer Amplifier presents a high-impedance, low-capacitance load to the input signal and delivers an accurate replica of that signal to a low-impedance buffer output circuit. The Low-Z output circuit is composed of a 250- $\Omega$ 

voltage-divider network (R139F through R139J) and the Volts/Div Var circuit (R141, C141, and R143). Switch S105B selects the appropriate output from the voltage divider. The Buffer Amplifier contains two paths: a slow path consisting of R116, R117, U120, and R119 in parallel with C119; and a fast path through C121. The signals through both paths are applied to the gate of Q122.

In the slow-path portion, the input signal is divided by ten by the combination of R117 and R116 and is then applied to U120 pin 3. The Buffer Amplifier output signal is also divided by ten by the combination of R139B, R139C, R139D, and R139N. Sufficient dc-gate bias for input FET Q122 is generated by the slow-path circuit to produce a null (zero difference) between pins 2 and 3 of U120. The closed-loop gain of the slow path is matched to the fast-path gain. If the average output voltage from the

about a 10-mA idle current.

A bootstrap circuit composed of Q139, VR122, and R122 connects the Q122 drain to the Q122 source. This circuit forces the bias voltage across Q122 to remain constant, which in conjunction with the constant bias current supplied by R125, keeps Q122 operating at a constant power level to prevent distortion due to changing signal currents.

Complementary emitter followers Q133 and Q134 supply drive current to the ÷1, ÷2.5, and ÷5 voltage dividers and provide impedance matching between input FET Q122 and the divider network. The bias levels of Q133 and Q134 are stabilized by emitter resistors R139A and R139E respectively. Average voltage changes occurring in the output of Q133 and Q134 are sensed through R139B and R139D which are connected to the point of lowest impedance (the emitters of Q133 and Q134). Resistor R139C provides a path that completes the feedback loop to the slow-path portion of the Buffer Amplifier.

# Volts/Div Var Circuit and X1/X10 Amplifier

The appropriate voltage divider signal output (÷1, ÷2.5, or ÷5) is selected by VOLTS/DIV switch S105B and routed to the Volts/Div Var circuit composed of C141, R141, and R143. Changes that occur in the Buffer Amplifier output impedance due to setting R141 or switching the divider output are sensed via R139M. These changes modify the slow-path feedback signal to cause U120 to again match the gain of both paths.

output stage for each channel. Vertical positioning of the channel display is incorporated in the common-base amplifier stage.

#### Channel 1 Vertical Preamplifier

The Channel 1 Vertical Preamplifier produces differential output signals to drive the Vertical Output Amplifier and internal trigger signals to drive the Trigger circuitry.

Differential signal current from the Attenuator circuitry is applied to common-base transistors Q157 and Q167 through cable-terminating resistors R151 and R161 respectively. The collector currents of Q157 and Q167 will flow through R158 and R168 to produce level-shifted signals which drive U170D and U170E. Balance potentiometer R154 is adjusted to balance the dc level of the Channel 1 output with the Channel 2 output by setting the bias levels of Q157 and Q167. Channel 1 frequency response is matched to Channel 2 response by adjusting C167.

Transistors U170D and U170E form a common-emitter amplifier. The gain of U170D and U170E is set by R180 (connected between the emitters), and the high-frequency response is compensated by C180. The emitters are also connected to the bases of U170C and U170B respectively to provide an internal trigger signal pickoff point. Vertical signal output current flows from the collectors of U170D and U170E to the emitters of common-base amplifiers Q177 and Q187. A shunt resistor gain network (R176 and R186) sets the gain of the common-base stage. Channel 1 POSITION control R190 supplies a variable offset current to the emitters of Q177 and Q187 which allows the trace

#### Internal Trigger Pickoff Amplifier

The Internal Trigger Pickoff Amplifier supplies trigger signals to the Internal Trigger Amplifier in the Trigger circuitry (Diagram 4). Internal trigger signals are provided by the vertical preamplifiers and are applied to the bases of U170B and U170C (for Channel 1) and U270B and U270C (for Channel 2). These transistor pairs are biased on, either individually or together, from the Internal Trigger Switching Logic circuit (Diagram 3).

When Channel 1 is the selected internal trigger source, Q173 and U170A (CH 1) will be biased on and Q273 (CH 2) biased off. Current flowing through R173, R183, and R197 will bias on U197A to keep U197E cut off. Emitter current is supplied to U170A by U197D. In turn, U170A then supplies emitter current to U170B and U170C to enable the Channel 1 internal trigger signals to pass to the Internal Trigger Amplifier.

When Channel 2 is selected as the internal trigger source, Q273 and U270A will be biased on and Q173 biased off. Transistor U197A will remain on, and current supplied by U197D will supply emitter current to U270A. Then U270A in turn supplies the emitter current to U270B and U270C and enables the Channel 2 internal trigger signals to pass to the Internal Trigger Amplifier.

The actual signal source selected when the A TRIGGER A & B INT switch is set to VERT MODE depends on the setting of the VERTICAL MODE switches. If either CH 1 or CH 2 VERTICAL MODE is selected, the preceding discussion on Channel 1 or Channel 2 internal trigger signals applies. When the VERTICAL MODE switch is set

previously established settings (VERTICAL MODE to BOTH, A & B INT to VERT MODE, and A SOURCE to INT), the internal trigger-select signals alternate between channels. On one sweep the Channel 1 internal trigger will be selected as previously described. On the alternate sweep, Channel 2 internal trigger will be selected, again as previously described.

Under the same switch-setting conditions, selecting CHOP VERTICAL MODE produces the same trigger-selection conditions as described for ADD VERTICAL MODE. The sum of the Channel 1 and Channel 2 internal trigger signals will be passed to the Internal Trigger Amplifier. See the "Internal Trigger Switching Logic" discussion for a description of how the internal trigger selection signals are generated.

# CHANNEL SWITCH AND VERTICAL OUTPUT

The Channel Switch circuitry, shown on Diagram 3, selects the input signal or combination of input signals to be connected to the Vertical Output Amplifier. By setting the logic input into the Channel Switching Logic circuit, VERTICAL MODE switches S315 and S317 select the input signal combinations to be displayed. The internal trigger-select signals are also generated in the Channel Switch circuitry.

#### **Diode Gates**

The Diode Gates, consisting of eight diodes, act as switches that are controlled by the Channel Switching

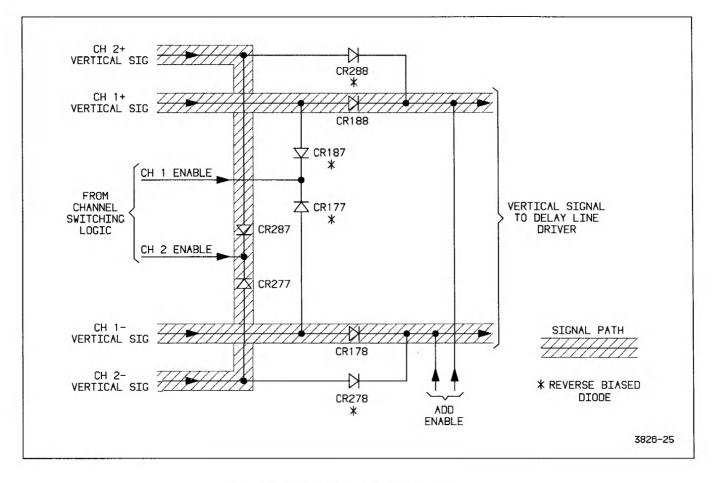


Figure 3-3. Diode gate biasing for a Channel 1 display.

#### **Delay Line**

Delay Line DL350 provides about 100 ns of delay in the vertical signal. When using internal triggering (CH 1, CH 2, or VERT MODE), the delay time allows the Sweep Generator sufficient time to produce a sweep before the vertical signal reaches the crt deflection plates. This feature permits viewing the leading edge of the internal signal that originates the trigger pulse.

#### Vertical Output Amplifier

The Vertical Output Amplifier, also shown on Diagram 3, provides final amplification of the input signals for application to the deflection plates of the crt. Signals from the Delay Line are applied to a differential amplifier input stage composed of Q350 and Q360. The Delay Line is terminated in the proper impedance by resistors R338 and R348. Resistor R355 sets the gain of Q350 and Q360. Thermal compensation of the stage gain is provided by thermistor RT356, connected in series with R356 across R355. The RC networks connected across R355 provide both low- and high-frequency compensation of the stage.

The differential output is applied to output transistor pairs Q376-Q377 and Q386-Q387. These transistors form a common-emitter shunt-feedback amplifier stage, with R376, R377, R386, and R387 serving as feedback elements. Capacitors C377 and C387, connected across R377 and R387 respectively, provide increasing negative feedback as the signal frequency rises to limit the amplifier bandwidth at the upper frequency limit. Output voltage from the amplifier is divided between the two transistors of each half. The signal voltage applied to the crt vertical deflection

display, Sep is LO and Q392 is biased off. This action allows A/B SWP SEP potentiometer R395 to affect the bias on one side of a differential amplifier composed of Q380 and Q370. The differential amplifier supplies a dc offset current to the Vertical Output signal that changes the position of the B trace on the crt face.

During the A trace portion of the Alternate Horizontal display, Sep is HI and Q392 is biased on. The base voltage on Q380 then equals the base voltage on Q370. With equal base voltages, the differential amplifier supplies equal current to both sides of the Vertical Output signal and no offset to the A trace occurs.

#### Channel Switching Logic Circuit

The Channel Switching Logic circuitry composed of U310A and U317A selects either Channel 1 or Channel 2 and various display modes for crt display via front-panel switches and the X-Y position of the A SEC/DIV switch.

When the instrument is not in the X-Y Mode, signal line XY is grounded through contacts on the A SEC/DIV switch (Diagram 8). This action establishes LO logic levels on pins C, B, and G of front-panel switch S317 (CH 1-BOTH-CH 2) and on pins C and B of S305 (A & B INT).

Switch S317 selects the vertical channel signal that drives the Delay Line Driver via the Channel Diode Gates. With S317 set to CH 1, a LO is applied to the Set input (pin 4) of U317A. Flip-flop U317A will then be set, and the Q output (pin 5) will be HI. Pin 5 of U317A is the CH 1 Enable signal line, and when it is HI, the Channel 1 vertical

algebraic sum of the two vertical signals.

The Add Enable circuit, composed of Q316, U197C, and U315A, is activated when both Diode Gates are turned on for an Add vertical display. With the Q and  $\overline{Q}$  outputs of U317A HI, the output of U315A will be LO and transistor Q316 is biased on. The collector of Q316 rises toward +5 V and U197C is biased on. Transistor U197C supplies the additional current required to keep both Diode Gates forward biased and to supply the proper dc level to the Delay Line Driver input. Bypass capacitor C316 prevents switching transients from being introduced into the Delay Line Driver by the Add Enable circuit.

When S315 is set to ALT, a HI is placed on both the Set and Reset inputs of U317A. Flip-flop U317A will transfer the logic level on the D input (pin 2) to the Q output (pin 5) on each clock-pulse rising edge. Pin 1 of NAND-gate U310A is held HI by the Chop Oscillator output, and pin 2 follows the Alt Sync signal produced by the Holdoff circuitry in the A Sweep Generator (Diagram 5). The output of U310A (pin 3) is therefore an inverted Alt Sync pulse. The signal on the D input of U317A (pin 2) follows the logic level set by the  $\overline{Q}$  output pin. As each clock pulse occurs, the states of the Q and  $\overline{Q}$  outputs reverse (toggle), enabling Channel 1 and Channel 2 Diode Gates alternately with each sweep.

CHOP OSCILLATOR. Setting S315 to CHOP enables the Chop Oscillator and the Chop Blanking circuit. Pins C and D of S315 are connected to place a LO logic level on

the chopped channel switching is about 250 kHz.

The signal output from U310C pin 8 is also fed to the Chop Blanking circuit. Capacitor C311 and resistors R310 and R311 form a differentiating circuit that produces positive and negative short-duration pulses when the Chop Oscillator signal changes levels.

The dc level at U310B pins 4 and 5 is set slightly above the HI switching threshold logic by a voltage divider consisting of R310 and R311. Positive pulses from C311 continue to hold U310B above the threshold level, so the output remains LO. Negative pulses from C311 drop below the threshold level of U310B, and the output of U310B switches HI for a duration of about 0.4  $\mu$ s (see Figure 3-4) to produce the positive Chop Blanking pulse. The Chop Blanking pulse is fed to the Z-Axis Amplifier and is used to prevent display of the transistions when switching between vertical channels.

#### Internal Trigger Switching Logic

Internal trigger-selection signals to the Trigger Pickoff Amplifier (Diagram 2) are produced in a logic circuit composed of U305B, U305C, U305D, U315B, and U315C. The A & B INT Trigger Source switch (S305), in conjunction with CH 1-BOTH-CH 2 switch (S317), determines the internal trigger source selected. When either the CH 1 or CH 2 Internal Trigger signal is selected by S305, the selected channel will be the internal trigger source. When VERT MODE is selected as the internal trigger signal, the position of S317 determines the channel(s) selected as the internal trigger source.

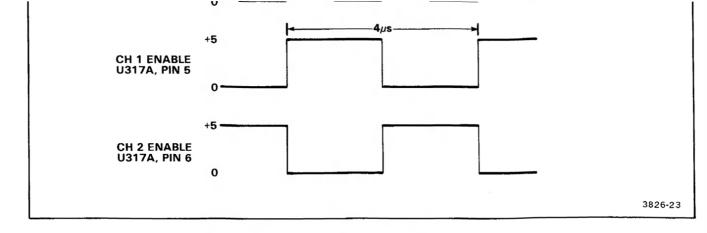


Figure 3-4. CHOP VERTICAL MODE waveforms.

CHANNEL 1 SOURCE. The XY signal line from the A SEC/DIV switch (S630B) applies a LO logic level to A & B INT switch S305 on pins B and C. In the CH 1 position, the LO is coupled from pin C to pin D and applied to U305B pin 4.

The LO is gated through U305B and applied to the CH 1
Trig signal line in a wired-AND connection. The LO from U305B is applied to Q273 in the Channel 2 Internal Trigger Pickoff Amplifier (Diagram 2) to bias it off, thus preventing the Channel 2 signal from being selected. Operation of the Internal Trigger Pickoff Amplifiers is discussed in the "Channel 1 and Channel 2 Preamps" circuit descriptions.

Concurrently, pins 9 and 10 of U305C are pulled HI through R304 and R300 respectively to place a HI at U305C pin 8. The HI from U305C to the wired-AND connection on the CH 2 Trig signal line enables the output of U315B to control the logic level of the CH 2 Trig signal. Control is accomplished by the logic levels on the inputs of U305D, pins 12 and 13.

The LO on U305B pin 4 (placed there by S305) also occurs on U305D pin 13. This ensures a LO at U305D pin 11, which is applied to U315C pin 9 and to U315B pin 5. The logic level applied to U315C pin 9 has no effect on the CH 1 Trig signal because a LO is already present at the wired-AND connection to the signal line. However, the

and 13 control the output of U315B. The LO on U305D pin 12 ensures a LO output at pin 11, which is applied to U315C at pin 9. This LO ensures a HI output at U315C pin 8, the CH 1 Trig signal line.

With the CH 1 Trig signal HI, Q273 in the Channel 2 Trigger Pickoff Amplifier is biased on and the Channel 2 signal is passed on to the Internal Trigger Amplifier.

VERT MODE SOURCE. Additional switch settings are involved in determining the internal trigger signal selection when VERT MODE Trigger Source is selected. Both the CH 1-BOTH-CH 2 and the ADD-ALT-CHOP VERTICAL MODE switches establish the vertical signal display and, as such, must also be used to obtain the internal vertical mode trigger signal.

When S305 is set to VERT MODE, the LO logic level on the XY signal line is removed from both U305B pin 4 and from U305D pins 12 and 13, pulling these inputs HI. In either ADD or ALT VERTICAL MODE, U305C pin 9 and U305B pin 5 are also pulled HI whenever a LO is not being applied from S315.

The input conditions just described for U305B, U305D, and U305C allow the logic levels on U315C pin 10 and U315B pin 4 to control the states of the CH 1 Trig and CH 2 Trig trigger-selection signals. Input signals to pins 10 and 4 are obtained from the Channel Enable signals present at pins 5 and 6 of Channel Switch U317A.

The sum of the two channel vertical signals is displayed, and the sum of the two channel trigger signals is used as the internal trigger signal.

Summation is accomplished by the HI logic levels from U317A pins 5 and 6 causing both the CH 1 Trig and CH 2 Trig signals to go LO. With the input transistors to both Trigger Pickoff Amplifiers biased off, additional circuitry within the Trigger Pickoff amplifiers biases on the pickoff transistors for both Channel 1 and Channel 2 (see the Channel 1 and Channel 2 Preamplifier circuit descriptions.

A CHOP VERTICAL MODE display also uses the sum of the two internal trigger signals, but the switching logic involved is different from the ADD VERTICAL MODE display. With S315 set to CHOP, a LO logic level is applied to U305B pin 5 and to U305C pin 9 from the XY signal line via contacts on S315, S317, and S305. The outputs of both U305C and U305B are LO and are applied to the wired-AND connection on the CH 1 Trig and CH 2 Trig signal lines. These LO signals override the outputs from U315C and U315B to hold the input transistors of both Channel 1 and Channel 2 Trigger Pickoff Amplifiers biased off. Channel 1 and Channel 2 Trigger signals are summed as described previously for the ADD VERTICAL MODE display.

X-Y MODE. When the A SEC/DIV switch is set to X-Y, the Channel 2 signal is selected as the input to the Vertical Output Amplifier to provide the X-Axis deflection. The Channel 1 Trigger signal provides the X-Axis signal to the XY Amplifier (Diagram 7) via the Internal Trigger

# TRIGGER

The Trigger circuit, shown on Diagram 4, is composed of the Internal and External Trigger Amplifiers, Sourceswitching circuit, and Trigger Generator circuit. Included in the Trigger Generator circuit is the Auto Trigger and Auto Baseline circuitry and the TV Triggering circuitry.

# Internal Trigger Amplifier

The Internal Trigger Amplifier converts the differential current input from the Trigger Pickoff circuit to a zeroreferenced, single-ended output for use by the A and B Trigger Level Comparators. Differential signals from the Pickoff Amplifier circuit are connected via R421 and R422 to common-base transistors U421E and U421D respectively. Transistor U421C and R428 constitute an invertingfeedback amplifier that converts U421D collector current to a voltage at the collector of U421C. This voltage is added in phase with the voltage drop across R427 produced by the signal current of U421E. The resulting sum is a singleended voltage signal that is applied to the base of emitterfollower U421A. The emitter-follower stage provides a low-output-impedance signal source that drives both the XY Amplifier (through R701) and the emitter-follower (U421B) and supplies the trigger signal to the Alternate B Sweep circuitry. The output signal from U421B is applied to the Trigger Source Switching Diode circuit at the cathode of CR440 where it is available for selection as the triggering signal.

## A External Trigger Amplifier

The A External Trigger Amplifier provides a means of triggering the instrument from an externally supplied signal that can be applied to the EXT INPUT connector. Input coupling to the Amplifier is selectable by the three-position A EXT COUPLING switch, S401. In the AC position, the dc component of the external trigger signal is blocked by coupling the signal through C402. In the DC position, all components of the signal are coupled directly to the gate of Q411A through an input divider composed of R404 and R408. Resistors R402 and R403 form a voltage-divider network that attenuates the signal by a factor of 10 whenever S401 is set to DC÷10.

Field-effect transistors Q411A and Q411B are a matched pair. Source-follower Q411A provides a high input impedance for the external trigger signal. Current-source transistor Q411B causes Q411A to operate at zero gate-to-source bias, so the device functions with no dc offset between the input and output signals. The output signal from the source of Q411A drives the base of emitter follower Q414. The emitter-follower stage lowers the output impedance of the Trigger Amplifier and functions as part of the Trigger Source Switching circuitry.

## **Auto Trigger Circuit**

When either AUTO or TV FIELD triggering is selected, the Auto Trigger circuit detects positive and negative peaks of the input trigger signal and produces output voltages that set the A TRIGGER LEVEL control range to within the peak-to-peak amplitude of the triggering signal. The peak detectors are disabled when S611 is set to NORM, and

voltage level. The charge is retained between trigger pulses due to the long RC time constant of R505 and C503. The comparator voltage is applied to U507A pin 3 which is a voltage follower and level shifter that sets the voltage at one end of the A TRIGGER LEVEL potentiometer (R455). Transistor Q507 provides the feedback path for U507A and thermally compensates for Q503. The base-to-emitter drop of Q507 corrects for the dc offset introduced by Q503, and potentiometer R511 is adjusted to balance out dc offsets introduced from the trigger circuitry.

The negative peak detector operates in the same manner as the positive peak detector, with corresponding components performing the identical circuit function on the trigger-signal negative peaks.

When S611 is set to NORM, +8.6 V is applied through the switch to R525 and R517. Transistor Q519 is biased into saturation by the positive voltage, and both CR503 and CR504 become forward biased. This action reverse biases peak detector transistors Q503 and Q504 to prevent the trigger signal from affecting the A TRIGGER LEVEL control range.

With CR503 and CR504 forward biased, the voltage divider network (R525, R527, R526, and R528) sets the input voltage to U507A pin 3 and U507B pin 5. A fixed positive output voltage from U507A pin 1 is applied to one end of R455, and a fixed negative output voltage from U507B pin 7 is applied to the other end of R455.

that will produce a trigger signal at the output of the Comparator. If the trigger signal amplitude at the base of U460E is below the reference level, the Schmitt Trigger circuit will never switch. If the trigger signal is above the reference level, the Schmitt Trigger circuit output will switch HI and remain HI until either the trigger signal is decreased or the reference dc level is increased.

The A TRIGGER SLOPE switch (S464) controls the bias on U460C and U460F. When set to the positive slope position, the ground is removed from the bottom end of R464, and the forward bias is then determined by the voltage divider formed by R462 and R463. Both U460C and U460F are biased into conduction and carry the signal current from the Comparator transistors. Moving the SLOPE switch to the negative slope position grounds the bottom of R464 and reduces the bias level of U460C and U460F. The fixed bias level on the bases of U460A and U460D is now higher than the bias on U460C and U460F so that U460A and U460D carry the signal current from the Comparator transitors. The collectors of U460A and U460D are cross connected to the collectors of U460F and U460C, so the resulting trigger signal output is inverted.

## Inverting Amplifier and TV Trigger Circuit

Current from one transistor of the conducting pair of transistors chosen by SLOPE switch S464 is applied to U480C pin 10. Current from the other side of the Comparator is applied to pin 14 at the output side of U480C through R468. Pin 11 of U480C is at a LO logic level except when TV FIELD triggering is enabled. This LO does not affect circuit operation in either AUTO or NORM triggering.

U460D causes a voltage drop that establishes the bias voltage on the base of Q474. Current flowing through R473 and R472 produces a voltage drop across R473 that establishes the bias voltage on the base of Q476. The circuit components are selected such that when the Comparator output voltages from both halves are equal, the base voltages to both Q474 and Q476 will be the same. With equal base voltages, each transistor will conduct an equal amount of current.

When the Comparator output becomes unbalanced, due to an input trigger signal, unequal biasing of Q474 and Q476 occurs. In response to a changing bias condition, the collector currents vary proportionally.

The collector current changes from Q474 are filtered by a network composed of C476, C477, R477, and R478. The filter network rejects TV video information and averages the TV horizontal-sync pulses. Setting the trigger-level threshold at near the center of the horizontal-sync-pulse swing establishes the untriggered level. When the TV vertical-sync block occurs, the output of the filter rises to a level that will cause the Schmitt Trigger circuit to switch. Precise TV field synchronization is obtained as a result of the filtering action.

The output signal from the filter is applied to U480B pin 6. The Schmitt Trigger circuit responds only to the TV sync signal because pin 7 is held LO by the output of U480C.

from U480D pins 9 and 15. The differential output signal derived from U480D is applied to a two-transistor level-shifting circuit composed of Q492 and Q493. The level-shifting circuit converts the ECL logic levels to TTL logic levels required for the Sweep Generator. A signal obtained from the collector of Q493 is used to drive the Auto Baseline circuit.

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#### **Auto Baseline Circuit**

The Auto Baseline circuit (composed of U640A, Q605, and associated components) is enabled in both AUTO and TV FIELD triggering modes. This circuit provides a signal to the Sweep Generator circuit (Diagram 5) that initiates a sweep if a triggering signal is not received by the Schmitt Trigger circuit within a period of about 100 ms. A second output from the circuit illuminates the TRIG'D LED on the instrument front panel when the sweep is triggered.

When adequate triggering signals are being received, the output of Q493 is applied to pin 5 of monostable multivibrator U640A. The negative-going edge of the signal causes pin 6 of U640A to switch HI. The HI forward biases CR615, and Q605 is then biased into conduction. With Q605 conducting, the Auto Baseline signal line is held LO to prevent the Sweep Generator circuit from free running.

The amount of time that pin 6 of U640A stays HI without receiving an input signal is determined by timing components R614 and C614. If a trigger signal is not received in about 100 ms, pin 6 of U640A will go LO and Q605 will be biased off. The Auto Baseline signal line then

by the Horizontal Amplifier to provide horizontal deflection on the crt. This sawtooth voltage (sweep) is produced on command from the Sweep Logic circuits. The Sweep Generator circuits also produce gate waveforms that are used by the Auto Intensity and Z-Axis circuits to establish the correct timing of the crt unblanking and intensity levels used for viewing the display. See Figure 3-5 for the A Sweep timing diagram.

The Sweep Logic circuitry controls the holdoff time, starts the sweep upon reception of a trigger signal, and terminates the sweep at the proper sweep level. When using AUTO or TV FIELD triggering, the Sweep Logic circuitry will cause the Sweep Generator to free run, producing a baseline trace if a trigger signal is not received within the predetermined time period.

## Miller Sweep Generator

The Miller Sweep circuit is composed of Q630A, Q630B, Q631, and associated timing components. The circuit operates to hold the charging current to the timing capacitor at a constant value. When a capacitor is charged in this manner, the rise of voltage across the capacitor is linear rather than exponential.

Field-effect transistors Q630A and Q630B are matched devices. As such, the I<sub>DSS</sub> (drain current with gate-to-source shorted) characteristics of each are nearly identical. FET Q630B acts as a source-current supply for Q630A and holds the gate-to-source voltage of Q630B at zero volts.

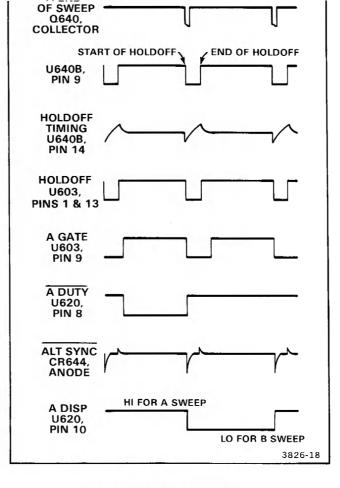


Figure 3-5. A Sweep timing diagram.

Logic circuit is prevented from responding to a trigger signal during this time by the Holdoff circuit. The end of sweep (and start of the holdoff period) is determined by the A End-of-Sweep Comparator (Q640).

The A Sweep ramp waveform is applied to the base of  $\Omega640$  through both a voltage divider and a biasing network composed of R637, R638, and C637. When the ramp amplitude reaches the threshold level of  $\Omega640$ , the collector of  $\Omega640$  goes LO, and a LO is placed on both U6408 pin 11 and U607C pin 10. The output of U607C goes HI, and the positive feedback supplied to the base of  $\Omega640$  through R639 speeds up the change of state of  $\Omega640$ . By reinforcing the switching action of  $\Omega640$  in this manner, noise occurring at the threshold level of  $\Omega640$  is overridden.

The sweep holdoff period commences when the LO from Q640 is applied to pin 11 of monostable multivibrator U640B. The  $\overline{\Omega}$  output on pin 9 goes LO and remains LO for a length of time determined by the RC timing components connected between pins 14 and 15 of U640B.

Holdoff time can be varied from the normal period by using VAR HOLDOFF control R647. Potentiometer R647 and a voltage divider composed of R645 and R646 establish the charging voltage of holdoff timing capacitors C645, C646, and C647. The capacitor (or combination of capacitors) used is switched into the holdoff circuit by contacts on S630B, the A SEC/DIV timing switch.

When the timing capacitor is charged up to the reset threshold of U640B, the holdoff time elapses, and U640B switches back to the stable state to place a HI on the  $\overline{\Omega}$  output (pin 9). The A End-of-Sweep Comparator output on U607C previously became HI when the Miller Sweep Generator finished resetting. With both inputs of U607C now HI, the output on pin 8 is LO. This LO is inverted to a HI by U607B and applied to both U603A and U603B to remove the reset condition. The  $\Omega$  output of U603B at pin 9 will remain LO when the reset is removed, while the  $\Omega$  output on U603A (pin 5) will depend on the state of the Set input when the reset is removed.

If the Set input to U603A is HI when the reset is removed, the Q output will be LO. However, if the Set input is LO, the Q output on U603A will be HI prior to the reset removal, and it will remain HI after the reset is removed. If the Set input of U603A was HI when the reset was removed, the triggering signal will make a negative transistion to set U603A before U603B is clocked, since U603B clocks only on positive transitions.

In either case (with the Set input either HI or LO when the holdoff period ends), the Q output of U603A will be HI as U603B is clocked by the first positive transition of the trigger signal after holdoff ends. The HI output present on the D input of U603B (pin 12) is then transferred to the Q output (pin 9), where it is applied to one input of each AND-gate contained in Sweep Logic Gate U620.

When the A Sweep is to be displayed, the signals at U620 pins 9 and 10 are both HI and U620 pin 8 is LO. The LO reverse biases CR620, and the Intens Level current from the Auto Intensity circuit (Diagram 6) passes through CR622 as the A Z-Drive signal. During B Sweep displays, the A Disp signal on U620 pin 10 is held LO and the signal on U620 pin 8 is HI. Diode CR620 becomes forward biased, reverse biasing CR622, and the Intens Level current is prevented from flowing through CR622 to the Z-Drive signal line. With the A Z-Drive signal shut off, the A Sweep display is blanked, and Z-Drive current is supplied by the B Z-Axis Logic circuit (Diagram 10).

AUTO BASELINE SWEEP. This feature causes an automatic sweep to be generated after about 100 ms if no trigger signals are received. Generation of the Auto Baseline signal was discussed previously in this section. The Auto Baseline signal is LO either when trigger signals are being received or when the circuit is disabled by using NORM triggering.

The Auto Baseline signal is applied to pin 1 of NAND-gate U607A, while the Holdoff Gate signal is applied to U607A pin 2. As long as the Auto Baseline signal remains LO, the output of U607A on pin 3 will be HI and will not affect the Set input of U603B. When the Auto Baseline signal goes HI in the absence of triggers (using either AUTO or TV FIELD triggering), the output of U607A is an inverted Holdoff Gate signal.

During holdoff, the output of the Holdoff Gate is a LO and places a reset on both U603A and U603B. The reset causes the Q output of U603B to be LO. At the end of the

voltage at one end of C644 at about 3 V, while the  $\overline{\Omega}$  output of U640B at pin 9 is HI. When the  $\overline{\Omega}$  output of U640B goes LO at the start of the holdoff period, C644 couples the negative-going edge of the pulse to the Alt Sync signal line.

Capacitor C644 charges rapidly to the new voltage difference through R642 to produce a very narrow pulse output across R642. When the holdoff period ends, the  $\overline{Q}$  output of U640B goes HI again and C644 charges in the opposite direction through VR644. The positive-going edge of the differentiated holdoff pulse is very small in amplitude and does not affect the circuitry to which the Alt Sync signal is applied.

The Alt Sync signal is fed to two places: the Alternate Sweep circuit and the Channel Switching circuit. It is used to synchronize the horizontal display with channel switching transitions when using ALT VERTICAL MODE and to alternately switch between the A and B Sweeps when using ALT HORIZONTAL MODE.

#### ALTERNATE B SWEEP

The Alternate B Sweep circuitry, shown on Diagram 10, produces the B sawtooth voltage that is amplified by the Horizontal Amplifier to provide the B Sweep horizontal deflection on the crt. The Alternate B Sweep circuitry also produces the sweep-switching signals, that control the display of the A and B Sweeps, and the gate waveforms used by the Auto Intensity and Z-Axis circuits to establish

If the B TRIGGER LEVEL control is not fully clockwise, Q573 is biased on, and the output of U690A is LO. Pin 10 of U665C will then be LO and, with the inverting by U690B, U696A will not be held reset. Operation of the B Sweep Logic circuitry under both of these input conditions is described in the "B Sweep Logic" discussion.

## **B Delay Time Position Comparator**

The B Delay Time Position Comparator circuit compares the amplitude of the A Sweep sawtooth voltage waveform with the dc voltage level set by the B DELAY TIME POSITION potentiometer (R658). The output of the comparator is used to initiate a B Sweep and to control the B Z-Axis Logic circuit switching.

Transistors U648A and U648B form the Comparator, and U648C acts as a current source for the Comparator. Wiper voltage from the B DELAY TIME POSITION potentiometer is applied to one input of the Comparator at the base of U648A (pin 1). The A Sweep sawtooth voltage is applied to the other Comparator input through a voltage divider composed of R653, R654, and R655. The divider establishes the portion of the sawtooth voltage amplitude that is applied to the base of U648B at pin 5. Delay Dial Gain potentiometer R654 is adjusted in conjunction with Delay Dial Start potentiometer R659 to set the B DELAY TIME POSITION dial accuracy.

Normally U648A in the Comparator is biased on by the dc level set by potentiometer R658, and U648B is biased off. When the sawtooth voltage amplitude at the base of U648B reaches the dc voltage level set by R658 on the base

## **B Sweep Logic**

The B Sweep Logic circuitry utilizes inputs from the associated B Sweep circuitry to generate a signal controlling both the B Miller Sweep and the B Z-Axis Switching Logic circuits.

In the RUN AFTER DELAY mode (R557 fully clockwise). U696A is held reset by U690B to place a HI on U665B pin 5, and U665C pin 10 is HI. The output of U665B, when LO, will enable the B Miller Sweep, and when HI, will disable the B Miller Sweep. The flip-flop composed of U665A and U665D will determine the output level of U665B through U665C. Input signals to the flip-flop come from the Delay Time Position circuitry (at U665D, pin 13). and from the ANDed output of the Alt Sync signal and the B End-of-Sweep Comparator circuitry (at U665A, pin 1). As long as the input to U665D pin 13 is HI, a B Sweep will not be generated. When U665D pin 13 goes LO, the output at pin 11 will go HI. If Alt Sync (applied to U693A pin 2) is also HI, U665A pin 3 will go LO and initiate a B Sweep through U665C and U665B. The sweep will run until either Alt Sync goes LO or the sweep output biases on the B Endof-Sweep Comparator transistor (Q690). In either case, the output of U693A will go LO, resetting the flip-flop and disabling the B Miller Sweep by setting the B Gate signal at U665B pin 6 HI.

When not in the RUN AFTER DELAY mode, U696A is not held reset (pin 1 is HI), and U665C pin 10 is LO. The output of U665D is LO, holding U696A in the set state to place a LO on U665B pin 5. The B Sweep is initiated on the

allowing only the A Sweep to be passed to the Horizontal Amplifier. In B HORIZONTAL MODE, U696B pin 10 is HI and pin 13 is LO, holding U696B reset and allowing only the B Sweep to go to the Horizontal Amplifier.

With S650 set to ALT and the CH 1-BOTH-CH 2 VER-TICAL MODE switch set to CH 1, all of the following pins are HI: U670D pin 13, U690D pin 9, U690E pin 11, and U670A pin 2. The resulting LOs applied to the inputs of U693D from the outputs of U690D and U690E cause the output of U693D (pin 11) to be LO. This LO is inverted by U690F, causing pin 10 of U693C to be HI. Since U696B is not held either set or reset (pins 10 and 13 are both HI). the output state will reverse (toggle) whenever a clock pulse is received on pin 11. Negative-going transistions of the Alt Sync signal will cause the output of U670D to go HI, which transfers through U693C, clocking U696B. With each Alt Sync pulse, the outputs of U696B will toggle to alternately enable the A and B Sweeps to reach the Horizontal Amplifier. For the CH 2 position of the VERTICAL MODE switch, circuit operation is the same except that U690E pin 11 is LO. Whenever the B Sweep is selected for the Horizontal Amplifier, U696B pin 8 will be HI. This HI is applied to U670A pin 1, and since pin 2 is also HI, output pin 3 (Sep) will go LO to enable the A/B Sweep Separation circuitry (Diagram 3).

When the VERTICAL MODE CH 1-BOTH-CH 2 switch is set to BOTH, the ADD-ALT-CHOP switch becomes functional. In the VERTICAL MODE ALT position, the following conditions are present: the Valt signal is LO, the Halt signal is HI, and the CH 1 Sel signal is a TTL square wave that switches states at the end of the A Sweep.

## **B Z-Axis Logic**

The B Z-Axis Switching Logic circuitry switches the B Z-Drive signal to supply current to the Z-Axis Amplifier for both the B and the A Intensified Sweep displays. The current supplied is summed with the other signal inputs on the Z-Drive line to produce the complete display intensity level. Figure 3-6 is a simplified diagram of the Z-Axis Switching Logic that includes the A Z-Axis Switching Logic circuit.

When HORIZONTAL MODE switch S650 is in the ALT position, pin 5 of U693B is HI. If the outputs of U696B are set for an A display (Q HI and Q LO), then the outputs of U693B and U670B will both be HI. The B Duty signal will therefore be HI, and the B Z-Drive current through R671 (Intens Level from the Auto Intensity circuit, Diagram 6) will be switched off of the Z-Drive line by reverse-biased diode CR671. Z-Drive current will be supplied by the A Z-Axis Logic circuit during this time. When the output of the B Sweep Logic circuit is currently enabling a B Sweep, then the output of U670C will be LO and CR672 will be forward biased. This will enable current from R672 to reach the Z-Drive line where it adds to the A Z-Drive current to produce an intensified A Sweep display. Should a B Sweep not be running, then the output of U670C will be HI, and current from R672 will be prevented from reaching the Z-Drive line by reverse biasing CR672.

If the outputs of U696B are set for a B display (Q LO and  $\overline{Q}$  HI), then the output of U693B will be LO, causing the output of U670C to be HI. This will forward bias CR669 and reverse bias CR672 to prevent the B Z-Drive

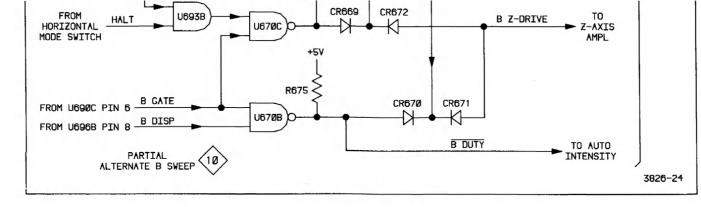


Figure 3-6. Simplified diagram of the Z-Axis Switching Logic circuit.

current (for intensifying the A Sweep) from reaching the Z-Drive line. While a B Sweep is not running, pin 5 of U670B will be LO. Output pin 6 will then be HI, forward biasing CR670 and reverse biasing CR671 to switch off B Z-Drive current from R671 to the Z-Drive line. However, when a B Sweep is enabled, the output of U670B will be LO, thereby forward biasing CR671 to pass current from R671 to the Z-Drive line for a B Sweep display.

## AUTO INTENSITY AND Z-AXIS AMPLIFIER

#### **Auto Intensity**

The purpose of the Auto Intensity circuit, shown in Diagram 6, is to keep the intensity of the trace on the crt at a constant level with changing sweep speeds and trigger

effect by increasing the Z-Axis Drive voltage for low A Sweep duty factors. The elements of the Auto Intensity circuit consist of four blocks: the duty-cycle averager, the boost-factor converter, the intensity-control multiplier, and the crt triode compensation circuit. The duty-cycle averager consists of an electronic switching circuit composed of U825A, U825B, and U825C. The A Duty signal that is applied to U825B pin 11 causes the output voltage at pin 14 to be switched between ground and +5 V. The output voltage is averaged by R821 and C821. The B Sweep duty-cycle averager operates in an identical manner as the A Sweep duty-cycle averager. The B Duty signal is connected to U825 pin 10 and is averaged by R825 and C825. Bilateral switch U825C, under control of the A Disp signal from the Alternate Display Switching Logic circuit

signal repetition rates. In conventional oscilloscopes, as

the duty cycle of the displayed trace changes, the intensity

will vary. The Auto Intensity circuit compensates for this

The nonlinear current is connected to the emitters of the differential amplifier composed of Q811 and Q812. The emitters of the two amplifier transistors are held at a constant voltage by the action of Q813. AUTO INTENSITY control R807 is connected to the base of Q811 via R811. It controls the portion of the boost current that goes to the summing junction of U835B. Boost current is proportional to the true beam current required at the faceplate of the crt.

The crt triode compensation circuit is an inverting operational amplifier with nonlinear feedback. It is composed of U835B, R834, R835, C834, and CR834. Output voltage of the circuit changes in response to the input current in a manner that complements the nonlinear triode characteristics of the crt. This output voltage is applied both to the Intens Level signal line and to the Z-Axis Amplifier via the A and B Z-Axis Logic Switching circuits. The Intens Level signal is also applied to the Focus circuit (Diagram 9) for use in focus tracking of the intensity level changes.

The intensity of the display is allowed to reduce to zero through the action of CR809, VR809, and R809. Without this circuit, the Auto Intensity circuit would not allow the intensity to go to zero when the AUTO INTENSITY control is set to minimum intensity.

## **Z-Axis Amplifier**

The Z-Axis Amplifier controls the crt intensity level via several input-signal sources. The effect of these input

as well as for dc and low-frequency signal components, Q847 acts as the amplifier, with Q850 supplying the current.

Diode CR856 prevents the Z-Axis output signal from going negative, and neon lamps DS854 and DS856 provide protection to the Z-Axis Amplifier in the event of high-voltage arcing in the crt.

The amplifier gain with respect to the A or B Z-Drive current is set to about 10 by the negative feedback supplied from the collectors of Q847 and Q850 to the base of Q845 via feedback resistor R846. The gain with respect to the external Z-Axis Input signal is held to about three by R801, R802, and R803 in series with the external input signal. Diodes CR801 and CR802 provide protection for the Z-Axis Amplifier in case of an accidental application of excessive signal amplitude to the Z-AXIS INPUT connector.

When CHOP VERTICAL MODE is selected, the Chop Blank signal is applied to the collector of Q841 during the display switching time. Signal current is shunted away from CR844, and the forward bias of Q844 increases to the blanking level. When blanked, the output of the Z-Axis Amplifier drops to about +10 V, and the crt beam current is reduced to below viewing intensity to eliminate chop switching transients from the display.

For an X-Y display, the A Z-Drive and B Z-Drive signal currents are switched off. When the XY signal is LO, CR837 is forward biased and Intens Level current flows

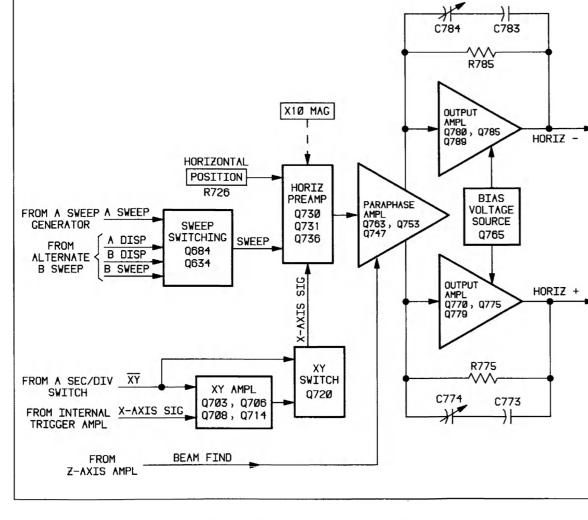


Figure 3-7. Detailed block diagram of the Horizontal Amplifier.

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the B Disp signal applied to the base of Q634 becomes HI. Switching transistor Q634 is biased on, and the A Sweep current is shunted to ground. The B Sweep current passes to the input summing junction to be added to the horizontal positioning current. The B Gain potentiometer (R682) is adjusted to provide the same gain for the B Sweep signal as for the A Sweep signal.

ALT HORIZONTAL DISPLAY. The A Disp and B Disp signals are switched at the alternate sweep rate by the Alternate Sweep Switching Logic circuit. When both vertical channels are being viewed simultaneously, the intensified traces of both Channel 1 and Channel 2 are first displayed, then both alternate B traces are displayed.

## Horizontal Preamplifier

The sum of the sweep and positioning current is applied to the input of one side of a differential amplifier composed of Q730 and Q731. For all conditions other than the X-Y Mode, XY Switch transistor Q720 is biased on to provide a ground reference at the other input of the differential amplifier (at the base of Q731). The output of the differential amplifier, taken from the collector of Q731, is amplified by Q736.

A feedback network connected between the output of Q736 and the base of Q730 provides the circuitry required for the X10 magnification feature. In the unmagnified mode, X10 Magnifier switch S734 is closed and the feedback is provided by the paralleled combination of R732 and C732. Resistor R732 sets the unmagnified amplifier gain and C732 provides the HF compensation.

The X-Axis signal is derived from the Channel 1 internal trigger signal and applied to the base of Q703. Transistor Q703 is one-half of a differential amplifier composed of Q703 and Q706. The base of Q706 is referenced to ground through R706. Transistor Q708 amplifies the output signal from the collector of Q706 and applies it to the drain of FET Q714. A feedback network composed of R709, R708, and C708 is connected between the collector of Q708 and the base of Q703. The feedback network sets the overall gain of the XY Amplifier, with X-Gain potentiometer R709 adjustable to obtain the exact gain required.

The X-Axis signal passes through FET Q714 and is applied to the base of Q731 in the Horizontal Preamplifier. Horizontal positioning current on the base of Q730 is added to the X-Axis signal by the action of the differential amplifier. Then the sum of these two currents is amplified by Q736 and applied to the input of the Horizontal Output Amplifier.

## Horizontal Output Amplifier

The Horizontal Output Amplifier converts the singleended output of the Preamplifier into the differential output required to drive the crt horizontal deflection plates. The output stage consists of an input paraphase amplifier and an output complementary amplifier.

Horizontal signal voltage from Q736 is applied to the base of Q763. The base of the other transistor (Q753) in the paraphase amplifier, is biased through a voltage divider composed of R758, R757, and R756. Horizontal centering between the X1 and X10 Magnified sweeps is accomplished by adjusting Mag Registration potentiometer R758.

Transistors Q780 and Q785 form a cascode feedback amplifier. Gain of the stage is set by feedback resistor R785, and high-speed compensation is provided by C783 and adjustable capacitor C784. For dc and low-frequency components of the horizontal deflection signal, Q789 acts as a current source for Q785. High-frequency components of the signal are coupled through C789 to the emitter of Q789 to speed up the output response time.

Emitter voltage for both Q780 and Q770 is supplied by a circuit composed of Q765 and associated components. The emitter voltage is maintained at a level that provides proper biasing for Q763 and Q753. Diodes CR770 and CR780 set up an emitter-bias difference between Q780 and Q770, causing the base voltage of both transistors to be equal.

## POWER SUPPLY

The Power Supply circuits provide all the low and high voltages required for operation of the instrument. The circuitry shown in Diagram 9 converts the ac-source voltage to the required levels through the action of a switching power supply. It does not have a primary power transformer.

## **Power Input**

The Power switch (S901) connects the line voltage to the instrument through line fuse F901 and transient suppressor VR901. Suppressor VR901 protects the instrument

THE 1990 CHARLESTON OFFICER COMPOSED OF GOOD, GOOD, and associated components provides overcurrent protection in the event of triac misfiring or ac-power-source transients. Transistor Q938 is an insulated-gate FET used as a switch in the charging path of C937. Transistor Q933 controls the FET bias to limit the current under abnormal firing conditions of Q925. In normal power-supply operation, the voltage developed across R937 is not sufficient to bias Q933 into conduction. The gate-to-source voltage of Q938 is set to 10 V by VR934 and R938, so the FET presents a low resistance to the charging current to C937. If triac Q925 should misfire to cause excessive current, Q933 becomes forward biased and Q938 is switched off to reduce the current. When Q938 switches off, the current that was flowing through Q938 flows through R939. The voltage drop developed across R939 causes current to flow through VR933 and R933, which holds Q933 on for most of the remainder of the ac-power-source input cycle. Resistor R939 limits the rate of collapse of the field around L925 to prevent damage to Q938. Thermistor RT935 adjusts the bias of Q933 over varying ambient temperature.

PREREGULATOR CONTROL. The ac-source voltage is full-wave rectified by CR903 through CR906 and applied to a voltage divider composed of R911, R912, and R915. Output from this divider serves as a reference voltage for a ramp-and-pedestal comparator utilizing a programmable unijunction transistor (PUT), Q921. Capacitor C912 filters the line noise to prevent false triggering of the PUT. Voltage-dropping resistor R914 provides current for zener diodes VR914 and VR915 to produce constant voltages during each half of the ac-power-source cycle.

When the instrument is first turned on, C917 is not charged. Capacitor C915 charges through CR917 to the

conduction angle of Q925.

The Preregulator circuit can handle a wide range of input voltages by changing the conduction angle of the triac as the input voltage changes. As the input voltage increases, the conduction angle will decrease to maintain the Preregulator output voltage at a constant level. The voltage divider composed of R911, R912, and R915 produces an output voltage proportional to the input line voltage that is applied to the gate of Q921. Since VR914 and VR915 hold bias levels on Q918 constant regardless of input voltage, the point on the cycle at which Q921 fires will vary with changes in the ac-source voltage. This feedforward, together with the feedback from the Inverter through optical isolator U931, ensures a constant Preregulator output to the Inverter.

#### Inverter

The Inverter circuit changes the dc voltage from the Preregulator to ac for use by the supplies that are connected to the secondaries of T940.

The output of the Preregulator circuit is applied to the center tap of T940. Power-switching transistors Q940 and Q942 alternate conducting current through R941 from the primary circuit common to the Preregulator output line. The transistor switching action is controlled by T942, a saturating base-drive transformer.

When the instrument is first turned on, one of the switching transistors will start to conduct and the collector

with the voltage on the wiper of potentiometer R946. The current through Q954 will set the base drive of Q956 and thereby control the voltage on C957. This voltage will bias Q940 and Q942 to a level that will maintain the peak-to-peak input voltage of T940. The amplitude of the voltage across the transformer primary winding and thus, that of the secondary voltages of T940, is set by adjusting —8.6 V Adj potentiometer R946.

At turn on, Q948 is biased off and Q954 is biased on. All the current of the error amplifier will therefore go through Q954 to bias on Q956. Diode CR956 allows the base of Q956 to go positive enough to initially turn on Q940 or Q942. The current through Q956 controls the base drive for Q940 and Q942. Base current provided by base-drive transformer T942 will charge C957 negative with respect to the Inverter circuit floating ground (common) level.

Voltage from CR940 and CR942 also provides a measurement of the minimum collector voltage of Q940 and Q942 with respect to the Inverter circuit floating ground. This voltage is fed back to the Preregulator through optical isolator U931 to control the output voltage from the Preregulator circuit. As the negative peak voltage at the collectors of the switching transistors is regulated by the error amplifier with respect to the ouput of the Preregulator, control of the dc level from the Preregulator will control the minimum voltage with respect to the floating ground. Potentiometer R952 (Head Room Voltage Adjust) is used to set this minimum voltage level to a point that prevents saturation and excessive power dissipation of the Inverter switching transistors.

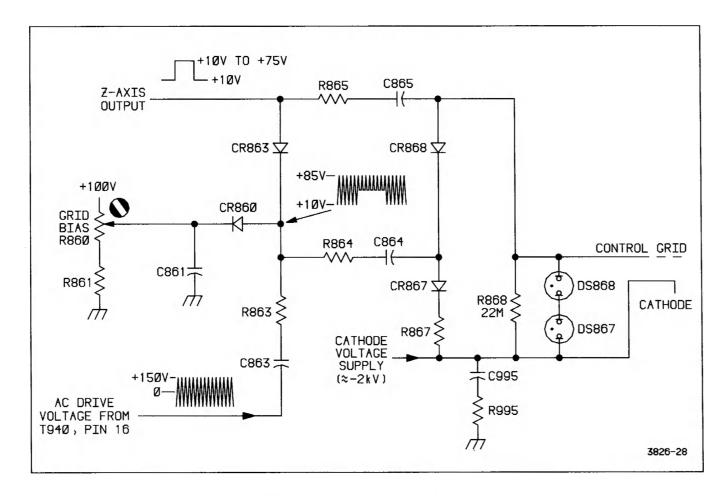


Figure 3-8. Simplified diagram of the DC Restorer circuit.

The DC Restorer is referenced to the -2-kV crt cathode voltage through R867 and CR867. Initially, both C865 and C864 will charge up to a level determined by the difference between the Z-Axis output voltage and the cathode voltage. Capacitor C865 charges from the crt cathode through R867, CR867, CR868, and R865 to the Z-Axis output. Capacitor C864 charges through R867, CR867, R864, and CR863 to the Z-Axis output.

When the ac-drive voltage starts its positive transition from the lower clamped level toward the higher clamped level, the charge on C864 increases due to the rising voltage. voltage is held constant by the long time-constant discharge path of C865 through R868.

Fast-rise and fast-fall transitions of the Z-Axis output signal are coupled to the crt control grid through C865. The fast transitions start the crt writing-beam current toward the new intensity level. The DC Restorer output level then follows the Z-Axis output-voltage level to set the new bias voltage for the crt control grid.

Neon lamps DS867 and DS868 protect the crt from excessive grid-to-cathode voltage if the potential on either the control grid or the cathode is lost for any reason.

To ensure instrument accuracy, its performance should be checked after every 2000 hours of operation or once each year, if used infrequently.

## TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1 is a complete list of the equipment required to accomplish both the "Performance Check Procedure" in this section and the "Adjustment Procedure" in Section 5. Test equipment specifications described in Table 4-1 are the minimum necessary to provide accurate results. Therefore, equipment used must meet or exceed the listed specifications. Detailed operating instructions for test equipment are not given in this procedure. If more operating information is required, refer to the appropriate test-equipment instruction manual.

When equipment other than that recommended is used, control settings of the test setup may need to be altered. If the exact item of equipment given as an example in Table 4-1 is not available, first check the "Purpose" column to verify use of this item. If it is used for a check that is of little or no importance to your measurement requirements, the item and corresponding steps may be deleted. If the check is important, use the "Minimum Specification" column carefully to determine if any other available test equipment might suffice.

instrument that is operating in and has been previously calibrated in an ambient temperature between +20°C and +30°C. The instrument also must have had as least a 20-minute warm-up period. Refer to the "Specification" (Section 1) for tolerances applicable to an instrument operating outside this temperature range. All tolerances specified are for the instrument only and do not include test-equipment error.

## PREPARATION

Test equipment items 1 through 9 in Table 4-1 are required to accomplish a complete Performance Check. At the beginning of each subsection, in both the "Performance Check Procedure" and the "Adjustment Procedure" sections, there is an equipment-required list showing only the test equipment necessary for performing the steps in that subsection. In this list, the item number that follows each piece of equipment corresponds to the item number listed in Table 4-1.

This procedure is structured in subsections, which can be performed independently, to permit checking individual portions of the instrument. At the beginning of each subsection is a list of all the front-panel control settings required to prepare the instrument for performing Step 1 in that subsection. Each succeeding step within a particular subsection should then be performed, both in the sequence presented and in its entirety, to ensure that control-setting changes will be correct for ensuing steps.

		with markers.		
4.	Cable (2 required)	Impedance: 50 Ω. Length: 42 in. Connectors: bnc.	Signal interconnection.	Tektronix Part Number 012-0057-01.
5.	Termination (2 required)	Impedance: 50 $\Omega$ . Connectors: bnc.	Signal termination.	Tektronix Part Number 011-0049-01.
6.	Dual-Input Coupler	Connectors: bnc-female-to-dual-bnc male.	Vertical checks and adjustments.	Tektronix Part Number 067-0525-01.
7.	10X Attenuator	Ratio: 10X. Impedance: $50\Omega$ . Connectors: bnc.	Vertical compensation and triggering checks.	Tektronix Part Number 011-0059-02.
8.	T-Connector	Connectors: bnc.	Signal interconnection.	Tektronix Part Number 103-0030-00.
9.	Adapter	Connectors: bnc-male-to- miniature probe tip.	Signal interconnection.	Tektronix Part Number 013-0084-02.
10	). Variable Auto- transformer	Capable of supplying 1.5 A at 115 V.	Instrument input voltage adjustment.	General Radio W8MT3VN Variac Autotransformer.

Z-axis check.

adjustments.

Horizontal checks and

Display adjustment.

Reference frequency: 50 kHz.

Amplitude accuracy: constant within 3% of reference frequency as output frequency

Marker outputs: 10 ns to

to 0.1 µs, time-coincident

0.5 s. Marker accuracy: ±0.1%. Trigger output: 1 ms

changes.

with markers

3. Time-Mark Generator

4-2

TEKTRONIX TG 501 Time-

Mark Generator.<sup>a</sup>

Alignment Iool | Bit size: 3/32 in.

<sup>a</sup>Requires a TM 500-series power-module mainframe.

# INDEX TO PERFORMANCE CHECK STEPS

Vertical	ł	Pag
1. Check Deflection Accuracy and Variable Range		4-4
2. Check Bandwidth		4-
3. Check Common-Mode Rejection Ratio		4-
Horizontal		
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3. Check SEC/DIV Variable Range		4-

Horizontal (cont)	Page
4. Check Delay Time Dial Accuracy	4-8
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6. Check POSITION Control Range	4-8
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Triggering	
1. Check Internal Triggering	4-9
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1. Check EXT Z-AXIS Operation	4-12
2. Check PROBE ADJUST Operation	4-12

#### Vertical

POSITION (both) Midrange
VERTICAL MODE CH 1
CH 1 VOLTS/DIV 2 mV
CH 2 VOLTS/DIV 10 V

VOLTS/DIV Variable

(both) CAL detent

INVERT Normal (button out)

AC-GND-DC (both) DC

#### Horizontal

POSITION Midrange

HORIZONTAL MODE A A AND B SEC/DIV 0.5 ms

A AND B SEC/DIV

Variable CAL detent X10 Magnifier Off (knob in)

#### Trigger

VAR HOLDOFF NORM A TRIGGER MODE AUTO A TRIGGER SLOPE \_\_\_

A TRIGGER SLOPE

A TRIGGER LEVEL Midrange

A & B INT VERT MODE

A SOURCE INT

#### PROCEDURE STEPS

## 1. Check Deflection Accuracy and Variable Range

a. Connect a 10-mV standard-amplitude signal to the CH 1 OR X input connector using a 50- $\Omega$  cable.

c. Set the VERTICAL MODE switch to CH 2 and move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

Table 4-2
Deflection Accuracy Limits

VOLTS/DIV Switch Setting	Standard Amplitude Signal	Vertical Deflection (Divisions)	3% Accuracy Limits (Divisions)
2 mV	10 mV	5	4.85 to 5.15
5 mV	20 mV	4	3.88 to 4.12
10 mV	50 mV	5	4.85 to 5.15
20 mV	0.1 V	5	4.85 to 5.15
50 mV	0.2 V	4	3.88 to 4.12
0.1 V	0.5 V	5	4.85 to 5.15
0.2 V	1 V	5	4.85 to 5.15
0.5 V	2 V	4	3.88 to 4.12
1 V	5 V	5	4.85 to 5.15
2 V	10 V	5	4.85 to 5.15
5 V	20 V	4	3.88 to 4.12
10 V	50 V	5	4.85 to 5.15

- Set the generator output amplitude for a 5-division, 50-kHz display.
- d. Change the generator output frequency to the value shown in Table 4-3 for the corresponding VOLTS/DIV switch setting.

Table 4-3
Settings for Bandwidth Checks

VOLTS/DIV Switch Settings	Generator Output Frequency
2 mV to 10 mV	50 MHz
20 mV to 10 V	60 MHz

- e. CHECK-Display amplitude is 3.5 divisions or greater.
- f. Repeat parts c through e for all indicated CH 1 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.
- g. Move the generator output signal from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.

- e. Set the VERTICAL MODE switches to BOTH and ADD; then push in the INVERT button.
  - f. CHECK-Display amplitude is 0.6 division or less.
- g. If the check in part f meets the requirement, skip to part n. If it does not, continue with part h.
  - h, Set VERTICAL MODE to CH 1.
- i. Change the generator frequency to 50 kHz and adjust the output to obtain a 6-division display.
  - j. Set VERTICAL MODE to BOTH.
- k. Adjust the CH 2 VOLTS/DIV Variable contol for minimum display amplitude (best CMRR).
  - I. Change the generator frequency to 10 MHz.
  - m. CHECK-Display amplitude is 0.6 division or less.
  - n. Disconnect the test setup.

Fully counterclockwise

#### Vertical

Channel 1 POSITION Midrange
VERTICAL MODE CH 1
CH 1 VOLTS/DIV 0.5 V

CH 1 VOLTS/DIV

Variable CAL detent

INVERT Normal (button out)
Channel 1 AC-GND-DC
Channel 2 AC-GND-DC
GND

#### Horizontal

POSITION Midrange
HORIZONTAL MODE A
A AND B SEC/DIV 0.05 us

A AND B SEC/DIV  $0.05 \mu s$ A AND B SEC/DIV

Variable CAL detent X10 Magnifier Off (knob in)

B DELAY TIME

## Trigger

POSITION

VAR HOLDOFF
A TRIGGER MODE
SLOPE (both)
LEVEL (both)
A & B INT
A SOURCE

NORM
NORM
NORM
NORM
VERT
VERT
MODE

A EXT COUPLING DC÷10

- b. Use the Channel 1 POSITION control to center the trace vertically. Adjust the A TRIGGER LEVEL control for a stable, triggered display.
- c. Use the Horizontal POSITION control to align the first time marker that is 50 ns beyond the start of the sweep with the 2nd vertical graticule line.

#### NOTE

When making timing measurements, use as a reference the same point on each time marker.

d. CHECK—Timing accuracy is within the limits shown in Table 4-4 for the applicable position of the X10 Magnifier. When making the check with the X10 Magnifier On, exclude any portion of the sweep past the 100th magnified division.

Table 4-4
A and B Timing Accuracy

X10 Magnifier	Accuracy at 10th Vertical Graticule Line
Off (knob in)	3% (0.24 division)
On (knob out)	5% (0.40 division)

Table 4-5
Settings for Timing Accuracy Checks

A AND B	Time-Mark Generator Output		
SEC/DIV Switch Setting	Normal	X10 Magnified	
0.05 μs	50 ns	10 ns	
0.1 μs	0.1 μs	10 ns	
0.2 μs	$0.2 \mu s$	20 ns	
0.5 μs	0.5 μs	50 ns	
1 μs	1 μs	0.1 μs	
2 μs	2 μs	0.2 μs	
5 μs	5 μs	0.5 μs	
10 μs	10 μs	1 μs	
20 μs	20 μs	2 μs	
50 μs	50 μs	5 μs	
0.1 ms	0.1 ms	10 μs	
0.2 ms	0.2 ms	20 μs	
0.5 ms	0.5 ms	50 μs	
1 ms	1 ms	0.1 ms	
2 ms	2 ms	0.2 ms	
5 ms	5 ms	0.5 ms	
10 ms	10 ms	1 ms	
20 ms	20 ms	2 ms	
50 ms	50 ms	5 ms	
	A Sweep Only		
0.1 s	0.1 s	10 ms	
0.2 s	0.2 s	20 ms	
0.5 s	0.5 s	50 ms	

- b. Align the start of the A sweep with the 1st vertical graticule line.
- c. CHECK—Intensified portion of the trace starts within
   0.5 division of the start of the sweep.
- d. Rotate the B DELAY TIME POSITION control fully clockwise.
- e. CHECK-Intensified zone is past the 11th vertical graticule line.

## 3. Check SEC/DIV Variable Range

a. Set:

CH 1 VOLTS/DIV 0.5 V
Channel 1 AC-GND-DC DC
HORIZONTAL MODE A
A SEC/DIV 0.2 ms

SEC/DIV Variable Fully counterclockwise

X10 Magnifier Off (knob in)

- b. Select 0.5-ms time markers from the time-mark generator.
  - c. CHECK-Time markers are 1 division or less apart.
- d. Return the SEC/DIV Variable control to the CAL detent.

- e. CHECK--The B DELAY TIME POSITION dial setting is between 8.87 and 9.14.
  - f. Set:

A SEC/DIV 0.5 ms B SEC/DIV 50  $\mu$ s

- g. Select 0.5-µs time markers.
- h. Repeat parts c through e.

#### 5. Check Delay Jitter

- a. Set the B SEC/DIV switch to 0.5 μs.
- b. Select 10-μs time markers.
- c. Slightly readjust the B DELAY TIME POSITION dial to position a time marker within the graticule area.
- d. CHECK—Jitter on the leading edge of the time marker does not exceed 1 division. Disregard slow drift.

#### 6. Check POSITION Control Range

a. Set:

A SEC/DIV 10  $\mu$ s HORIZONTAL MODE A

#### 7. Check X-Gain

a. Set:

CH 1 VOLTS/DIV 20 mV A SEC/DIV X-Y

b. Connect a 0.1-V standard-amplitude signal to the CH 1 OR X input connector using a 50- $\Omega$  cable.

c. CHECK—Display is 5 divisions  $\pm 0.25$  division (4.75 to 5.25 divisions).

d. Disconnect the test setup.

#### 8. Check X-Bandwidth

- a. Connect a 50-kHz leveled sine-wave signal via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector,
- b. Set the generator to obtain a 5-division horizontal display.
  - c. Adjust the generator output frequency to 2 MHz.
  - d. CHECK-Display is at least 3.5 divisions in length.
  - e. Disconnect the test setup.

## TRIGGERING

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

Leveled Sine-Wave Generator (Item 2)

50- $\Omega$  BNC Cable (Item 4)

50- $\Omega$  BNC Termination (Item 5)

10X Attenuator (Item 7)

BNC T-Connector (Item 8)

Probe-tip-to-BNC Adapter (Item 9)

P6120 Probe (provided with instrument)

#### **INITIAL CONTROL SETTINGS**

#### PROCEDURE STEPS

**POWER** 

ON (button in)

#### 1. Check Internal Triggering

**TRIGGER MODE** 

**NORM** 

**NORM** 

**AUTO AUTO** 

a. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector.

#### **CRT**

**AUTO INTENSITY AUTO FOCUS** 

As desired

Best focused display

b. Set the generator output to produce a 4-division, 2-MHz display.

Vertical

POSITION (both) **VERTICAL MODE** 

CH 1 VOLTS/DIV CH 2 VOLTS/DIV

**VOLTS/DIV** Variable

(both) **INVERT** 

AC-GND-DC (both)

Midrange CH 1

2 mV 20 mV

CAL detent

Normal (button out)

DC

c. Set the CH 1 VOLTS/DIV switch to 20 mV.

d. CHECK-Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6.

Table 4-6 Switch Combinations for A Triggering Checks

TRIGGER SLOPE

### Horizontal

**POSITION** HORIZONTAL MODE A AND B SEC/DIV

A AND B SEC/DIV

Variable X10 Magnifier Midrange

 $0.2 \mu s$ 

C 0

AL detent	
ff (knob in)	

## **Trigger**

VAR HOLDOFF A TRIGGER MODE

SLOPE (both) LEVEL (both) A & B INT

A SOURCE A EXT COUPLING ·NORM **NORM** 

Midrange **VERT MODE** 

INT DC

e. Set the HORIZONTAL MODE switch to B.

f. CHECK-Stable display can be obtained by adjusting the B TRIGGER LEVEL control for both positive- and negative-going positions of the B TRIGGER SLOPE switch.

m. Move the generator output from the CH 2 OR Y input connector to the CH 1 OR X input connector. Set VERTICAL MODE to CH 1.

VOLTS/DIV10 mVA SEC/DIV10  $\mu$ sVERTICAL MODECH 1

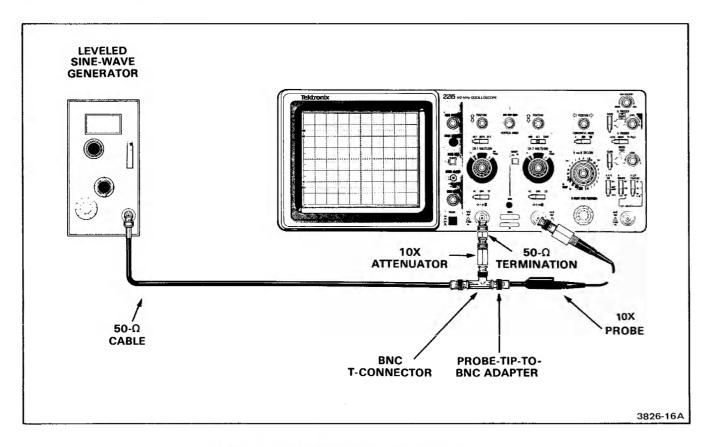


Figure 4-1. Test setup for external trigger and jitter checks.

**4-10** REV SEP 1981

- g. CHECK—Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6.
- h. Remove the 10X attenuator from the test setup and set the A EXT COUPLING switch to DC÷10.
  - i. Repeat part g.

- o. Set the generator to 60 MHz.
- p. Repeat parts g and h.
- q. Repeat part g.
- r. Disconnect the test setup.

#### Vertical

Channel 1 POSITION Midrange VERTICAL MODE CH 1 CH 1 VOLTS/DIV 2 V

CH 1 VOLTS/DIV
Variable CAL detent
Channel 1 AC-GND-DC DC

#### Horizontal

 POSITION
 Midrange

 HORIZONTAL MODE
 A

 A SEC/DIV
 20 μs

 A AND B SEC/DIV

Variable CAL detent

## Trigger

VAR HOLDOFF NORM
A TRIGGER MODE AUTO
A TRIGGER SLOPE
A TRIGGER LEVEL Midrange
A & B INT VERT MODE
A SOURCE INT

- b. Adjust the generator controls to produce a 5-volt,
   50 kHz display.
- c. CHECK—For noticeable intensity modulation. The positive part of the sine wave should be of lower intensity than the negative part.
  - d. Disconnect the test setup.

### 2. Check PROBE ADJUST Operation

a. Set:

CH 1 VOLTS/DIV 10 mV A SEC/DIV 0.5 ms

- b. Connect the P6120 Probe to the CH 1 OR X input connector and insert the probe tip into the PROBE ADJUST jack on the instrument front panel. If necessary, adjust the probe compensation for a flat-topped square-wave display.
- c. CHECK-Display is 5 divisions  $\pm 1$  division (4 to 6 divisions).
  - d. Disconnect the test setup.

indicated a need for adjustment of the instrument.

#### TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1 is a complete list of the equipment required to accomplish both the "Adjustment Procedure" in this section and the "Performance Check Procedure" in Section 4. Test equipment specifications described in Table 4-1 are the minimum necessary to provide accurate results. Therefore, equipment used must meet or exceed the listed specifications. Detailed operating instructions for test equipment are not given in this procedure. If more operating information is required, refer to the appropriate test equipment instruction manual.

When equipment other than that recommended is used, control settings of the test setup may need to be altered. If the exact item of equipment given as an example in Table 4-1 is not available, first check the "Purpose" column to verify use of this item. Then use the "Minimum Specification" column to determine if any other available test equipment might suffice.

## **LIMITS AND TOLERANCES**

The limits and tolerances stated in this procedure are instrument specifications only if they are listed in the "Performance Requirements" column of the "Specification" (Section 1). Tolerances given are applicable only to the instrument undergoing adjustment and do not include test equipment error. Adjustment of the instrument must

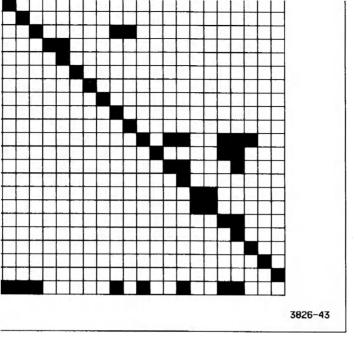
This procedure is structured in subsections to permit adjustment of individual sections of the instrument (except the Power Supply) whenever a complete readjustment is not required. For example, if only the Vertical section fails to meet the Performance Requirements (or has had repairs made or components replaced), it can be readjusted with little or no effect on other sections of the instrument. However, if the Power Supply section has undergone repairs or adjustments that change the absolute value of any of the supply voltages, a complete readjustment of the instrument may be required.

At the beginning of each subsection is a list of all the front-panel control settings required to prepare the instrument for performing Step 1 in that subsection. Each succeeding step within a subsection should then be performed both in the sequence presented and in its entirety to ensure that control settings will be correct for ensuing steps,

#### ADJUSTMENT INTERACTION

The use of Table 5-1 is particularly important if a partial procedure is performed or if a circuit requires readjustment due to a component replacement. To use this table, first find the adjustment that was made (extreme left column). Then move to the right, across the row, until you come to a darkened square. From the darkened square, move up the table to find the affected adjustment at the heading of that column. Check the accuracy of this adjustment and, if necessary, perform readjustment.

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for possible interacting adjustments that might be required.

All test equipment items described in Table 4-1 are required to accomplish a complete Adjustment Procedure. At the beginning of each subsection there is an equipment-required list showing only the test equipment necessary for performing the steps in that subsection. In this list, the item number following each piece of equipment corresponds to the item number listed in Table 4-1.

Make initial control settings as listed at the beginning of each subsection. Then connect the test equipment to an appropriate ac-power-input source and connect the 2215 to a variable autotransformer (Item 10 in Table 4-1) that is set for 115 V ac. Apply power and allow a 20-minute warm-up period before commencing any adjustments.

The most accurate display adjustments are made with a stable, well-focused, low-intensity display. Unless otherwise noted, adjust the AUTO INTENSITY, AUTO FOCUS, and TRIGGER LEVEL controls as needed to view the display.

Wherever possible in this procedure, instrument performance is first checked before an adjustment is made. Steps containing both checks and adjustments are titled "Check/Adjust." Those steps with only checks are titled "Check."

O, Thejast trigger mainteet to the territories to the
10. Adjust Attenuator Compensation
11. Adjust Vertical Output Amplifier Compensation5-10
12. Adjust Channel Matching and Check Bandwidth5-11
13. Check Common-Mode Rejection Ratio 5-11
14. Check POSITION Control Range
15. Check Channel Isolation 5-12
Horizontal
1. Adjust Horizontal Amplifier Gain
2. Adjust Magnifier Registration
3. Adjust Delay Dial Timing
4. Adjust 5-μs Timing
5. Adjust High-Speed Timing
6. Check Timing Accuracy
7. Check B DELAY TIME POSITION Control
Range
8. Check SEC/DIV Variable Range
9. Check B DELAY TIME POSITION Dial
Accuracy
10. Check Delay Jitter
11. Check POSITION Control Range
12. Adjust X-Gain
13. Check X-Bandwidth
Triggering
1. Adjust Trigger Slope Balance
2. Check/Adjust Auto Trigger Centering and
TRIG'D LED Operation
3. Check Internal Triggering
4. Check External Triggering
External Z-Axis and Probe Adjust
1. Check EXT Z-AXIS Operation
2 Check PRORE AD ILIST Operation 5-21

both the instrument and the test equipment and allow a 20-minute warm-up period before commencing the adjustments and checks.

## **INITIAL CONTROL SETTINGS**

#### CRT

AUTO INTENSITY As desired

AUTO FOCUS Best focused display

#### Vertical (both)

 POSITION
 Midrange

 VERTICAL MODE
 CH 1

 VOLTS/DIV
 0.1 V

 VOLTS/DIV Variable
 CAL detent

AC-GND-DC GND

#### Horizontal

POSITION Midrange HORIZONTAL MODE A

A SEC/DIV  $5 \mu s$ 

A AND B SEC/DIV Variable CAL detent

Variable CAL detent X10 Magnifier Off (knob in)

### Trigger

VAR HOLDOFF NORM A TRIGGER MODE TV FIELD

A TRIGGER SLOPE

A TRIGGER LEVEL Midrange
A & B INT VERT MODE

A SOURCE INT

#### NOTE

Review the information at the beginning of the Adjustment Procedure before starting this step.

a. Remove the High-Voltage shield (see the "High-Voltage Shield" removal procedure in Section 6).

## WARNING

When checking the Head Room Voltage, use a digital voltmeter that is isolated from ground, because the Inverter power-supply circuitry common is at line potential.

- b. Connect the digital voltmeter low lead to common (TP934) and connect the volts lead to TP952.
- c. CHECK-Reading is +4.2~V to +4.4~V. If the reading is within these limits, skip to part e.
- d. ADJUST-Head Room Voltage Adjust (R952) for +4.3 V.
  - e. Disconnect the voltmeter leads.
- f. Connect the digital voltmeter low lead to chassis ground (TP501) and connect the volts lead to the --8.6-V supply (TP500).





+8.6 V	W975	8.34 to 8.86	<10
+30 V	W965	28.5 to 31.5	<50
+100 V	W966	95 to 105	<200

- k. Connect the test oscilloscope, using a 1X probe, to the first test point indicated in Table 5-2 and connect the probe ground lead to TP501.
- I. CHECK—Ripple amplitude of the dc supply is within the typical value given in Table 5-2.
  - m. Repeat parts k and I for each test point in Table 5-2.
  - n. Disconnect the test setup.

## 2. Check High-Voltage Supply

- a. Set the POWER switch to OFF (button out).
- b. Set the dc voltmeter to a range of at least -2500 V dc and connect the volts lead to chassis ground. Remove the crt base-socket cover and connect the common lead of the dc voltmeter to pin 2 on the socket.

- b. Rotate the AUTO INTENSITY control fully counterclockwise.
- c. Connect a 50- $\Omega$  termination to the EXT Z AXIS INPUT connector located on the rear panel.
- d. ADJUST—Both the Grid Bias adjustment (R860) and the AUTO FOCUS control for a visible dot. Then back off the Grid Bias potentiometer until the dot just disappears.
  - e. Disconnect the test setup.

# 4. Adjust Astigmatism and Auto Focus Tracking (R887 and R875)

a. Set:

- b. Connect a leveled sine-wave generator via a 50- $\!\Omega$  cable and a 50- $\!\Omega$  termination to the CH 1 OR X input connector.
- c. Adjust the generator output for a 4-division, 50-kHz display.

b. CHECK—That the trace is parallel to the center horizontal graticule line.

e. Disconnect the test setup.

## **VERTICAL**

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

Calibration Generator (Item 1)

Leveled Sine-Wave Generator (Item 2)

50-Ω BNC Cable (Item 4)

50- $\Omega$  BNC Termination (Item 5)

Dual-Input Coupler (Item 6)

10X Attenuator (Item 7)

Adapter (Item 9)

Digital Voltmeter (Item 11)

1X Probe (Item 12)

Screwdriver (Item 14)

Low-Capacitance Alignment Tool (Item 15)

P6120 Probe (Included with instrument)

See

**ADJUSTMENT LOCATIONS 1** 

and

**ADJUSTMENT LOCATIONS 2** 

at the back of this manual for locations of test points and adjustments.

#### INITIAL CONTROL SETTINGS

#### PROCEDURE STEPS

**POWER** 

ON (button in)

1. Adjust Vertical Gain (R186, R286, R145, and

R245)

display.

**CRT** 

**AUTO INTENSITY** 

**AUTO FOCUS** 

As desired

Best focused display

a. Connect a 100-mV standard-amplitude signal via a 50- $\Omega$  cable to the CH 1 OR X input connector.

Vertical (both)

**POSITION** 

**VERTICAL MODE** 

VOLTS/DIV

**VOLTS/DIV** Variable

**INVERT** 

CH 1 20 mV CAL detent

DC

Midrange

Normal (button out)

AC-GND-DC

b. ADJUST-Ch 1 Gain (R186) for an exact 5-division display.

c. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector. Change the VERTICAL

MODE switch to CH 2.

Horizontal

**POSITION** 

HORIZONTAL MODE A AND B SEC/DIV

A AND B SEC/DIV

Variable

X10 Magnifier

Midrange

0.5 ms

Α

CAL detent

Off (knob in)

e. Change the generator output to 10 mV and set the CH 1 and CH 2 VOLTS/DIV switches to 2 mV.

d. ADJUST-Ch 2 Gain (R286) for an exact 5-division

f. ADJUST-Ch 2 X10 Vert Gain (R245) for an exact 5-division display.

Trigger

VAR HOLDOFF

A TRIGGER MODE A TRIGGER SLOPE

A TRIGGER LEVEL

A & B INT A SOURCE **NORM** 

**AUTO** Γ

Midrange **VERT MODE** 

INT

q. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector. Change the VERTICAL MODE switch to CH 1.

h. ADJUST-Ch 1 X10 Vert Gain (R145) for an exact 5-division display.

- 1. Change the VENTICAL WODE SWITCH to Ch 2.
- g. Repeat parts b through e for Channel 2, adjusting Ch 2 Step Bal (R238) in step d.

## 3. Adjust Attenuator X10 Balance (R146 and R246)

- a. Set the CH 2 VOLTS/DIV switch to 20 mV.
- b. Position the trace on the center horizontal graticule line using the Channel 2 POSITION control.
  - c. Change the CH 2 VOLTS/DIV switch to 10 mV.
- d. ADJUST-Ch 2 X10 Bal (R246) to set the trace on the center horizontal graticule line.
- e. Repeat parts a through d until there is no trace shift when changing the CH 2 VOLTS/DIV switch from 20 mV to 10 mV.
  - f. Change the VERTICAL MODE switch to CH 1.
- g. Repeat parts a through e for Channel 1, adjusting Ch 1 X10 Bal (R146) in step d.

Setting	Signal	(Divisions)	(Divisions)
2 mV	10 mV	5	4.85 to 5.15
5 mV	20 mV	4	3.88 to 4.12
10 mV	50 mV	5	4.85 to 5.15
20 mV	0.1 V	5	4.85 to 5.15
50 mV	0.2 V	4	3.88 to 4.12
0.1 V	0.5 V	5	4.85 to 5.15
0.2 V	1 V	5	4.85 to 5.15
0.5 V	2 V	4	3.88 to 4.12
1 V	5 V	5	4.85 to 5.15
2 V	10 V	5	4.85 to 5.15
5 V	20 V	4	3.88 to 4.12
10 V	50 V	5	4.85 to 5.15

c. Set the VERTICAL MODE switch to CH 2 and move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

d. CHECK—Deflection accuracy is within the limits given in Table 5-3 for each CH 2 VOLTS/DIV switch setting and corresponding standard-amplitude signal. Perform the checks from the bottom to the top of Table 5-3 to avoid unnecessary switch-position changes. When at the 20-mV VOLTS/DIV switch setting, rotate the CH 2 VOLTS/DIV Variable control fully counterclockwise and CHECK that the display decreases to 2 divisions or less.

- the input signal from the CH 2 OR Y input connector to the CH 1 OR X input connector.
  - g. Repeat parts c through e for Channel 1.

#### 6. Check ALT and CHOP Operation

a. Set:

VERTICAL MODE	BOTH-ALT	
AC-GND-DC (both)	GND	
A SEC/DIV	10 ms	

- b. CHECK—Display alternates between the CH 1 and CH 2 displays. If necessary, use both POSITION controls to separate the two traces.
  - c. Set VERTICAL MODE to CHOP.
- d. CHECK—CH 1 and CH 2 displays are both displayed simultaneously.

# 7. Check VOLTS/DIV Variable Control Trace Shift

a. Set:

VERTICAL MODE	CH 1
VOLTS/DIV (both)	2 mV
AC-GND-DC (both)	DC
A SEC/DIV	0.2 ms

- Set the CH Z VULIS/DIV switch to ZUMV.
- b. Center the trace on the center horizontal graticule line using the Channel 2 POSITION control.
  - c. Push in the INVERT button.
- d. ADJUST-Invert Bal (R264) to position the trace on the center horizontal graticule line.
  - e. Return the INVERT button to Normal (button out).
- f. Repeat parts c through e until there is no trace shift when switching the INVERT button between Invert and Normal.

#### 9. Adjust Trigger Balance (R154)

- a. Set the A & B INT switch to CH 2.
- b. Connect the digital voltmeter low lead to chassis ground (TP501) and the volts lead to pin 16 of U421; note the voltage reading for use in part d.
  - c. Set the A & B INT switch to CH 1.
- d. ADJUST-Ch 1/Ch 2 Balance (R154) so that the voltage reading is the same as that obtained in part b.

- e. Replace the probe and probe-tip-to-bnc adapter with a  $50-\Omega$  cable.
  - f. Adjust the generator output for a 5-division display.

#### NOTE

Use Table 5-4 to identify the correct capacitor for each channel adjustment.

g. ADJUST—The ÷10 LF Comp capacitor for best front corner.

Table 5-4
Attenuator Compensation Adjustments

Adjustment	Channel 1	Channel 2
÷10 LF Comp	C105	C205
÷10 Input C	C104	C204
÷100 LF Comp	C111	C211
÷100 Input C	C110	C210

h. Replace the cable and  $50\text{-}\Omega$  termination with the P6120 Probe and probe-tip-to-bnc adapter.

i. Adjust the generator output for a 5-division display.

- q. Adjust the generator output to produce a display as close as possible to 5 divisions.
- r. ADJUST-The  $\div 100$  Input C capacitor for best flat top.
- s. Repeat parts m through r until no further improvement is noted.
  - t. Set the VERTICAL MODE switch to CH 2.
  - u. Repeat parts b through s for CH 2.
  - v. Disconnect the test setup.

# 11. Adjust Vertical Output Amplifier Compensation (R357, C357, R367, R366, and C366)

a. Set:

VOLTS/DIV (both)

20 mV

A SEC/DIV  $0.05 \,\mu s$ 

b. Connect a 1-MHz, positive-going fast-rise square-wave via a 50- $\Omega$  cable, a 10X attenuator, and a 50- $\Omega$  termination to the CH 2 OR Y input connector.

- i. Set the CH 2 VOLTS/DIV switch to 0.1 V and repeat parts f and g for best compromise with the 20-mV VOLTS/DIV switch setting.
  - j. Disconnect the test setup.

# 12. Adjust Channel Matching (C167) and Check Bandwidth

a. Set:

VOLTS/DIV (both)

20 mV

A SEC/DIV

20 μs

- b. Connect the leveled sine-wave generator output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 2 OR Y input connector.
- Set the generator output for a 5-division, 50-kHz display.
- d. Increase the generator frequency until the display reduces to 3.5 divisions.
- e. Move the signal from the CH 2 OR Y input connector to the CH 1 OR X input connector. Set the VERTICAL MODE switch to CH 1.
- f. ADJUST-CH 1 & CH 2 HF Match (C167) for a vertical display amplitude of 3.5 divisions.

2 mv to 10 mv	50 WH2	
20 mV to 10 V	60 MHz	

- k. CHECK-Display amplitude is 3.5 divisions or greater.
- I. Repeat parts i through k for all indicated CH 1 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.
- m. Move the generator output signal from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.
- n. Repeat parts i through k for all indicated CH 2 VOLTS/DIV switch settings up to the output-voltage upper limit of the sine-wave generator being used.
  - o. Disconnect the test setup.

## 13. Check Common-Mode Rejection Ratio

- a. Set both VOLTS/DIV switches to 20 mV.
- b. Connect a 10-MHz, leveled sine-wave signal via a 50- $\Omega$  cable, a 50- $\Omega$  termination, and a dual-input coupler to the CH 1 OR X and the CH 2 OR Y input connectors.
- c. Set the generator output amplitude to produce a 6-division display.

- j. Set VERTICAL MODE to BOTH.
- k. Adjust the CH 2 VOLTS/DIV Variable control for minimum display amplitude (best CMRR).
  - I. Change the generator frequency to 10 MHz.
  - m. CHECK-Display amplitude is 0.6 division or less.
  - n. Disconnect the test setup.

#### 14. Check POSITION Control Range

a. Set:

VERTICAL MODE CH 1 VOLTS/DIV (both) 50 mV AC-GND-DC (both) AC

- b. Connect a 0.5-V standard-amplitude signal via a 50- $\Omega$  cable to the CH 1 OR X input connector.
- c. Adjust the CH 1 VOLTS/DIV Variable control for a 4.4-division display. Then set the CH 1 VOLTS/DIV switch to 10 mV.

CH 1 VOLTS/DIV	0.5 V
CH 2 VOLTS/DIV	10 m\
VERTICAL MODE	CH 1

- b. Connect a 10-MHz leveled sine-wave signal via a 50- $\!\Omega$  cable and a 50- $\!\Omega$  termination to the CH 1 OR X input connector.
- c. Adjust the generator output for an 8-division input connector.
  - d. Set the VERTICAL MODE switch to CH 2.
  - e. CHECK-Display amplitude is 4 divisions or less.
- f. Move the input signal from the CH 1 OR X input connector to the CH 2 OR Y input connector  $\frac{1}{2}$ 
  - g. Set:

CH 1VOLTS/DIV 10 mV CH 2 VOLTS/DIV 0.5 V VERTICAL MODE CH 1

- h. CHECK-Display amplitude is 4 divisions or less.
- i. Disconnect the test setup.

# HORIZONTAL

# Equipment Required (see Table 4-1):

Calibration Generator (Item 1)

Leveled Sine-Wave Generator (Item 2)

Time-Mark Generator (Item 3)

Two 50- $\Omega$  BNC Cables (Item 4)

Two 50- $\Omega$  BNC Terminations (Item 5)

Screwdriver (Item 14)

Low-Capacitance Alignment Tool (Item 15)

See

**ADJUSTMENT LOCATIONS 1** 

and

**ADJUSTMENT LOCATIONS 2** 

at the back of this manual for test point and adjustment locations.

## **INITIAL CONTROL SETTINGS**

#### PROCEDURE STEPS

**POWER** 

ON (button in)

#### **CRT**

**AUTO INTENSITY AUTO FOCUS** 

As desired

Best focused display

# Vertical

Channel 1 POSITION **VERTICAL MODE** 

CH 1 VOLTS/DIV

CH 1 VOLTS/DIV

Variable

**INVERT** 

Channel 1 AC-GND-DC

Channel 2 AC-GND-DC

Midrange CH<sub>1</sub>

0.5 V

CAL detent

Normal (button out)

DC

**GND** 

# 1. Adjust Horizontal Amplifier Gain (R752, R682, and R733)

a. Connect 0.1-ms time markers from the time-mark generator via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the CH 1 OR X input connector. Connect the generator Trigger output via a 50- $\Omega$  cable and a 50- $\Omega$  termination to the EXT INPUT connector.

b. ADJUST-Horiz Gain (R752) for 1 time marker per division.

c. Set the HORIZONTAL MODE switch to B.

d. ADJUST-B Gain (R682) for 1 time marker per division.

### Horizontal

**POSITION** 

HORIZONTAL MODE

A AND B SEC/DIV A AND B SEC/DIV

Variable X10 Magnifier

**B DELAY TIME POSITION** 

Midrange

0.1 ms

CAL detent Off (knob in)

1.00

#### e. Set the HORIZONTAL MODE switch to A.

f. Set the X10 Magnifier on (knob out) and select 10-μs time markers from the time-mark generator.

g. ADJUST-X10 Gain (R733) for 1 time marker per division.

### Trigger

VAR HOLDOFF

SLOPE (both)

A TRIGGER MODE LEVEL (both) A & B INT

A SOURCE A EXT COUPLING NORM **AUTO** 

Midrange **VERT MODE** 

**EXT** DC÷10

#### 2. Adjust Magnifier Registration (R758)

a. Select 0.5-ms time markers from the time-mark generator and set the X10 Magnifier off (knob in).

b. Position the middle time marker to the center vertical graticule line using the Horizontal POSITION control.

A SEC/DIV 0.1 ms B SEC/DIV 1 μs

X10 Magnifier Off (knob in)

- b. Select 0.1-ms time markers from the time-mark generator and verify that the B DELAY TIME POSITION control is set to 1.00.
- c. ADJUST—Delay Dial Start Adj (R659) so that the 2nd A-sweep time marker is intensified and the B-sweep time marker starts at the beginning of the B sweep.
  - d. Set the B DELAY TIME POSITION control to 9.00.
- e. ADJUST—Delay Dial Gain (R654) so that the 10th A-sweep time marker is intensified and the B-sweep time marker starts at the beginning of the B sweep.
- f. Set the B DELAY TIME POSITION control to 1.00 and repeat parts c through e until no further improvement is noted.

# 4. Adjust 5-μs Timing (C676 and C626)

a. Set:

HORIZONTAL MODE B A AND B SEC/DIV 5  $\mu$ s

b. Select 5- $\mu$ s time markers from the time-mark generator.

d. Set the X10 Magnifier on (knob out) and select 10-ns time markers from the time-mark generator.

#### NOTE

In the next part, keep the adjustment screws for C774 and C784 as close to the same length as possible.

- e. ADJUST-5 ns Timing (C774 and C784) alternately for one time marker every 2 divisions over the center 8 divisions of the magnified sweep.
- f. Adjust the Horizontal POSITION control so that the 5th time marker is aligned with the 2nd vertical graticule line.
- g. ADJUST—5 ns Linearity (C734) for one time marker every 2 divisions over the center 8 divisions of the magnified sweep. Adjust the Horizontal POSITION control to check the linearity to the 15th time marker.
- h. Repeat parts e through g until no further improvement is noted.
- i. Set the X10 Magnifier off (knob in) and recenter the trace using the Horizontal POSITION control.
- j. Repeat parts b through i until no further improvement is noted.

nifier. When making the check with the X10 Magnifier On, exclude any portion of the sweep past the 100th magnified division

- e. Set the HORIZONTAL MODE switch to B and adjust the B TRIGGER LEVEL control for a stable display.
- f. Align the first time marker that is 50 ns beyond the start of the sweep with the 2nd vertical graticule line, using the Horizontal POSITION control
- g. CHECK—Timing accuracy is within the limits shown in Table 5-6 for the applicable position of the X10 Magnifier. When making the check with the X10 Magnifier On, exclude any portion of the sweep past the 100th magnified division.
  - h. Set the HORIZONTAL MODE switch to A.
- i. Repeat parts b through h for the A and B SEC/DIV and time-mark generator setting combinations shown in Table 5-7 under the "Normal" column.
  - j. Set:

A and B SEC/DIV

 $0.05 \,\mu s$ 

X10 Magnifier

On (knob out)

A AND B SEC/DIV Switch Setting	Time-Mark Generator Output		
	Normal	X10 Magnified	
0.05 μs	50 ns	10 ns	
0.1 μs	0.1 μs	10 ns	
0.2 μs	0.2 μs	20 ns	
0.5 μs	0.5 μs	50 ns	
1 μs	1 μs	0.1 μs	
2 μs	2 μs	0.2 μs	
5 μs	5 μs	0.5 μs	
10 μs	10 μs	1 μs	
20 μs	20 μs	2 μs	
50 μs	50 μs	5 μs	
0.1 ms	0.1 ms	10 μs	
0.2 ms	0.2 ms	20 μs	
0.5 ms	0.5 ms	50 μs	
1 ms	1 ms	0.1 ms	
2 ms	2 ms	0.2 ms	
5 ms	5 ms	0.5 ms	
10 ms	10 ms	1 ms	
20 ms	20 ms	2 ms	
50 ms	50 ms	5 ms	
	A Sweep Only		
0.1 s	0.1 s	10 ms	
0.1 s	0.2 s	20 ms	
0.5 s	0.5 s	50 ms	

# 8. Check SEC/DIV Variable Range

a. Set:

CH 1 VOLTS/DIV 0.5 V
Channel 1 AC-GND-DC DC
HORIZONTAL MODE A
A SEC/DIV 0.2 ms

SEC/DIV Variable Fully counterclockwise

X10 Magnifier Off (knob in)

 Select 0.5-ms time markers from the time-mark generator.

- c. CHECK-Time markers are 1 division or less apart.
- d. Return the SEC/DIV Variable control to the CAL detent.

# 9. Check B DELAY TIME POSITION Dial Accuracy

a. Set:

HORIZONTAL MODE B A SEC/DIV 0.2  $\mu$ s B SEC/DIV 0.05  $\mu$ s

B TRIGGER LEVEL CW-RUN AFTER DLY

Select 0.2-μs time markers.

h. Repeat parts c through e.

# 10. Check Delay Jitter

- a. Set the B SEC/DIV switch to  $0.5 \,\mu s$ .
- b. Select 10-µs time markers.
- c. Slightly readjust the B DELAY TIME POSITION dial to position a time marker within the graticule area.
- d. CHECK—Jitter on the leading edge of the time marker does not exceed 1 division. Disregard slow drift.

# 11. Check POSITION Control Range

a. Set:

A SEC/DIV  $10 \mu s$  HORIZONTAL MODE A

- b. Select 50-µs time markers.
- c. Align the 3rd time marker with the center vertical graticule line.
  - d. Set the X10 Magnifier knob to On (knob out).

CKI

AUTO INTENSITY AUTO FOCUS As desired Best focused display

Vertical (both)

POSITION
VERTICAL MODE
VOLTS DIV
VOLTS/DIV Variable

INVERT AC-GND-DC Midrange CH 1 20 mV CAL detent Normal (button out)

DC

Horizontal

POSITION HORIZONTAL MODE A AND B SEC/DIV A AND B SEC/DIV

Variable X10 Magnifier Midrange Α 20 μs

CAL detent Off (knob in)

Trigger

VAR HOLDOFF A TRIGGER MODE SLOPE (both) LEVEL (both) A & B INT

A SOURCE A EXT COUPLING NORM AUTO

Midrange VERT MODE

INT DC input connector.

- b. Adjust the generator output for a 50-kHz, 5-division display.
- c. ADJUST—Slope Bal (R482) for a positive vertical shift of 0.15 division at the sweep start when changing the A TRIGGER SLOPE switch from  $\setminus$  to  $\int$ .

# 2. Check/Adjust Auto Trigger Centering (R511 and R512) and TRIG'D LED Operation

a. Set:

A TRIGGER LEVEL Fully clockwise A TRIGGER SLOPE

- b. Adjust the generator output for a 1-division display.
- c. ADJUST-(+) Auto (R511) so that the display just triggers on the positive peak of the signal.
  - d. Set:

A TRIGGER LEVEL Fully counterclockwise A TRIGGER SLOPE

e. ADJUST-(-) Auto (R512) so that the display just triggers on the negative peak of the signal.

Table 5-8
Switch Combinations for A Triggering Checks

TRIGGER MODE	TRIGGER SLOPE	
NORM	5	
NORM	7	
AUTO	7	
AUTO	5	

- e. Set the HORIZONTAL MODE switch to B.
- f. CHECK—Stable display can be obtained by adjusting the B TRIGGER LEVEL control for both positive- and negative-going positions of the B TRIGGER SLOPE switch.
  - g. Set:

VERTICAL MODE CH 2 HORIZONTAL MODE A

- h. Move the generator output from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set VERTICAL MODE to CH 2.
  - i. Repeat parts d through f.

- p. Repeat parts e and f.
- q. Move the generator output from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set VERTICAL MODE to CH 2.
  - r. Repeat part f.
  - s. Disconnect the test setup.

# 4. Check External Triggering

a. Set:

VOLTS/DIV (both) 10 mV A SEC/DIV 10 μs VERTICAL MODE CH 1

- b. Connect the test setup as shown in Figure 4-1.
- c. Set the leveled sine-wave generator to produce a 5-division, 50-kHz display.
  - d. Set:

 $\begin{array}{lll} \text{VERTICAL MODE} & \text{CH 2} \\ \text{A SEC/DIV} & \text{0.2} \ \mu\text{s} \\ \text{A SOURCE} & \text{EXT} \\ \end{array}$ 

VOLTS/DIV (both)	50 mV
VERTICAL MODE	CH 1
A SEC/DIV	20 μs
A SOURCE	INT

- q. Repeat part g.
- r. Disconnect the test setup.

#### Vertical

Channel 1 POSITION Midrange
VERTICAL MODE CH 1
CH 1 VOLTS/DIV 2 V
CH 1 VOLTS/DIV

Variable CAL detent
Channel 1 AC-GND-DC DC

#### Horizontal

 POSITION
 Midrange

 HORIZONTAL MODE
 A

 A SEC/DIV
 20 μs

 A AND B SEC/DIV

Variable CAL detent

# Trigger

VAR HOLDOFF NORM
A TRIGGER MODE AUTO
A TRIGGER SLOPE 

A TRIGGER LEVEL Midrange
A & B INT VERT MODE
A SOURCE INT

- c. CHECK-For noticeable intensity modulation. The positive part of the sine wave should be of lower intensity than the negative part.
  - d. Disconnect the test setup.

# 2. Check PROBE ADJUST Operation

a. Set:

CH 1 VOLTS/DIV 10 mV A SEC/DIV 0.5 ms

- b. Connect the P6120 Probe to the CH 1 OR X input connector and insert the probe tip into the PROBE ADJUST jack on the instrument front panel. If necessary, adjust the probe compensation for a flat-topped square-wave display.
- c. CHECK—Display is 5 divisions  $\pm 1$  division (4 to 6 divisions).
  - d. Disconnect the test setup.

(mmm)

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. Table 6-1 lists the relative susceptibility of various classes of semi-conductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

When performing maintenance observe the following precautions to avoid component damage:

- 1. Minimize handling of static-sensitive components.
- Transport and store static-sensitive components or assemblies in their original containers or on a metal rail.
   Label any package that contains static-sensitive components or assemblies.
- 3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these components. Servicing static-sensitive components or assemblies should be performed only at a static-free work station by qualified service personnel.
- 4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.

Table 6-1

Relative Susceptibility to Static-Discharge Damage

Semiconductor Classes		Relative Susceptibility Levels <sup>a</sup>	
MOS or CMOS micr discretes, or linear n MOS inputs		1	
ECL		2	
Schottky signal diodes		3	
Schottky TTL		4	
High-frequency bipo	olar transistors	5	
JFET		6	
Linear microcircuits		7	
Low-power Schottk	y TTL	8	
TTL	(Least Sensitive)	9	

 $<sup>^{</sup>a}Voltage$  equivalent for levels (voltage discharged from a 100-pF capacitor through a resistance of 100  $\Omega)$  :

#### **GENERAL CARE**

The cabinet minimizes accumulation of dust inside the instrument and should normally be in place when operating the 2215. The optional front-panel cover provides both dust and damage protection for the front panel and crt face, and it should be in place whenever the instrument is stored or is being transported.

## INSPECTION AND CLEANING

The instrument should be visually inspected and cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket, preventing efficient heat dissipation. It also provides an electrical conduction path that could result in instrument failure, especially under high-humidity conditions.



Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Use a nonresidue-type cleaner, preferably isopropyl alcohol, denatured ethyl alcohol, or a solution of 1% mild detergent with 99% water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

# CAUTION

To prevent getting moisture inside the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.

CLEANING. Loose dust on the outside of the instrument can be removed with a soft cloth or small soft-bristle brush. The brush is particularly useful for dislodging dirt on and around the controls and connectors. Dirt that remains can be removed with a soft cloth dampened in a mild detergent-and-water solution. Do not use abrasive cleaners. Clean the light filter and the crt face with a soft lint-free cloth dampened with either denatured alcohol or a mild detergent-and-water solution.

#### Interior

To gain access to internal portions of the instrument for inspection and cleaning, refer to the "Removal and Replacement Instructions" in the "Corrective Maintenance" part of this section.

INSPECTION. Inspect the internal portions of the instrument for damage and wear, using Table 6-3 as a guide. Deficiencies found should be repaired immediately. The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.





#### Internal Inspection Checklist

Circuit Boards  Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.		s. Clean solder corrosion with an eraser and flush with isopropyl alcohol. Resolder defective connections. Determine cause of burned items and repair. Repair defective circuit runs.	
Solder Connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.	
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.  Replace defective capacitors. Clean so connections and flush with isopropyle		
Wiring and Cables  Loose plugs or connectors. Burned, broken, or frayed wiring.		Firmly seat connectors. Repair or replace defective wires or cables.	
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.	

If any electrical component is replaced, conduct a Performance Check of the affected circuit and of other closely related circuits (see Section 4). If repair or replacement work is done on any of the power supplies, conduct a complete Performance Check and, if so indicated, an instrument readjustment (see Section 5).



To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the instrument. CLEANING. To clean the interior, blow off dust with dry, low-pressure air (approximately 9 psi). Remove any remaining dust with a soft brush or a cloth dampened with a solution of mild detergent and water. A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.

If these methods do not remove all the dust or dirt, the instrument may be spray washed using a solution of 5% mild detergent and 95% water as follows:

1. Gain access to the parts to be cleaned (see "Removal and Replacement Instructions").

- 1. Spray hot water into the slots at the top of each switch housing while rotating the switch control knob. Spray only for approximately five seconds, using an atomizing spray device.
- 2. Dry both the switch and the circuit board on which it is mounted, using dry low-pressure air.
- 3. Bake the switch and the circuit board at 75°C (167°F) for 15 minutes to eliminate all moisture.
- 4. Spray a very small amount (only about a 1/2-second squirt) of a recommended lubricant, such as No Noise, into the slots at the top of the switch housing.
- 5. Rotate the switch control knob about 180° and again spray a very small amount of lubricant into each slot.

#### PERIODIC READJUSTMENT

To ensure accurate measurements, check the performance of this instrument after every 2000 hours of operation, or if used infrequently, once each year. In addition, replacement of components may necessitate readjustment of the affected circuits.

Complete Performance Check and Adjustment instructions are given in Sections 4 and 5. The Performance Check Procedure can also be helpful in localizing certain trouble in the instrument. In some cases, minor problems may be revealed or corrected by readjustment. If only a partial adjustment is performed, see the interaction chart, Table 5-1, for possible adjustment interactions with other circuits.



enclosed within heavy black lines. Also within the black lines, near either the top or the bottom edge, are the assembly number and name of the circuit board.

Component numbers and electrical values of components in this instrument are shown on the schematic diagrams. Refer to the first page of the "Diagrams" section for definitions of the reference designators and symbols used to identify components. Important voltages and waveform reference numbers (enclosed in hexagonal-shaped boxes) are also shown on each diagram. Waveform illustrations are located adjacent to their respective schematic diagram, and the physical location of each waveform test point is shown on the appropriate circuit board illustration.

#### Circuit Board Illustrations

Circuit board illustrations (showing the physical location of each component) are provided for use in conjunction with each schematic diagram. Each board illustration can be found on the back side of a foldout page, preceding the schematic diagram(s) to which it relates. If more than one schematic diagram is associated with a particular circuit board, the board illustration is located on a left-hand page preceding the diagram with which the board is first associated.

Also provided in the "Diagrams" section is an illustration of the bottom side of the Main circuit board. This drawing facilitates troubleshooting by showing the connection pads and the location of components that are mounted on the top side of the board. Probing of Main board component signals that are inaccessible from the

A circuit board interconnection diagram is also provided in the "Diagrams" section to aid in tracing a signal path or power source between boards. The entire oscilloscope is illustrated, with plug and jack numbers shown along with associated pin numbers. The off-board components are also shown, and the schematic diagram numbers on which these components can be found are identified.

## Power Distribution Diagram

A Power Distribution diagram is provided to aid in troubleshooting power-supply problems. This diagram shows service jumpers used to remove power from the various circuit boards. Excessive loading on a power supply by a circuit board can be isolated to the faulty board by disconnecting appropriate service jumpers.

## **Grid Coordinate System**

Each schematic diagram and circuit board illustration has a grid border along its left and top edges. A table located adjacent to each schematic diagram lists the grid coordinates of each component shown on that schematic. To aid in physically locating a component on the respective circuit board, this table also lists the circuit-board grid coordinate of each component.

Adjacent to each circuit board illustration is an alphanumeric listing of every component mounted on that board. A second column in this listing identifies the schematic diagram in which each component can be found. These component-locator tables are especially useful when more than one schematic diagram is associated with a particular circuit board.

performing the particular troubleshooting step called for in that box. General Notes contain information that pertains to the overall troubleshooting procedure.

Some malfunctions, especially those involving multiple simultaneous failures, may require more elaborate trouble-shooting approaches with references to circuit descriptions in the "Theory of Operation" section of this manual.

### Component Color Coding

Information regarding color codes and markings of resistors and capacitors is located in the color-coding illustration (Figure 9-1) at the beginning of the "Diagrams" section.

RESISTOR COLOR CODE. Resistors used in this instrument are carbon-film, composition, or precision metal-film types. They are color coded with the EIA color code; however, some metal-film resistors may have the value printed on the body. The color code is interpreted by starting with the stripe that is nearest to one end of the resistor. Composition resistors have four stripes; these represent two significant figures, a multiplier, and a tolerance value. Metal-film resistors have five stripes which represent three significant figures, a multiplier, and a tolerance value.

CAPACITOR MARKINGS. Capacitance values of common disc capacitors and small electrolytics are marked on the side of the capacitor body. White ceramic capacitors are color coded in picofarads, using a modified EIA code.

typical of those available at completion of the design of the instrument. Vendor changes and performance improvement changes may result in changes of case styles or lead configurations. If the device in question does not appear to match the configuration in Figure 9-2, examine the associated circuitry or consult a semiconductor manufacturer's data sheet.

#### **Multipin Connectors**

Multipin connector orientation is indicated by two triangles: one on the holder and one on the circuit board. Slot numbers are usually molded into the holder. When a connection is made to circuit-board pins, ensure that the triangle on the holder and the triangle on the circuit board are aligned with each other (see Figure 6-1).

#### TROUBLESHOOTING EQUIPMENT

The equipment listed in Table 4-1, or equivalent equipment, may be useful when troubleshooting this instrument.

#### TROUBLESHOOTING TECHNIQUES

The following procedure is arranged in an order that enables checking simple trouble possibilities before requiring more extensive troubleshooting. The first four checks ensure proper control settings, connections, operation, and adjustment. If the trouble is not located by these checks, the remaining steps will aid in locating the defective component. When the defective component is





section.



Before using any test equipment to make measurements on static-sensitive, current-sensitive, or voltagesensitive components or assemblies, ensure that any voltage or current supplied by the test equipment does not exceed the limits of the component to be tested.

#### 1. Check Control Settings

Incorrect control settings can give a false indication of instrument malfunction. If there is any question about the correct function or operation of any control, refer to either the "Operating Instructions" (Section 2) in this manual or to the instrument Operators Manual.

# 2. Check Associated Equipment

Before proceeding, ensure that any equipment used with this instrument is operating correctly. Verify that input signals are properly connected and that the interconnecting cables are not defective. Check the power-input-source voltages.

WARNING

To avoid electric shock, disconnect the instrument from the power-input source before performing visual inspection.

#### 5. Isolate Trouble to a Circuit

To isolate problems to a particular area, use the trouble symptom to help identify the circuit in which the trouble is located. Refer to the troubleshooting charts in the "Diagrams" section as an aid in locating a faulty circuit.

#### 6. Check Power Supplies

WARNING

It is recommended for safety that an isolation transformer be connected between the ac-power source and the autotransformer whenever troubleshooting is done in the Preregulator and the Inverter Power Supply sections. Most autotransformers are NOT isolation transformers.

Check the power supplies whenever trouble symptoms appear in more than one circuit. The correct output voltage and ripple for each supply should be measured between the supply test point and chassis ground (see Diagram 9 and its associated circuit board illustration). When checking power-supply circuitry utilizing common as the reference, use either a DMM or an oscilloscope and observe the preceding WARNING. If power supply voltages and ripple are within their listed ranges, the supply can be assumed to be operating correctly. If any are outside their ranges, the supply may be either misadjusted or operating incorrectly. A defective component elsewhere in the instrument can create the appearance of a power-supply problem and may also affect the operation of other circuits.

initial front-panel control settings, and cableconnection instructions. The control-setting changes (from initial setup) required to obtain the given waveforms and voltages are located on the waveformdiagram page.



To avoid electric shock, always disconnect the instrument from the power input source before removing or replacing components.

# 9. Check Individual Components

The following procedures describe methods of checking individual components. Two-lead components that are soldered in place are most accurately checked by first disconnecting one end from the circuit board. This isolates the measurement from the effects of surrounding circuitry. See Figure 9-1 for value identification or Figure 9-2 for typical semiconductor lead configuration.



When checking semiconductors, observe the staticsensitivity precautions located at the beginning of this section.

TRANSISTORS. A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a

paring two voltages taken with respect to ground. If the former method is used, both leads of the voltmeter must be isolated from ground.

If values less than these are obtained, either the device is shorted or no current is flowing in the external circuit. If values exceed the emitter-to-base values given, either the junction is reverse biased or the device is defective. Voltages exceeding those given for typical emitter-to-collector values could indicate either a nonsaturated device operating normally or a defective (open-circuited) transistor. If the device is conducting, voltage will be developed across the resistors in series with it; if it is open, no voltage will be developed across the resistors in series with it, unless current is being supplied by a parallel path.



When checking emitter-to-base junctions, do not use an ohmmeter range that has a high internal current. High current can damage the transistor. Reverse biasing the emitter-to-base junction with a high current may degrade the transistor's current-transfer ratio (Beta).

A transistor emitter-to-base junction also can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R X 1  $k\Omega$  range. The junction resistance should be very high in one direction and very low when the meter leads are reversed.





performed in much the same manner as on transistor emitter-to-base junctions. Do not check tunnel diodes or back diodes with an ohmmeter; use a dynamic tester, such as the TEKTRONIX 576 Curve Tracer.

**DIODES.** A diode can be checked for either an open or a shorted condition by measuring the resistance between terminals with an ohmmeter set to a range having a low internal source current, such as the R X 1 k $\Omega$  range. The diode resistance should be very high in one direction and very low when the meter leads are reversed.

Silicon diodes should have 0.6 to 0.8 V across their junctions when conducting. Higher readings indicate that they are either reverse biased or defective, depending on polarity.

### 10. Repair and Adjust the Circuit

If any defective parts are located, follow the replacement procedures given under "Corrective Maintenance" in this section. After any electrical component has been replaced, the performance for that particular circuit should be checked, as well as the performance of other closely related circuits. Since the power supplies affect all circuits, performance of the entire instrument should be checked if work has been done in any of the power supplies or if the power transformer has been replaced. Readjustment of the affected circuitry may be necessary. Refer to the "Performance Check Procedure" and "Adjustment Procedure" (Sections 4 and 5) and to Table 5-1 (Adjustment Interactions).

source before removing or installing components.

- 2. Use care not to interconnect instrument grounds which may be at different potentials (cross grounding).
- 3. When soldering on circuit boards or small insulated wires, use only a 15-watt, pencil-type soldering iron.

## OBTAINING REPLACEMENT PARTS

Most electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can usually be obtained from a local commercial source. Before purchasing or ordering a part from a source other than Tektronix, Inc., please check the "Replaceable Electrical Parts" list (Section 8) for the proper value, rating, tolerance, and description.

#### NOTE

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

### Special Parts

In addition to the standard electronic components, some special parts are used in this instrument. These

numbers).

- 2. Instrument serial number.
- A description of the part (if electrical, include its component number).
  - 4. Tektronix part number.

### MAINTENANCE AIDS

The maintenance aids listed in Table 6-4 include items required for performing most of the maintenance procedures on this instrument. Equivalent products may be substituted for the examples given, provided their characteristics are similar.

## INTERCONNECTIONS

Pin connectors are used to connect wires to the interconnecting pins. They are grouped together and mounted in a plastic holder and should be removed, reinstalled, or replaced as a unit. If an individual wire or connector in the assembly is faulty, the entire cable assembly should be replaced. To provide correct orientation of this multipin connector when it is reconnected to its mating pins, an arrow is stamped on the circuit board, and a matching arrow is molded into the plastic housing of the multipin connector. Be sure these arrows are aligned with each other when the multipin connector is reinstalled.

			replacement.	
7. D	Diagonal Cutters		Component removal and replacement.	
	/acuum Solder Extractor	No static charge retention.	Unsoldering components.	Pace Model PC-10.
9. L	ubricant	No-Noise.	Switch lubrication.	Tektronix Part Number 006-0442-02.
10. P	in-replacement Kit		Replace circuit board connector pins.	Tektronix Part Number 040-0542-00.

# TRANSISTORS AND INTEGRATED CIRCUITS

Transistors and integrated circuits should not be replaced unless they are actually defective. If unsoldered from the circuit board during routine maintenance, return them to their original board locations. Unnecessary replacement or transposing of semiconductor devices may affect the adjustment of the instrument. When a semiconductor is replaced, check the performance of any instrument circuit that may be affected.

Any replacement component should be of the original type or a direct replacement. Bend transistor leads to fit their circuit board holes and cut the leads to the same length as the original component. See Figure 9-2 for typical lead-configuration illustrations.

To remove a soldered dual-in-line packaged (DIP) IC, do not heat adjacent conductors consecutively. Apply heat to pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

The heat-sink-mounted power supply transistors are insulated from the heat sink. In addition, a heat-sink compound is used to increase heat transfer capabilities. Reinstall the insulators and replace the heat-sink compound when replacing these transistors. The compound should be applied to both sides of the insulators and should be applied to the bottom side of the transistor where it comes in contact with the insulator.

#### NOTE

After replacing a power transistor, check that the collector is not shorted to the heat sink before applying power to the instrument.

When soldering on circuit boards or small insulated wires, use only a 15-watt, pencil-type soldering iron. A higher wattage soldering iron can cause etched circuit conductors to separate from the board base material and melt the insulation on small wires. Always keep the soldering-iron tip properly tinned to ensure best heat transfer from the iron tip to the solder joint. To protect heat-sensitive components, either hold the component lead with long-nose pliers or place a heat block between the component body and the solder joint. Apply only enough solder to make a firm joint. After soldering, clean the area around the solder connection with an approved flux-removing solvent (such as isopropyl alcohol) and allow it to air dry.



Attempts to unsolder, remove, and resolder leads from the component side of a circuit board may cause damage to the reverse side of the circuit board.

The following techniques should be used to replace a component on any of the circuit boards:

1. Touch the vacuum desoldering tool to the lead at the solder connection. Never place the iron directly on the board; doing this may damage the board. 2222222

Excessive heat can cause the etched circuit conductors to separate from the circuit board. Never allow the solder extractor tip to remain at one place on the board for more than three seconds. Solder wick, spring-actuated or squeeze-bulb solder suckers, and heat blocks (for desoldering multipin components) must not be used. Damage caused by poor soldering techniques can void the instrument warranty.

- 3. To replace the component, bend the leads of the replacement item to fit the holes in the circuit board. If the component is replaced while the board is installed in the instrument, cut the leads so they protrude only a small amount through the reverse side of the circuit board. Excess lead length may cause shorting to other conductive parts.
- 4. Insert the leads into the holes of the board so that the replacement component is positioned the same as the original component. Most components should be firmly seated against the circuit board.
- Touch the soldering iron to the connection and apply enough solder to make a firm solder joint. Do not move the component while the solder hardens.
- Cut off any excess lead protruding through the circuit board (if not clipped to size in step 3).

To remove the instrument cabinet, perform the following steps:

- 1. Disconnect the instrument from its ac-power-input source.
- On instruments with detachable power cords, disconnect the power cord from the instrument.
- 3. Remove the screw from the right rear side of the cabinet and two screws from the rear panel. Then remove the rear panel and, if applicable, feed the nondetachable power cord through the rear panel as the panel is removed.
- Pull the front panel and attached chassis forward and out of the cabinet.

To reinstall the cabinet, perform the following steps:

- Slide the chassis frame into the cabinet from the front until the cabinet is fully into the front-panel groove and the rear of the cabinet is flush with the rear of the chassis.
- 6. Feed the attached power cord (if applicable) through the hole in the rear panel. Align the rear-panel and side mounting holes with the screw holes in the chassis frame and reinstall the three screws removed in step 3.

To remove the crt, perform the following steps:

1. Disconnect four deflection-plate wires at the middle of the crt neck and unplug the Trace Rotation connector (P8006) from the Front-Panel circuit board (note the connection locations and wire color for reinstallation reference).

## WARNING

The crt anode and output terminal of the High-Voltage Multiplier will retain a high-voltage charge after the instrument is turned off. To avoid electrical shock, ground both the output terminal of the multiplier and the crt high-voltage anode lead to the main instrument chassis after disconnecting the high-voltage lead.

- Unplug the crt anode lead connector from the High-Voltage Multiplier at the front left corner of the High-Voltage shield and discharge it to the chassis.
- 3. Remove two screws that retain the plastic crt frame and light filter to the front panel. Remove the crt frame and light filter from the instrument.
- 4. With the rear of the instrument facing you, place the fingers of both hands over the front edge of the front subpanel. Then, using both thumbs, press forward gently on the crt funnel near the front of the crt. When the crt

- 8. Reconnect the crt anode lead to the High-Voltage Multiplier (disconnected in step 2).
- Reconnect the four deflection-plate wires and the Trace Rotation connector (disconnected in step 1).

## High-Voltage Shield

To remove the High-Voltage shield, perform the following steps:

- Remove the screw from the plastic high-voltage cover on the bottom section of the Main circuit board.
   Press gently on the rear of the cover and slide it forward.
- Remove the screw securing the High-Voltage shield to the Main circuit board (located at the bottom of the circuit board near the right side of the frame).
- 3. Remove two screws securing the left rear of the High-Voltage shield to the back of the chassis frame.
- Remove the screw from the front upper right-hand corner of the High-Voltage shield.
- Remove the screw at the front upper left-hand corner and rotate the support bracket away from the High-Voltage shield.

- 11. Reinstall the screw holding the shield to the Main circuit board at the right side of the frame (removed in step 2).
- 12. Reinstall the plastic high-voltage cover on the bottom of the Main circuit board and secure the shield and cover with one screw (removed in step 1).

## Alt Sweep Circuit Board

To remove the Alt Sweep circuit board, perform the following steps:

- 1. Use a vacuum-desoldering tool to unsolder the 27 pins (which secure the Alt Sweep circuit board to the Main circuit board) from the Main circuit board.
- 2. Remove the Alt Sweep circuit board from the instrument by unclipping it from the plastic holder attached to the High-Voltage shield.
- If component removal is desired, remove the two nuts which secure the shield to the Alt Sweep circuit board and remove the shield.

To reinstall the Alt Sweep circuit board, perform the following steps:

4. Reinstall the shield to the Alt Sweep circuit board (if previously removed in step 3).

- 2. Set the CH 1 and CH 2 VOLTS/DIV switches to the same position; then remove their knobs by pulling straight out from the front panel. Note switch positions for reinstallation reference.
- 3. Use a 9/16-inch nut driver to remove the nuts securing the VOLTS/DIV switches to the front panel.
- 4. Lock the A and B SEC/DIV knobs together and note their position for reinstallation reference. Use a 1/4-inch nut driver to remove the nut and washers securing the B SEC/DIV knob; pull off the knob and collet from the shaft assembly.
- Use a 1/16-inch Allen wrench to loosen the set screws which secure the A SEC/DIV dial to the shaft assembly.
- 6. Disconnect the following connectors from the Attenuator/Sweep circuit board:
  - a. P1011, a four-wire connector located behind the CH 1 VOLTS/DIV switch assembly.
  - P2011, a four-wire connector located behind the CH 2 VOLTS/DIV switch assembly.
  - P7000, a seven-wire connector located on the rear edge of the circuit board.
  - d. P6000, a ten-wire connector located on the right edge of the circuit board.

the bottom of the shield and separate the shield from the circuit board.

To reinstall the Attenuator/Sweep circuit board, perform the following steps:

- 11. If the shield has been removed, secure it to the Attenuator/Sweep circuit board using three screws (removed in step 10). Insert two screws in the bottom of the shield at the front edge (removed in step 10), but do not tighten them.
- 12. Insert the three switch shafts through the holes in the Front-Panel circuit board and the front panel. Carefully align the 10 interconnecting pins on the Front-Panel circuit board with their corresponding connectors on the Attenuator/Sweep circuit board. Push the board forward into position, ensuring that the two screws in the bottom shield engage the front-panel bracket.
- 13. Tighten two screws securing the shield to the frontpanel bracket (loosened in step 8).
- 14. Reinstall three screws securing the shield to the Main circuit board (removed in step 7). Then tighten the two screws installed at the front edge of the shield in step 11.
- 15. Reconnect the four connectors to the Attenuator/ Sweep circuit board that were disconnected in step 6.

#### Front-Panel Circuit Board

To remove the Front-Panel circuit board, perform the following steps:

- 1. Remove the crt (see the "Cathode-Ray Tube" removal procedure).
- 2. Remove the Attenuator/Sweep circuit board (see the "Attenuator/Sweep Circuit Board" removal procedure).
- 3. Remove the knobs from the following control shafts by pulling them straight out from the front panel: Channel 1 and Channel 2 POSITION, A/B SWP SEP, Horizontal POSITION, AUTO FOCUS, AUTO INTENSITY, A TRIGGER LEVEL, and B TRIGGER LEVEL.
- Unplug the three-wire B DELAY TIME POSITION potentiometer connector (P7055) from the Main circuit board (located in front of the High-Voltage shield).
- 5. Unsolder the resistors from the CH 1 OR X, CH 2 OR Y, and EXT INPUT connectors and disconnect the two-wire connector (P1000) from the Front-Panel circuit board to the PROBE ADJUST jack. Unsolder two wires (from the VAR HOLDOFF control) from the Front-Panel circuit board.

- 10. Use a vacuum-desoldering tool to unsolder the 39 wire straps from the Main circuit board which connect to the Front-Panel circuit board.
- 11. Remove the Front-Panel circuit board from the instrument and clean the wire-strap holes on the Main circuit board of any remaining solder.

#### NOTE

If a vacuum-desoldering tool is not available, lift each strap out of the Main circuit board as its joint is heated.

To reinstall the Front-Panel circuit board, perform the following steps:

- 12. Insert but do not solder the 39 wire straps on the Front-Panel circuit board into their corresponding holes in the Main circuit board (unsoldered in step 10).
- 13. Align the two frame assemblies disassembled in step 9, making sure the POWER extension-shaft button is in place in the front panel. Reinstall four frame-securing screws (removed in step 8).
- 14. Reinstall three screws securing the Front-Panel circuit board to the front panel (removed in step 7).

20. Reinstall the crt (see the "Cathode-Ray Tube" reinstallation procedure).

#### Main Circuit Board

All components on the Main circuit board are accessible either directly or by removing the crt, Attenuator/Sweep circuit board, or High-Voltage shield. Removal of the Main circuit board is required only when it is necessary to replace the board with a new one.

To remove the Main circuit board, perform the following steps:

- 1. Remove the Attenuator/Sweep circuit board (see the "Attenuator/Sweep Circuit Board" removal procedure).
- 2. Disconnect the three-wire B DELAY TIME POSI-TION potentiometer connector (P7055) from the Main circuit board (located in front of the High-Voltage shield).
- 3. Remove the High-Voltage shield (see the "High-Voltage Shield" removal procedure).
- Remove the Alt Sweep circuit board (see the "Alt Sweep Circuit Board" removal procedure).
- Remove the AUTO FOCUS control-knob shaft assembly by pulling it straight out from the front panel.

- Unsolder two sets of delay-line wires from the Main circuit board, noting wire color and position for reinstallation reference.
- 11. Remove two screws securing the power-supply transistor heat-sink assembly to the right side of the frame.
- 12. Remove three screws securing the Main circuit board to the instrument frame (one under the EXT Z AXIS connector and two along the left side of the Main circuit board).
- 13. Use a vacuum-desoldering tool to unsolder the 39 interconnecting wire straps (connecting the Main circuit board to the Front-Panel circuit board) from the Main circuit board.

#### NOTE

If a vacuum-desoldering tool is not available, lift each wire strap out of the Main circuit board as its joint is heated. Use care to maintain, as nearly as possible, the original shape and spacing of the wire straps to facilitate replacing the circuit board.

14. Push the wire-strap connection end of the Main circuit board down until it is clear of the wire strap ends; then remove it through the bottom of the instrument frame. Ensure that the interconnecting wire straps are not bent out of place.

- 20. Move the front part of the Main circuit board into position. Align the 39 wire straps and insert them into their corresponding holes while maintaining their original shape and spacing.
  - 21. Resolder the wire straps to the Main circuit board.
- 22. Resolder two sets of delay-line wires at the location noted in step 10.
- 23. Resolder two sets of crt socket wires at the locations noted in step 9.
- Insert and resolder the EXT Z AXIS connector wire into the Main circuit board.
- 25. Reconnect the leads of L925 (inductor), the fuse holder, the power cord connector, and four wires from the Current Limit board (removed in step 7).
- 26. Insert the POWER switch extension-shaft push button assembly into the front panel (from the rear). Use a flat-bit screwdriver to hold the POWER switch shaft fully in and align the extension shaft with the switch shaft. Press them together gently until they snap into position.

### **Current Limit Circuit Board**

To remove the Current Limit board, perform the following steps:

- 1. Remove the High-Voltage shield (see the "High-Voltage Shield" removal procedure).
- 2. Disconnect the four single-wire connectors from the Current Limit board (P801, P802, P803, and P804).
- 3. Remove the screw and nut which secure the Current Limit board to the chassis frame.

To reinstall the Current Limit board, perform the following steps:

- 4. Reinstall the securing screw and nut (removed in step 3).
- 5. Reconnect the four single-wire connectors (removed in step 2).
- 6. Reinstall the High-Voltage shield (see the "High-Voltage Shield" reinstallation procedure).



A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

## CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

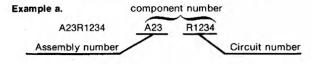
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

#### **ABBREVIATIONS**

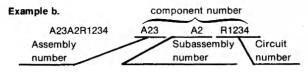
Abbreviations conform to American National Standard Y1.1.

## COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:



Read: Resistor 1234 of Assembly 23



Read: Resistor 1234 of Subassembly 2 of Assembly 23

#### Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

## SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

## NAME & DESCRIPTION (column five of the Electrical Parts List)

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.

## MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

## MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

	FAIRCHILD CAMERA AND INSTRUMENT CORP.
09969	DALE ELECTRONICS, INC.
12697	CLAROSTAT MFG CO., INC.
12969	UNITRODE CORPORATION
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.
14552	MICRO SEMICONDUCTOR CORP.
14752	ELECTRO CUBE INC.
15238	ITT SEMICONDUCTORS, A DIVISION OF INTER
	NATIONAL TELEPHONE AND TELEGRAPH CORP.
15454	RODAN INDUSTRIES, INC.
18324	SIGNETICS CORP.
19396	ILLINOIS TOOL WORKS, INC. PAKTRON DIV.
19701	ELECTRA-MIDLAND CORP., MEPCO ELECTRA INC.
20462	PREM ENTERPRISES, INC.
20932	EMCON DIV OF ILLINOIS TOOL WORKS INC.
22229	SOLITRON DEVICES, INC.,
22229	SEMICONDUCTOR GROUP
22526	BERG ELECTRONICS, INC.
24444	GENERAL SEMICONDUCTOR INDUSTRIES INC.
24444	GENERAL SEMICONDUCTOR INDUSTRIES INC.
24546	CORNING GLASS WORKS, ELECTRONIC
	COMPONENTS DIVISION
27014	NATIONAL SEMICONDUCTOR CORP.
31918	IEE/SCHADOW INC.
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.
50157	MIDWEST COMPONENTS INC.
50434	HEWLETT-PACKARD COMPANY
51642	CENTRE ENGINEERING INC.
52306	HIGH VOLTAGE DEVICES, INC.
52769	SPRAGUE GOODMAN ELEC., INC.
53184	XCITON CORPORATION
53944	ELT INC., GLOW LITE DIVISION
54473	MATSUSHITA ELECTRIC, CORP. OF AMERICA
54937	DEYOUNG MFG., INC.
55210	GETTIG ENG. AND MFG. COMPANY
55680	NICHICON/AMERICA/CORP.
56289	SPRAGUE ELECTRIC CO.
59660	TUSONIX INC.
71400	TUSONIX INC. BUSSMAN MFG., DIVISION OF MCGRAW- EDISON CO.
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.

464 ELLIS STREET MOUNTAIN VIEW, CA 94042 P O BOX 180, EAST HIGHWAY 50 YANKTON, SD 57078 LOWER WASHINGTON STREET DOVER, NH 03820 580 PLEASANT STREET WATERTOWN, MA 02172 LOS GATOS, CA 95030 2830 E FAIRVIEW ST. SANTA ANA, CA 92704 1710 S. DEL MAR AVE. SAN GABRIEL, CA 91776 P.O. BOX 168, 500 BROADWAY LAWRENCE, MA 01841 2905 BLUE STAR ST. ANAHEIM, CA 92806 811 E. ARQUES SUNNYVALE, CA 94086 900 FOLLIN LANE, SE VIENNA, VA 22180 MINERAL WELLS, TX 76067 P O BOX 760 MCHENRY, IL 60050 3519 N. CHAPEL HILL 11620 SORRENTO VALLEY RD P O BOX 81542 SAN DIEGO, CA 92121 SAN DIEGO OPERS, CA 92123 8808 BALBOA AVENUE YOUK EXPRESSWAY NEW CUMBERLAND, PA 17070 2001 W 10TH PLACE P.O. BOX 3078 TEMPE, AZ 85281 550 HIGH STREET BRADFORD, PA 16701 2900 SEMICONDUCTOR DR. SANTA CLARA, CA 95051 8081 WALLACE ROAD EDEN PRAIRIE, MN 55343 1200 COLUMBIA AVE. RIVERSIDE, CA 92507 P. O. BOX 787 1981 PORT CITY BLVD. MUSKEGON, MI 49443 640 PAGE MILL ROAD PALO ALTO, CA 94304 2820 E COLLEGE AVENUE STATE COLLEGE, PA 16801 7485 AVENUE 304 VISALIA, CA 93277 134 FULTON AVENUE GARDEN CITY PARK, NY 11040 5 HEMLOCK STREET LATHAM, NY 12110 BOX 698 PAULS VALLEY, OK 73075 1 PANASONIC WAY SECAUCUS, NJ 07094 PO BOX 1806, 1517 130TH AVE. BELLEVUE, WA 98009 PO BOX 85, OFF ROUTE 45 SPRING MILLS, PA 16875 6435 N PROESEL AVENUE CHICAGO, IL 60645 87 MARSHALL ST. NORTH ADAMS, MA 01247 2155 N FORBES BLVD TUCSON, AZ 85705

2536 W. UNIVERSITY ST.

644 W. 12TH ST.

ST. LOUIS, MO 63107

ERIE, PA 16512

REV AUG 1982 8-3

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A10C255	281-0773-00		CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	GC70-1C103K
A10C260	281-0773-00		CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	GC70-1C103K
A10C264	283-0084-00		CAP., FXD, CER DI: 270PF, 5%, 1000V	72982	838-533B271J
A10C265	281-0773-00	XB011400	CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	GC70-1C103K
A10C270	281-0862-00		CAP., FXD, CER DI:0.001UF, +80-20%, 100V	20932	401-ES-100AD1022
A10C273	281-0814-00		CAP., FXD, CER DI:100PF, 10%, 100V	04222	GC70-1-A101K
A10C275	281-0791-00		CAP., FXD, CER DI: 270PF, 10%, 100V	72982	8035D2AADX5R271F
A10C279	281-0823-00		CAP., FXD, CER DI: 470PF, 10%, 50V	12969	CGB471KDN
A10C280	283-0648-00		CAP., FXD, MICA D: 10PF, 5%, 100V	00853	D151C100D0
A10C284	283-0154-00	B010100 B011399	CAP., FXD, CER DI:22PF, 5%, 50V	72982	8111B061C0G220J
A10C284	281-0759-00	B011400	CAP., FXD, CER DI: 22PF, 10%, 100V	72982	8035D9AADC1G220I
A10C285	281-0791-00		CAP., FXD, CER DI: 270PF, 10%, 100V	72982	8035D2AADX5R2711
A10C293	281-0862-00		CAP., FXD, CER DI:0.001UF, +80-20%, 100V	20932	401-ES-100AD1027
A10C299	290-0136-00		CAP., FXD, ELCTLT: 2.2UF, 20%, 20V	56289	162D225X0020CD2
A10C304	281-0773-00		CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	GC70-1C103K
A10C305	290-0167-00		CAP., FXD, ELCTLT: 10UF, 20%, 15V	56289	150D106X0015B2
A10C308	285-0643-00		CAP., FXD, PLSTC: 0.0047UF, 5%, 100V	84411	TEK-180 47251
A10C310	281-0775-00		CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
A10C311	281-0862-00		CAP., FXD, CER DI:0.001UF, +80-20%, 100V	20932	401-ES-100AD102
A10C314	281-0773-00	B010100 B017149X	CAP., FXD, CER DI:0.01UF, 10%, 100V	04222	GC70-1C103K
A10C316	281-0862-00		CAP., FXD, CER DI: 0.001UF, +80-20%, 100V	20932	401-ES-100AD102
A10C317	281-0775-00		CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
A10C335	281-0810-00		CAP., FXD, CER DI:5.6PF, 0.5%, 100V	04222	GC10-1A5R6D
A10C340	281-0645-00		CAP., FXD, CER DI:8.2PF,+/-0.25PF,500V	59660	374 018 COH0829
A10C345	281-0810-00		CAP., FXD, CER DI:5.6PF, 0.5%, 100V	04222	GC10-1A5R6D
A10C350	281-0823-00		CAP., FXD, CER DI: 470PF, 10%, 50V	12969	CGB471KDN
A10C357	281-0226-00		CAP., VAR, PLSTC: 5.5-65PF, 100V	52769	GXD38000
A10C358	281-0767-00		CAP., FXD, CER DI: 330PF, 20%, 100V	12969	CGB331MEX
A10C360	281-0823-00		CAP., FXD, CER DI: 470PF, 10%, 50V	12969	
A10C366	281-0234-00		CAP., VAR, PLSTC: 5.5-65PF, 100V	80031	2810C5R565UJ02F
A10C367	281-0814-00		CAP., FXD, CER DI: 100PF, 10%, 100V	04222	GC70-1-A101K
A10C368	283-0051-00		CAP., FXD, CER DI:0.0033UF, 5%, 100V	56289	
A10C372	281-0862-00	XB016700	CAP., FXD, CER DI:0.001UF, +80-20%, 100V	20932	401-ES-100AD102
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8-4					REV AUG 1982

CAP., FXD, CER DI: 470PF, 10%, 50V

CAP., FXD, MICA D: 10PF, 5%, 100V

CAP., FXD, CER DI: 270PF, 10%, 100V

CAP., FXD, ELCTLT: 2.2UF, 20%, 20V

CAP., FXD, CER DI: 0.001UF, +80-20%, 100V

CAP., FXD, CER DI:0.001UF, +80-20%, 100V

12969 CGB471KDN

00853 D151C100D0

72982 8035D2AADX5R271K

20932 401-ES-100AD102Z

56289 162D225X0020CD2

20932 401-ES-100AD1022

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281-0823-00

283-0648-00

281-0791-00

281-0862-00

290-0136-00

281-0862-00

A10C179

A10C180

A10C185

A10C193

A10C199

A10C253

A10C455 281-0862-00 CAP.,FXD,CER DI:0.001UF,+80-20%,100V	
A10C457 281-0773-00 CAP., FXD, CER DI: 0.01UF, 10%, 100V	
A10C458 281-0773-00 CAP.,FXD,CER DI:0.01UF,10%,100V	
A10C476 281-0773-00 CAP., FXD, CER DI:0.01UF, 10%, 100V	
A10C477 281-0773-00 CAP.,FXD,CER DI:0.01UF,10%,100V	
A10C480 281-0773-00 CAP.,FXD,CER DI:0.01UF,10%,100V	
A10C503 290-0246-00 CAP.,FXD,ELCTLT:3.3UF,10%,15V	
A10C504 290-0246-00 CAP., FXD, ELCTLT: 3.3UF, 10%, 15V	
A10C505 281-0773-00 CAP., FXD, CER DI:0.01UF, 10%, 100V	
A10C506 283-0177-00 CAP.,FXD,CER DI:1UF,+80-20%,25V	
A10C564 281-0773-00 CAP.,FXD,CER DI:0.01UF,10%,100V	
A10C569 281-0773-00 CAP., FXD, CER DI:0.01UF, 10%, 100V	
A10C601 281-0774-00 CAP., FXD, CER DI: 0.022UF, 20%, 100V	
A10C602 281-0862-00 B010100 B018549X CAP., FXD, CER DI:0.001UF, +80-207, 100V	
A10C603 281-0775-00 CAP., FXD, CER DI:0.1UF, 207, 50V	
A10C604 281-0775-00 CAP., FXD, CER DI:0.1UF, 20%, 50V	
A10C605 281-0775-00 CAP., FXD, CER DI:0.1UF, 20%, 50V	
A10C606 281-0862-00 B010100 B018549X CAP.,FXD,CER DI:0.001UF,+80-20%,100V	
A10C606 281-0862-00 XB020500 CAP., FXD, CER DI:0.001UF, +80-20%, 100V	
A10C607 281-0862-00 B010100 B018549X CAP.,FXD,CER DI:0.001UF,+80-20%,100V	
A10C608 281-0775-00 CAP., FXD, CER DI:0.1UF, 20%, 50V	
A10C610 281-0775-00 CAP.,FXD,CER DI:0.1UF,20%,50V	
A10C614 290-0135-00 CAP.,FXD,ELCTLT:15UF,20%,20V	
A10C618 281-0773-00 CAP.,FXD,CER DI:0.01UF,10%,100V	
A10C619 281-0791-00 B010100 B011229X CAP., FXD, CER DI: 270PF.10%, 100V	
A10C628A,B 295-0138-00 B010100 B020949 CAP.SET, MATCHED: 1UF, 0.01UF, 1%, OA RAN	GE 32
A10C628A,B 295-0138-01 B020950 CAP SET, MATCHED: 1UF, 0.01UF, 17, 0A RAN	
A10C637 281-0810-00 CAP., FXD, CER DI:5.6PF, 0.5%, 100V	
A10C640 281-0775-00 CAP., FXD, CER DI:0.1UF, 20%, 50V	
A10C642 281-0770-00 CAP., FXD, CER DI:0.001UF, 20%, 100V	
A10C644 281-0770-00 CAP., FXD, CER DI:0.001UF, 20%, 100V	
A10C645 290-0167-00 CAP.,FXD,ELCTLT:10UF,20X,15V	
A10C646 281-0775-00 CAP.,FXD,CER DI:0.1UF,20%,50V	
A10C647 281-0772-00 CAP.,FXD,CER DI:0.0047UF,10%,100V	
A10004/ 201-0//2-00 Ont., FAD, OBA D1:0.004/0F, 104, 1004	
A10C648 281-0773-00 CAP.,FXD,CER DI:0.01UF,10%,100V	
A10C651 281-0773-00 CAP., FXD, CER DI: 0.01UF, 107, 100V	
A10C658 290-0745-00 B010100 B010684X CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	

04222 GC70-1C103K 04222 GC70-1C103K 04222 GC70-1C103K 04222 GC70-1C103K 04222 GC70-1C103K 56289 162D335X9015CD2 56289 162D335X9015CD2 04222 GC70-1C103K 56289 273C5 04222 GC70-1C103K 04222 GC70-1C103K 12969 CGE223MEZ 20932 401-ES-100AD102Z 04222 SA205E104MAA 04222 SA205E104MAA 04222 SA205E104MAA 20932 401-ES-100AD102Z 20932 401-ES-100AD102Z 20932 401-ES-100AD102Z 04222 SA205E104MAA 04222 SA205E104MAA 56289 150D156X0020B2 04222 GC70-1C103K 72982 8035D2AADX5R271K 80009 295-0138-00 80009 295-0138-01 04222 GC10-1A5R6D 04222 SA205E104MAA 72982 8035D9AADX5R102M 72982 8035D9AADX5R102M 56289 150D106X0015B2 04222 SA205E104MAA 04222 GC701C472K 04222 GC70-1C103K 04222 GC70-1C103K 56289 502D225

20932 401-ES-100AD102Z

A10C820 A10C821 A10C822 A10C824 A10C825 A10C834 A10C836 A10C840 A10C841 A10C842 A10C844	281-0773-00 290-0183-00 281-0775-00 281-0773-00 290-0183-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00		CAP., FXD, ELCT CAP., FXD, CER CAP., FXD, ELCT CAP., FXD, CER	DI:0.01UF,10%,100V FLT:1UF,10%,35V DI:0.1UF,20%,50V DI:0.01UF,10%,100V FLT:1UF,10%,35V	90201 04222 04222 90201	
A10C822 A10C824 A10C825 A10C834 A10C836 A10C840 A10C841 A10C842 A10C844	281-0775-00 281-0773-00 290-0183-00 281-0775-00 281-0773-00 281-0775-00 281-0775-00		CAP., FXD, CER CAP., FXD, ELCT CAP., FXD, CER	DI:0.1UF,20%,50V DI:0.01UF,10%,100V FLT:1UF,10%,35V	04222 04222 90201	SA205E104MAA GC70-1C103K
A10C824 A10C825 A10C834 A10C836 A10C840 A10C841 A10C842 A10C844	281-0773-00 290-0183-00 281-0756-00 281-0773-00 281-0775-00 281-0773-00 281-0775-00		CAP., FXD, CER CAP., FXD, ELCT CAP., FXD, CER	DI:0.01UF,10%,100V FLT:1UF,10%,35V	04222 90201	GC70-1C103K
A10C825 A10C834 A10C836 A10C840 A10C841 A10C842 A10C844	290-0183-00 281-0756-00 281-0773-00 281-0775-00 281-0773-00 281-0775-00		CAP., FXD, ELCT	TLT: 1UF, 10%, 35v	90201	
A10C834 A10C836 A10C840 A10C841 A10C842 A10C844	281-0756-00 281-0773-00 281-0775-00 281-0773-00 281-0775-00		CAP., FXD, CER		1,11	TAC105K035P02
A10C836 A10C840 A10C841 A10C842 A10C844	281-0773-00 281-0775-00 281-0773-00 281-0775-00			DI: 2.2PF.0.5%.200V	10000	
A10C840 A10C841 A10C842 A10C844	281-0775-00 281-0773-00 281-0775-00		CAP. FXD. CER		12969	CGB2R2DFN
A10C841 A10C842 A10C844	281-0773-00 281-0775-00			DI:0.01UF,10%,100V	04222	GC70-1C103K
A10C842 A10C844	281-0775-00		CAP., FXD, CER	DI:0.1UF,20%,50V	04222	SA205E104MAA
A10C844			CAP., FXD, CER	DI:0.01UF,10%,100V	04222	GC70-1C103K
	001 0060 00		CAP., FXD, CER	DI: 0.1UF, 20%, 50V	04222	SA205E104MAA
	281-0862-00		CAP., FXD, CER	DI:0.001UF,+80-20%,100V	20932	401-ES-100AD102Z
A10C845	281-0775-00			DI:0.1UF,20%,50V	04222	
A10C847	281-0775-00			DI: 0.1UF, 20%, 50V	04222	SA205E104MAA
A10C848	281-0775-00			DI:0.1UF,20%,50V	04222	
A10C849	283-0057-00			DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C852	283-0057-00			DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C854	283-0057-00		CAP., FXD, CER	DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C861	283-0057-00			D1:0.1UF,+80-20%,200V		2C20Z5U104Z200B
A10C863	281-0791-00			DI: 270PF, 10%, 100V	72982	The second secon
A10C864	283-0279-00			DI:0.001UF,20%,3000V	59660	878-530 Y5S0102M
A10C865	283-0430-00			DI:0.02UF,+80-20%,3000V	0001Q	
A10C871	283-0057-00			DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C873	283-0057-00		CAP., FXD, CER	DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C876	283-0057-00			DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C877	283-0057-00			DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C878	283-0109-00			DI: 27PF,5%,1000V	56289	
A10C879	283-0109-00			DI: 27PF, 5%, 1000V	56289	200376
A10C886	283-0057-00			DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A10C901	285-1196-00		CAP., FXD, PAPE	ER:0.01UF,20%,250V	84411	PME 271 Y 510
A10C912	281-0770-00			DI:0.001UF,20%,100V	72982	8035D9AADX5R102N
A10C915	290-0188-00	B010100 B021999X			56289	162D104X9035BC2
A10C917	290-0808-00	B010100 B021999X	CAP., FXD, ELC	TLT: 2.7UF, 10%, 20V	56289	162D275X9020CD2

CAP., FXD, CER DI: 0.1UF, 20%, 50V

CAP., FXD, CER DI: 680PF, 10%, 50V

CAP., FXD, CER DI: 270PF, 10%, 100V CAP., FXD, CER DI: 0.01UF, 10%, 100V

CAP., FXD, CER DI:0.1UF,+80-20%,200V

281-0775-00

283-0057-00

281-0820-00

281-0791-00

281-0773-00

B010100 B018549

B018550

XB010685

A10C798

A10C799

A10C803

A10C803

A10C810

04222 SA205E104MAA

72982 8035D2AADX5R271K

12969 CGB681KDX

04222 GC70-1C103K 04222 GC70-1C103K

2C20Z5U104Z200B

56289

A10C995 A10CR177 A10CR178 A10CR178 A10CR178 A10CR187 A10CR187 A10CR187 A10CR188 A10CR188 A10CR188 A10CR196 A10CR196 A10CR197 A10CR188 A10CR196 A10CR278 A10CR277 A10CR278 A10CR288 A152-0141-02 A10CR288 A152-0141-02 A10CR288 A152-0141-02 A10CR296 A10CR305 A10CR305 A10CR305 A10CR307 A10CR408 A10CR408 A10CR408 A10CR408 A10CR408 A10CR409 A10CR408 A10CR408 A10CR409 A10CR408 A10CR610 A10CR600 A10CR408 A10CR600 A10CR408 A10CR600 A10CR408 A10CR601 A	A10C995	283-0430-00 BC	010100 B018549	CAP., FXD, CER DI:0.02UF, +80-20%, 3000V
A10CR177 A10CR177 A10CR178 A10CR187 A10CR187 A10CR187 A10CR188 A152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA SEMICOND DEVICE: SILICON, 30V, 150MA A10CR186 A10CR196 A10CR277 A10CR278 A10CR278 A10CR278 A10CR278 A10CR278 A10CR287 A10CR288 A10CR287 A10CR288 A10CR288 A10CR288 A10CR288 A10CR296 A10CR297 A10CR297 A10CR297 A10CR297 A10CR298 A10CR2				CAP., FXD, MTLZD: 0.01 UF, 20%, 4000V
A10CR187 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR187 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR188 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR276 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR277 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR278 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR287 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR288 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR296 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR305 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR305 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR409 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR418 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR440 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR440 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR444 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR444 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR440 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR640 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR610 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR610 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR611 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR611 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR611 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR622 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR644 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR645 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR646 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR640 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR705 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR706 152-0141-02 SEMICOND DEVICE: SI			010330	
A10CR188				
A10CR188	410an197	152 01/1 02		SEMICOND DEVICE-STITCON 30V 150MA
A10CR196 A10CR277 A10CR278 A10CR278 A10CR278 A10CR287 A10CR287 A10CR287 A10CR287 A10CR287 A10CR287 A10CR288 A10CR288 A10CR296 A10CR305 A10CR296 A10CR305 A10CR296 A10CR305 A10CR296 A10CR305 A10CR296 A10CR305 A10CR296 A10CR305 A10CR296 A10CR306 A10CR296 A10CR307 A10CR296 A10CR307 A10CR409 A10CR409 A10CR409 A10CR418 A10CR418 A10CR418 A10CR440 A10CR444 A152-0141-02 A10CR444 A152-0141-02 A10CR444 A152-0141-02 A10CR444 A152-0141-02 A10CR446 A10CR446 A10CR446 A10CR447 A10CR407 A10CR601 A10CR503 A10CR504 A10CR504 A10CR504 A10CR504 A10CR504 A10CR504 A10CR601 A10CR604 A10CR606 A10CR604 A10CR606 A10CR607 A10CR607 A10CR607 A10CR608 A10CR				
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A10CR504 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR611 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR615 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR620 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR622 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR640 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR644 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR644 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR745 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR748 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR749 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR770 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR772 152-0322-00 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR773 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR7780 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA		152-0141-02		SEMICOND DEVICE: SILICON, 30V, 150MA
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A10CR615 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR620 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR622 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR640 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR644 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR745 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR748 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR749 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR770 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR771 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR772 152-0322-00 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR773 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR773 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR7780 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR7780 SEMICOND DEVICE: SILICON, 30V, 150MA				
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A10CR620 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR622 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR640 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR644 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR745 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR748 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR749 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR770 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR771 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR772 152-0322-00 SEMICOND DEVICE: SILICON, 15V, HOT CARRIER A10CR773 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR7780 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR7780 SEMICOND DEVICE: SILICON, 30V, 150MA				
A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR705 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR706 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR707 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR707 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR770 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR772 152-0322-00 SEMICOND DEVICE: SILICON, 15V, HOT CARRIER A10CR773 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA A10CR7780 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA SEMICOND DEVICE: SILICON, 30V, 150MA SEMICOND DEVICE: SILICON, 30V, 150MA				
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A10CR644 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR704 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR745 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR748 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR749 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR770 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR772 152-0322-00 SEMICOND DEVICE: SILICON, 15V, HOT CARRIER  A10CR773 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA  A10CR7780 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA				
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A10CR748 152-0141-02 SEMICOND DEVICE:SILICON, 30V, 150MA A10CR749 152-0141-02 SEMICOND DEVICE:SILICON, 30V, 150MA A10CR770 152-0141-02 SEMICOND DEVICE:SILICON, 30V, 150MA A10CR772 152-0322-00 SEMICOND DEVICE:SILICON, 15V, HOT CARRIER  A10CR773 152-0141-02 SEMICOND DEVICE:SILICON, 30V, 150MA A10CR780 152-0141-02 SEMICOND DEVICE:SILICON, 30V, 150MA	100000000000000000000000000000000000000			
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A10CR780 152-0141-02 SEMICOND DEVICE: SILICON, 30V, 150MA	AIUUR/12	132-0322-00		SENTEUR DEVICE. SILICON, 13V, NOT CARRIER
	A10CR773	152-0141-02		SEMICOND DEVICE: SILICON, 30V, 150MA
A10CR782 152-0322-00 SEMICOND DEVICE: SILICON, 15V, HOT CARRIER	A10CR780	152-0141-02		SEMICOND DEVICE: SILICON, 30V, 150MA
	A10CR782	152-0322-00		SEMICOND DEVICE: SILICON, 15V, HOT CARRIER

84411 TEK-183103040 01295 1N4152R 01295 IN4152R 01295 1N4152R 50434 5082-2672 01295 1N4152R 01295 1N4152R 50434 5082-2672

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			demessor delegations
A10CR931	152-0782-00	B010100 B021199X	
A10CR933	152-0782-00	B010100 B021199X	
A10CR940	152-0414-00	BOTOTOO BOZITION	SEMICOND DEVICE: SILICON, 200V, 0.75A
A10CR942	152-0414-00		SEMICOND DEVICE: SILICON, 200V, 0.75A
AIUCR942	132-0414-00		SEMICOND DEVICE. SIEIGON, 2007, 0.73K
A10CR956	152-0141-02		SEMICOND DEVICE: SILICON, 30V, 150MA
A10CR961	152-0413-00		SEMICOND DEVICE: SILICON, 400V, 750MA
A10CR963	152-0413-00		SEMICOND DEVICE: SILICON, 400V, 750MA
A10CR965	152-0414-00		SEMICOND DEVICE: SILICON, 200V, 0.75A
A10CR967	152-0414-00		SEMICOND DEVICE: SILICON, 200V, 0.75A
A10CR971	152-0414-00		SEMICOND DEVICE: SILICON, 200V, 0.75A
A 1000072	152-0414-00		SEMICOND DEVICE: SILICON, 200V, 0.75A
A10CR972			SEMICOND DEVICE: SILICON, 200V, 0.75A
A10CR973	152-0414-00		SEMICOND DEVICE: SILICON, 200V, 0.75A
A10CR974	152-0414-00		SEMICOND DEVICE: SILICON, 200V, 0.75A
A10CR977	152-0413-00		SEMICOND DEVICE: SILICON, 400V, 750MA SEMICOND DEVICE: SILICON, 600V, 1A
A10CR985	152-0040-00		LAMP, GLOW: 90V, 0.3MA
A10DS854	150-0035-00		LAMP, GLOW: 90V, U. SMA
A10DS856	150-0035-00		LAMP, GLOW: 90V, 0.3MA
A10DS867	150-0035-00		LAMP, GLOW: 90V, 0.3MA
A10DS868	150-0035-00		LAMP,GLOW:90V,0.3MA
A10DS870	150-0035-00		LAMP, GLOW: 90V, 0.3MA
A10E199	276-0532-00		SHIELDING BEAD,:
A10E299	276-0532-00		SHIELDING BEAD,:
A10L971	108-1058-00		COIL, RF: FIXED, 10UH
A10L972	108-1058-00		COIL, RF: FIXED, 10UH
A10P1011	131-0608-00	B010100 B010417X	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD
Alorioni		2010100 2010 1111	(QTY 4)
A10P2011	131-0608-00	B010100 B010417X	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD
			(QTY 4)
A10P6001	131-0608-00	B010100 B010417X	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD
ATOT GOOT		2010100	(QTY 10)
A10P7001	131-0608-00	B010100 B010417X	TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD
			(QTY 7)
A10P7055	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD
			(QTY 3)
A10P9000	131-1048-00		TERM.QIK DISC:CKT BD MT.O.11 X 0.02
11201 7000	131 1040 00		(QTY 2)
A10P9025	131-1048-00	B010100 B021199X	
			(QTY 2)
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12969	UTR308
01295	1N4152R
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12060	UTP 30.7
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15238	LG109
53944	UTR307 LG109 A1B-3
53944	A1B-3
02114	56-590-65/4A6
02114	56-590-65/4A6 56-590-65/4A6
02113	B8724 B8724
02113	B8724
22526	47357
22526	47357
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00779	61134-1
00779	61134-1

05828 GP20J-009 05828 GP20J-009 12969 UTR308

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Code	Mfr Part Number
A10Q157	151-0712-00		TRANSISTOR: SILICON, NPN	04713	SPS8223
A10Q167	151-0712-00		TRANSISTOR: SILICON, NPN	04713	
				04713	
A10Q173	151-0188-00		TRANSISTOR: SILICON, PNP		
A10Q177 A10Q187	151-0712-00 151-0712-00		TRANSISTOR: SILICON, NPN TRANSISTOR: SILICON, NPN	04713 04713	
Alogion	131-0712-00		TRANSISTOR. SILICON, MIN	04/13	51.00225
A10Q257	151-0712-00		TRANSISTOR: SILICON, NPN	04713	
A10Q258	151-0712-00		TRANSISTOR: SILICON, NPN	04713	
A10Q267	151-0712-00		TRANSISTOR: SILICON, NPN	04713	
A10Q268	151-0712-00		TRANSISTOR: SILICON, NPN	04713	
A10Q273	151-0188-00		TRANSISTOR: SILICON, PNP	04713	
A10Q277	151-0712-00		TRANSISTOR: SILICON, NPN	04713	SPS8223
A10Q287	151-0712-00		TRANSISTOR: SILICON, NPN	04713	SPS8223
A10Q316	151-0188-00		TRANSISTOR: SILICON, PNP	04713	SPS6868K
A10Q331	151-0369-00		TRANSISTOR: SILICON, PNP	01295	
A10Q335	151-0221-02		TRANSISTOR: SILICON, PNP	80009	151-0221-02
A10Q341	151-0369-00		TRANSISTOR: SILICON, PNP	01295	
A10Q345	151-0221-02		TRANSISTOR: SILICON, PNP	80009	
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A10Q350	151-0271-00		TRANSISTOR: SILICON, PNP	04713	
A10Q360	151-0271-00		TRANSISTOR: SILICON, PNP	04713	
A10Q370	151-0188-00		TRANSISTOR: SILICON, PNP	04713	F C C C C C C C C C C C C C C C C C C C
A10Q376	151-0752-00		TRANSISTOR: SILICON, NPN	01281	
A10Q377 A10Q380	151-0127-00		TRANSISTOR: SILICON, NPN	07263 04713	
A10Q360	151-0188-00		TRANSISTOR: SILICON, PNP	04/13	STSUBUOK
A10Q386	151-0752-00		TRANSISTOR: SILICON, NPN	01281	BFR96
A10Q387	151-0127-00		TRANSISTOR: SILICON, NPN	07263	S006075
A10Q392	151-0736-00		TRANSISTOR: SILICON, NPN	04713	SPS8317
A10Q411A,B	151-1042-00		SEMICOND DVC SE: MATCHED PAIR FET	01295	SKA5390
A10Q414	151-0198-00		TRANSISTOR: SILICON, NPN, SEL FROM MPS918	04713	SPS8802-1
A10Q474	151-0276-00		TRANSISTOR: SILICON, PNP	80009	151-0276-00
A10Q476	151-0276-00		TRANSISTOR: SILICON, PNP	80009	151-0276-00
A10Q492	151-0221-02		TRANSISTOR: SILICON, PNP	80009	
A10Q493	151-0221-02		TRANSISTOR: SILICON, PNP	80009	
A10Q503	151-0424-00		TRANSISTOR: SILICON, NPN	04713	
A10Q504	151-0199-00		TRANSISTOR: SILICON, PNP	04713	
A10Q507	151-0424-00		TRANSISTOR: SILICON, NPN	04713	
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A10Q508	151-0199-00		TRANSISTOR: SILICON, PNP	04713	
A10Q519	151-0190-00		TRANSISTOR: SILICON, NPN	07263 07263	
A100605	151-0190-00		TRANSISTOR: SILICON, NPN	07263	
A100640	151-0190-00		TRANSISTOR: SILICON, NPN TRANSISTOR: SILICON, PNP		151-0276-00
A10Q703 A10Q706	151-0276-00 151-0276-00		TRANSISTOR: SILICON, PNP		151-0276-00
A10Q708	151-0190-00		TRANSISTOR: SILICON, NPN	07263	
A10Q714	151-1097-00		TRANSISTOR: SILICON, FE		SPF713
A10Q747	151-0190-00		TRANSISTOR: SILICON, NPN	07263	
A10Q753	151-0198-00		TRANSISTOR: SILICON, NPN, SEL FROM MPS918	04713	
A10Q763	151-0198-00		TRANSISTOR: SILICON, NPN, SEL FROM MPS918	04713	
A10Q765	151-0190-00		TRANSISTOR: SILICON, NPN	07263	8 8032677
A100770	151-0188-00		TRANSISTOR: SILICON, PNP	04713	SPS6868K
A10Q775	151-0347-00		TRANSISTOR: SILICON, NPN	56289	
A100779	151-0350-00		TRANSISTOR: SILICON, PNP		SPS6700
A10Q780	151-0190-00		TRANSISTOR: SILICON, NPN	07263	
A10Q785	151-0347-00		TRANSISTOR: SILICON, NPN	56289	
A10Q789	151-0350-00		TRANSISTOR: SILICON, PNP	04713	
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A100811	151-0188-00		TRANSISTOR: SILICON, PNP	04713	
A100812	151-0188-00		TRANSISTOR: SILICON, PNP	04713	
A10Q813	151-0188-00		TRANSISTOR: SILICON, PNP	04/13	SPS6868K

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A10R161	315-0360-00	RES., FXD, CMPSN: 36 OHM, 5%, 0.25W	01121	CB3605	
A10R162	321-0187-00	RES., FXD, FILM: 866 OHM, 1%, 0.125W	91637		
A10R163	321-0224-00	RES., FXD, FILM: 2.1K OHM, 1%, 0.125W	91637	MFF1816G21000F	
A10R168	321-0126-00	RES., FXD, FILM: 200 OHM, 1%, 0.125W	91637	MFF1816G200R0F	
A10R169	321-0199-00	RES., FXD, FILM: 1.15K OHM, 1%, 0.125W	91637	MFF1816G11500F	
A10R170	321-0203-00	RES., FXD, FILM: 1.27K OHM, 1%, 0.125W	91637		
A10R172	321-0083-00	RES., FXD, FILM: 71.5 OHM, 1%, 0.125W	91637		
A10R173	315-0102-00	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W		CB1025	
A10R174	315-0111-00	RES., FXD, CMPSN:110 OHM, 5%, 0.25W		CB1115	
A10R175	315-0102-00	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W		CB1025	
A10R176	315-0391-00	RES., FXD, CMPSN: 390 OHM, 5%, 0.25W	01121	CB3915	
A10R177	321-0091-00	RES., FXD, FILM: 86.6 OHM, 1%, 0.125W		MFF1816G86R60F	
A10R178	321-0162-00	RES., FXD, FILM: 475 OHM, 1%, 0.125W		MFF1816G475R0F	
A10R179	315-0621-00	RES., FXD, CMPSN: 620 OHM, 5%, 0.25W		CB6215	
A10R180	321-0088-00	RES., FXD, FILM:80.6 OHM, 1%, 0.125W	91637		
A10R182	321-0083-00	RES., FXD, FILM:71.5 OHM, 1%, 0.125W		MFF1816G71R50F	
A10R183	315-0201-00	RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015	
A10R185	315-0102-00	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W		CB1025	
A10R186	311-1238-00	RES., VAR, NONWIR: 5K OHM, 10%, 0.50W		72-27-0	
A10R187	321-0091-00	RES., FXD, FILM: 86.6 OHM, 1%, 0.125W		MFF1816G86R60F	
A10R188	321-0162-00	RES., FXD, FILM: 475 OHM, 1%, 0.125W		MFF1816G475R0F	
A10R189	315-0621-00	RES.,FXD,CMPSN:620 OHM,5%,0.125W		CB6215	
Alukloy	313-0621-00	RES., FAD, CMPSN: 020 OnM, 3%, 0.23W	01121	CB0213	
A10R192	321-0231-00	RES., FXD, FILM: 2.49K OHM, 1%, 0.125W	91637	MFF1816G24900F	
A10R193	321-0230-00	RES., FXD, FILM: 2.43K OHM, 1%, 0.125W	91637	MFF1816G24300F	
A10R194	315-0470-00	RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705	
A10R196	315-0681-00	RES., FXD, CMPSN: 680 OHM, 5%, 0.25W	01121	CB6815	
A10R197	315-0561-00	RES., FXD, CMPSN: 560 OHM, 5%, 0.25W	01121	CB5615	
A10R250	315-0911-00	RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	СВ9115	
A10R251	315-0360-00	RES., FXD, CMPSN: 36 OHM, 5%, 0.25W	01121	CB3605	
A10R252	321-0188-00	RES., FXD, FILM: 887 OHM, 1%, 0.125W	91637	MFF1816G887R0F	
A10R253	321-0203-00	RES., FXD, FILM: 1.27K OHM, 1%, 0.125W	91637	MFF1816G12700F	
A10R254	315-0821-00	RES., FXD, CMPSN: 820 OHM, 5%, 0.25W	01121	CB8215	
A10R256	321-0253-00	RES., FXD, FILM: 4.22K OHM, 1%, 0.125W	91637	MFF1816G42200F	
A10R258	321-0126-00	RES., FXD, FILM: 200 OHM, 1%, 0.125W	91637	MFF1816G200R0F	
A10R259	321-0199-00	RES., FXD, FILM: 1.15K OHM, 1%, 0.125W	91637	MFF1816G11500F	
A10R261	315-0360-00	RES., FXD, CMPSN: 36 OHM, 5%, 0.25W		CB3605	
A10R262	321-0188-00	RES., FXD, FILM: 887 OHM, 1%, 0.125W		MFF1816G887R0F	
111011202	521 0100 00	120., 110, 11211.007 OHI, 18, 0.125W	71037		

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A10R263	321-0225-00		RES., FXD, FILM: 2.15K OHM, 1%, 0.125W	91637	MFF1816G21500F
A10R264	311-1567-00		RES., VAR, NONWIR: TRMR, 100 OHM, 0.50W		91-89-0
A10R266	321-0253-00		RES., FXD, FILM: 4.22K OHM, 1%, 0.125W		MFF1816G42200F
A10R268	321-0126-00		RES., FXD, FILM: 200 OHM, 1%, 0.125W	91637	
A10R269	321-0199-00		RES.,FXD,FILM:1.15K OHM,1%,0.125W	91637	
A10R270	321-0203-00		RES., FXD, FILM:1.27K OHM, 1%, 0.125W	91637	
A10R272	321-0083-00		RES., FXD, FILM:71.5 OHM, 1%, 0.125W	91637	MFF1816G71R50F
A10R273	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A10R275	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A10R276	315-0391-00		RES., FXD, CMPSN: 390 OHM, 5%, 0.25W	01121	CB3915
A10R277	321-0091-00		RES., FXD, FILM: 86.6 OHM, 1%, 0.125W	91637	MFF1816G86R60F
A10R278	321-0162-00		RES.,FXD,FILM:475 OHM,1%,0.125W	91637	MFF1816G475R0F
A10R279	315-0621-00		RES., FXD, CMPSN: 620 OHM, 5%, 0.25W	01121	
A10R280	321-0088-00		RES., FXD, FILM: 80.6 OHM, 1%, 0.125W		MFF1816G80R60F
A10R282	321-0083-00		RES., FXD, FILM: 71.5 OHM, 1%, 0.125W	91637	
A10R283	315-0201-00		RES., FXD, CMPSN: 200 OHM, 5%, 0.25W	01121	
A10R284	315-0111-00		RES., FXD, CMPSN:110 OHM, 5%, 0.25W	01121	
A10R285	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A10R286	311-1238-00		RES., VAR, NONWIR: 5K OHM, 10%, 0.50W	73138	72-27-0
A10R287	321-0091-00		RES., FXD, FILM: 86.6 OHM, 1%, 0.125W		MFF1816G86R60F
A10R288	321-0162-00		RES., FXD, FILM: 475 OHM, 1%, 0.125W		MFF1816G475R0F
A10R289	315-0621-00		RES., FXD, CMPSN: 620 OHM, 5%, 0.25W	01121	
A10R292 A10R293	321-0231-00 321-0230-00		RES.,FXD,FILM:2.49K OHM,1%,0.125W RES.,FXD,FILM:2.43K OHM,1%,0.125W	91637 91637	
A10R294	315-0470-00		RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	СВ4705
A10R294 A10R295	315-0102-00		RES., FXD, CMPSN:1K OHM, 5%, 0.25W		
A10R295	315-0681-00		RES., FXD, CMPSN: 680 OHM, 5%, 0.25W	01121	CB1025 CB6815
A10R290 A10R297	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W		CB1025
A10R297 A10R299	315-0912-00		RES., FXD, CMPSN: 9.1K OHM, 5%, 0.25W		CB1025
A10R300	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W		CB5125
A10R301	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R302	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W		CB5125
A10R304	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W		CB5125
A10R305	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	
A10R306	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	
A10R307	315-0361-00		RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	СВ3615
A10R308	315-0911-00		RES., FXD, CMPSN: 910 OHM, 5%, 0.25W	01121	СВ9115
A10R310	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A10R311	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A10R312	315-0511-00		RES., FXD, CMPSN: 510 OHM, 5%, 0.25W		CB5115
A10R313 A10R315	315-0511-00 315-0103-00	B010100 B010684X	RES.,FXD,CMPSN:510 OHM,5%,0.25W RES.,FXD,CMPSN:10K OHM,5%,0.25W		CB5115 CB1035
A10R316	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W		CB5125
A10R317	315-0101-00		RES., FXD, CMPSN: 100 OHM, 5%, 0.25W		CB1015
A10R318	315-0101-00		RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
A10R319	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R320 A10R321	315 <b>-</b> 0102-00 315 <b>-</b> 0512-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121 01121	CB1025 CB5125
A10R322	315-0201-00		RES., FXD, CMPSN: 200 OHM, 5%, 0.25W	01121	CB2015
A10R322 A10R323	315-0103-00		RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	01121	
A10R324	321-0253-00		RES., FXD, FILM: 4.22K OHM, 1%, 0.125W	91637	
A10R325	321-0253-00		RES., FXD, FILM: 4.22K OHM, 1%, 0.125W	91637	
A10R326	315-0362-00		RES., FXD, CMPSN: 3.6K OHM, 5%, 0.25W	01121	CB3625
A10R327	315-0362-00		RES., FXD, CMPSN: 3.6K OHM, 5%, 0.25W	01121	CB3625
A10R330	321-0140-00		RES.,FXD,FILM:280 OHM,1%,0.125W	91637	MFF1816G280R0F
A10R331	321-0152-00		RES., FXD, FILM: 374 OHM, 1%, 0.125W	91637	MFF1816G374R0F
A10R332	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015

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A10R361	321-0130-00	RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
A10R363	315-0390-00	RES., FXD, CMPSN: 39 OHM, 5%, 0.25W	01121	CB3905
A10R364	321-0180-00	RES., FXD, FILM: 732 OHM, 1%, 0.125W	91637	MFF1816G732R0F
A10R366	311-1236-00	RES., VAR, NONWIR: 250 OHM, 10%, 0.50W	73138	72-22-0
A10R367	311-1237-00	RES., VAR, NONWIR: 1K OHM, 10%, 0.50W	32997	3386X-T07-102
A10R368	315-0912-00	RES., FXD, CMPSN: 9.1K OHM, 5%, 0.25W	01121	CB9125
A10R370	315-0471-00	RES., FXD, CMPSN: 470 OHM, 5%, 0.25W	01121	CB4715
A10R371	315-0561-00	RES., FXD, CMPSN: 560 OHM, 5%, 0.25W	01121	CB5615
A10R373	321-0068-00	RES., FXD, FILM: 49.9 OHM, 1%, 0.125W	91637	MFF1816G49R90F
A10R374	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A10R376	321-0196-00	RES., FXD, FILM: 1.07K OHM, 1%, 0.125W	91637	MFF1816G10700F
A10R377	321-0190-00	RES., FXD, FILM: 931 OHM, 1%, 0.125W	91637	MFF1816G931R0F
A10R378	323-0148-00	RES., FXD, FILM: 340 OHM, 1%, 0.50W	91637	MFF1226G340R0F
A10R379	323-0148-00	RES., FXD, FILM: 340 OHM, 1%, 0.50W	91637	MFF1226G340R0F
A10R380	315-0471-00	RES., FXD, CMPSN: 470 OHM, 5%, 0.25W	01121	CB4715
A10R383	321-0068-00	RES., FXD, FILM: 49.9 OHM, 1%, 0.125W	91637	MFF1816G49R90F
A10R384	321-0198-00	RES., FXD, FILM: 1.13K OHM, 1%, 0.125W	91637	MFF1816G11300F
A10R386	321-0196-00	RES., FXD, FILM: 1.07K OHM, 1%, 0.125W	91637	MFF1816G10700F
A10R387	321-0190-00	RES., FXD, FILM: 931 OHM, 1%, 0.125W	91637	MFF1816G931R0F
A10R388	323-0148-00	RES., FXD, FILM: 340 OHM, 1%, 0.50W	91637	MFF1226G340R0F
A10R389	323-0148-00	RES., FXD, FILM: 340 OHM, 1%, 0.50W	5,715,71	MFF1226G340R0F
A10R390	322-0084-00	RES., FXD, FILM: 73.2 OHM, 1%, 0.25W	91637	CMF1842G73R2OF
A10R391	315-0271-00	RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A10R392	315-0752-00	RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W	01121	CB7525
A10R393	315-0621-00	RES., FXD, CMPSN: 620 OHM, 5%, 0.25W	01121	CB6215
A10R394	315-0821-00	RES., FXD, CMPSN: 820 OHM, 5%, 0.25W	01121	CB8215
A10R397	315-0681-00	RES., FXD, CMPSN: 680 OHM, 5%, 0.25W		CB6815
A10R398	301-0510-00	RES., FXD, CMPSN: 51 OHM, 5%, 0.50W	01121	EB5105
A10R399	301-0510-00	RES.,FXD,CMPSN:51 OHM,5%,0.50W	01121	EB5105
A10R408	321-0427-00	RES., FXD, FILM: 274K OHM, 1%, 0.125W	24546	NA55D2743F
A10R410	315-0101-00	RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
A10R411	315-0121-00	RES., FXD, CMPSN: 120 OHM, 5%, 0.25W	01121	CB1215
A10R412	315-0100-00	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	01121	CB1005
A10R414	315-0270-00	RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
A10R415	315-0911-00	RES., FXD, CMPSN: 910 OHM, 5%, 0.25W	01121	СВ9115
A10R417	315-0751-00	RES., FXD, CMPSN: 750 OHM, 5%, 0.25W	01121	CB7515
A10R418	315-0360-00	RES., FXD, CMPSN: 36 OHM, 5%, 0.25W	01121	CB3605

CB2015	01121	RES., FXD, CMPSN: 200 OHM, 5%, 0.25W	315-0201-00	A10R491
CB2413	17110	KES., FAU, CMPSN: 240 OHM, 36, 0. 23W	313-0241-00	AIOK490
EB3605	01121	RES., FXD, CMPSN: 36 OHM, 5%, 0.5W	301-0360-00	A10R487
CB4315	01121	RES., FXD, CMPSN: 430 OHM, 5%, 0.25W	315-0431-00	A10R485
CB4315	01121	RES., FXD, CMPSN: 430 OHM, 5%, 0.25W	315-0431-00	A10R484
СВ3925	01121	RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W	315-0392-00	A10R483
72-27-0	73138	RES., VAR, NONWIR: 5K OHM, 10%, 0.50W	311-1238-00	A10R482
MFF1816G953R0F	91637	RES., FXD, FILM: 953 OHM, 1%, 0.125W	321-0191-00	A10R481
СВ8225	01121	RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W	315-0822-00	A10R480
СВ7525	01121	RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W	315-0752-00	A10R479
CB3925	01121	RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W	315-0392-00	A10R478
CB3925	01121	RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W	315-0392-00	A10R477
CB3925	01121	RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W	315-0392-00	A10R476
CB1825	01121	RES., FXD, CMPSN: 1.8K OHM, 5%, 0.25W	315-0182-00	A10R474
CB5625	01121	RES., FXD, CMPSN: 5.6K OHM, 5%, 0.25W	315-0562-00	A10R473
CB2215	01121	RES., FXD, CMPSN: 220 OHM, 5%, 0.25W	315-0221-00	A10R472
CB4325	01121	RES., FXD, CMPSN: 4.3K OHM, 5%, 0.25W	315-0432-00	A10R471
CB2015	01121	RES., FXD, CMPSN: 200 OHM, 5%, 0.25W	315-0201-00	A10R470
CB1135	01121	RES., FXD, CMPSN: 11K OHM, 5%, 0.25W	315-0113-00	A10R469
CB8205	01121	RES., FXD, CMPSN: 82 OHM, 5%, 0.25W	315-0820-00	A10R468
СВ6815	01121	RES., FXD, CMPSN: 680 OHM, 5%, 0.25W	315-0681-00	A10R467
CB1015	01121	RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	315-0101-00	A10R466
CB2425	01121	RES., FXD, CMPSN: 2.4K OHM, 5%, 0.25W	315-0242-00	A10R464
MFF1816G12100F	91637	RES., FXD, FILM: 1.21K OHM, 1%, 0.125W	321-0201-00	A10R463
MFF1816G12700F	91637	RES., FXD, FILM: 1.27K OHM, 1%, 0.125W	321-0203-00	A10R462
MFF1816G11000F	91637	RES., FXD, FILM: 1.1K OHM, 1%, 0.125W	321-0197-00	A10R461
MFF1816G14000F	91637	RES., FXD, FILM: 1.4K OHM, 1%, 0.125W	321-0207-00	A10R460
CB1035	01121	RES., FXD, CMPSN:10K OHM, 5%, 0.25W	315-0103-00	A10R459
CB1005	01121	RES., FXD, CMPSN:10 OHM, 5%, 0.25W	315-0100-00	A10R458
CB1005	01121	RES., FXD, CMPSN:10 OHM, 5%, 0.25W	315-0100-00	A10R457
CB3025	01121	RES., FXD, CMPSN: 3K OHM, 5%, 0.25W	315-0302-00	A10R456
CB5145	01121	RES., FXD, CMPSN: 510K OHM, 5%, 0.25W	315-0514-00	A10R454
CB5105	01121	RES., FXD, CMPSN:51 OHM, 5%, 0.25W	315-0510-00	A10R453
EB4335	01121	RES., FXD, CMPSN: 43K OHM, 5%, 0.50W	301-0433-00	A10R450
CB4735	01121	RES., FXD, CMPSN:47K OHM, 5%, 0.25W	315-0473-00	A10R448
EB4335	01121	RES., FXD, CMPSN: 43K OHM, 5%, 0.50W	301-0433-00	A10R447
CB7515	01121	RES., FXD, CMPSN: 750 OHM, 5%, 0.25W	315-0751-00	A10R446

A10R525	315-0274-00	RES., FXD, CMPSN: 270K OHM, 5%, 0.25W	01121	CB2745
A10R526	315-0274-00	RES., FXD, CMPSN: 270K OHM, 5%, 0.25W		CB2745
A10R527	315-0473-00	RES.,FXD,CMPSN:47K OHM,5%,0.25W		CB4735
A10R528	315-0473-00	RES., FXD, CMPSN: 47K OHM, 5%, 0.25W		CB4735
A10R603	315-0512-00	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R605	315-0512-00	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R607	315-0512-00	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R608	315-0512-00	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R610	315-0512-00	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R611	315-0682-00	RES., FXD, CMPSN: 6.8K OHM, 5%, 0.25W	01121	CB6825
A10R612	315-0163-00	RES., FXD, CMPSN: 16K OHM, 5%, 0.25W	01121	CB1635
A10R614	315-0203-00	RES., FXD, CMPSN: 20K OHM, 5%, 0.25W	01121	CB2035
A10R615	315-0621-00	RES., FXD, CMPSN: 620 OHM, 5%, 0.25W	01121	CB6215
A10R618	315-0221-00	RES., FXD, CMPSN: 220 OHM, 5%, 0.25W	01121	CB2215
A10R619	315-0621-00	RES., FXD, CMPSN: 620 OHM, 5%, 0.25W	01121	CB6215
A10R620	315-0102-00	RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
A10R622	315-0302-00	RES., FXD, CMPSN: 3K OHM, 5%, 0.25W	01121	СВ3025
A10R623	315-0681-00	RES., FXD, CMPSN: 680 OHM, 5%, 0.25W	01121	CB6815
A10R637	321-0322-00	RES., FXD, FILM: 22.1K OHM, 1%, 0.125W	91637	MFF1816G22101F
A10R638	321-0319-00	RES., FXD, FILM: 20.5K OHM, 1%, 0.125W	91637	MFF1816G20501F
A10R639	315-0153-00	RES., FXD, CMPSN: 15K OHM, 5%, 0.25W	01121	CB1535
A10R640	315-0512-00	RES., FXD, CMPSN: 5.1k OHM, 5%, 0.25W	01121	CB5125
A10R642	315-0222-00	RES., FXD, CMPSN: 2.2K OHM, 5%, 0.25W	01121	CB2225
A10R649	315-0512-00	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A10R651	315-0201-00	RES., FXD, CMPSN: 200 OHM, 5%, 0.25W	01121	CB2015
A10R666	315-0820-00	RES., FXD, CMPSN: 82 OHM, 5%, 0.25W	01121	CB8205
A10R668	315-0820-00	RES., FXD, CMPSN: 82 OHM, 5%, 0.25W	01121	CB8205
A10R670	315-0100-00	RES., FXD, CMPSN:10 OHM, 5%, 0.25W	01121	CB1005
A10R673	315-0681-00	RES., FXD, CMPSN: 680 OHM, 5%, 0.25W	01121	CB6815
A10R674	315-0621-00	RES., FXD, CMPSN: 620 OHM, 5%, 0.25W	01121	CB6215
A10R701	321-0235-00	RES., FXD, FILM: 2.74K OHM, 1%, 0.125W	91637	MFF1816G27400F
A10R702	315-0392-00	RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W	01121	CB3925
A10R703	315-0154-00	RES., FXD, CMPSN: 150K OHM, 5%, 0.25W	01121	CB1545
A10R704	315-0621-00	RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
A10R705	315-0752-00	RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W	01121	CB7525
A10R706	315-0202-00	RES., FXD, CMPSN: 2K OHM, 5%, 0.25W	01121	CB2025
A10R707	315-0132-00	RES., FXD, CMPSN: 1.3K OHM, 5%, 0.25W	01121	CB1325

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	CB5115	01121	RES., FXD, CMPSN: 510 OHM, 5%, 0.25W	315-0511-00	A10R822
	CB1045	01121	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	315-0104-00	A10R821
	СВ1025	01121	RES., FXD, CMPSN:1K OHM, 5%, 0.25W	315-0102-00	A10R820
MFF1816G422R0F	MFF1816	91637	RES., FXD, FILM: 422 OHM, 1%, 0.125W	321-0157-00	A10R817
MFF1816G165R0F	MFF1816	91637	RES., FXD, FILM: 165 OHM, 1%, 0.125W	321-0118-00	A10R816
MFF1816G12402F	MFF1816	91637	RES., FXD, FILM: 124K OHM, 1%, 0.125W	321-0394-00	A10R814
	CB4/35	17.110	RES., FXD, CMPSN: 4/K OHM, 5%, 0.25W	315-04/3-00	AIUKSIS
	CB1825	12110	KES., FXD, CMPSN: 1. OK OHM, DX, U. 25W	315-0182-00	ALUKSIZ
	СВ6835	01121	RES., FXD, CMPSN: 68K OHM, 5%, 0.25W	315-0683-00	A10R811
	CB1035	01121	RES., FXD, CMPSN: 10K OHM, 5%, 0.25W	315-0103-00	A10R810
	CB1345	01121	RES., FXD, CMPSN: 130K OHM, 5%, 0.25W	315-0134-00	A10R809
	CB1025	01121	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	315-0102-00	A10R803
	EB4725	01121	RES., FXD, CMPSN:4.7K OHM, 5%, 0.50W	301-0472-00	A10R802
	EB4725	01121	RES., FXD, CMPSN: 4.7K OHM, 5%, 0.50W	301-0472-00	A10R801
	CB1005	01121	RES., FXD, CMPSN:10 OHM, 5%, 0.25W	315-0100-00	A10R799
	CB1005	01121	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	315-0100-00	A10R798
	CB1005	01121	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	315-0100-00	A10R797
	CB1005	01121	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W	315-0100-00	A10R796
MFF1816G93101F	MFF1816	91637	RES., FXD, FILM: 93.1K OHM, 1%, 0.125W	321-0382-00	A10R793
MFF1816G56200F	MFF1816	91637	RES., FXD, FILM: 5.62K OHM, 1%, 0.125W	321-0265-00	A10R792
	CB2735	01121	RES., FXD, CMPSN: 27K OHM, 5%, 0.25W	315-0273-00	A10R789
	CB1015	01121	RES., FXD, CMPSN:100 OHM, 5%, 0.25W	315-0101-00	A10R788
	CB4705	01121	RES., FXD, CMPSN:47 OHM, 5%, 0.25W	315-0470-00	A10R787
MFF1816G909R0F	MFF1816	91637	RES., FXD, FILM: 909 OHM, 1%, 0.125W	321-0189-00	A10R786
MFF1226G17401F	MFF1226	91637	RES., FXD, FILM:17.4K OHM, 1%, 0.50W	323-0312-00	A10R785
	CB2735	01121	RES., FXD, CMPSN: 27K OHM, 5%, 0.25W	315-0273-00	A10R782
MFF1816G12100F	MFF1816	91637	RES., FXD, FILM: 1.21K OHM, 1%, 0.125W	321-0201-00	A10R781
MFF1816G14700F	MFF1816	91637	RES., FXD, FILM: 1.47K OHM, 1%, 0.125W	321-0209-00	A10R780
	CB2735	01121	RES., FXD, CMPSN: 27K OHM, 5%, 0.25W	315-0273-00	A10R779
	CB1015	01121	RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	315-0101-00	A10R778
	CB4705	01121	RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	315-0470-00	A10R777
MFF1816G909R0F	MFF1816	91637	RES., FXD, FILM: 909 OHM, 1%, 0.125W	321-0189-00	A10R776
MFF1226G17401F	MFF1226	91637	RES., FXD, FILM:17.4K OHM, 1%, 0.50W	323-0312-00	A10R775
	СВ2735	01121	RES., FXD, CMPSN: 27K OHM, 5%, 0.25W	315-0273-00	A10R772
MFF1816G768R0F	MFF1816	91637	RES., FXD, FILM: 768 OHM, 1%, 0.125W	321-0182-00	A10R771
MFF1816G392R0F	MFF1816	91637	RES., FXD, FILM: 392 OHM, 1%, 0.125W	321-0154-00	A10R768
MFF1816G64900F	MFF1816	91637	RES., FXD, FILM: 6,49K OHM, 1%, 0.125W	321-0271-00	A10R766

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A10R850	315-0471-00		RES., FXD, CMPSN: 470 OHM, 5%, 0.25W	01121	CB4715
A10R851	315-0222-00		RES., FXD, CMPSN: 2.2K OHM, 5%, 0.25W		CB2225
A10R852	315-0104-00		RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
A10R854	315-0180-00	XB012543	RES., FXD, CMPSN:18 OHM, 5%, 0.25W	01121	CB1805
A10R856	315-0470-00		RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	СВ4705
A10R860	311-1558-00		RES., VAR, NONWIR: 20K OHM, 20%, 0.50W	73138	91-80-0
A10R861	315-0203-00		RES., FXD, CMPSN: 20K OHM, 5%, 0.25W	01121	CB2035
A10R863	315-0474-00		RES., FXD, CMPSN: 470K OHM, 5%, 0.25W	01121	CB4745
A10R864	315-0472-03		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
A10R865	315-0470-03		RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
A10R867	315-0511-02		RES., FXD, CMPSN:510 OHM, 5%, 0.25W		CB5115
A10R868	315-0226-01		RES., FXD, CMPSN: 22M OHM, 5%, 0.25W		CB2265
A10R870	311-1555-00		RES., VAR, NONWIR: 100K OHM, 20%, 0.5W		91-77-0
A10R871	315-0471-00		RES., FXD, CMPSN: 470 OHM, 5%, 0.25W		CB4715
A10R872	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W		CB1025
A10R873	315-0513-00		RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
A10R874	315-0433-00		RES., FXD, CMPSN: 43K OHM, 5%, 0.25W	01121	CB4335
A10R875	311-1550-00		RES., VAR, NONWIR: 2M OHM, 20%, 0.50W	73138	91-72-0
A10R876	315-0471-00		RES., FXD, CMPSN: 470 OHM, 5%, 0.25W	01121	CB4715
A10R877	315-0183-00		RES., FXD, CMPSN: 18K OHM, 5%, 0.25W	01121	CB1835
A10R878	301-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.50W	01121	EB1055
A10R879	301-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.50W	01121	EB1055
A10R880	301-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.50W	01121	EB1055
A10R881	301-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.50W		EB1055
A10R882	301-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.50W		EB1055
A10R883	311-1933-00		RES., VAR, NONWIR: PNL, 5M OHM, 10%, 0.50W		17M095
A10R884	301-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.50W		EB1055
A10R886	315-0471-00		RES., FXD, CMPSN: 470 OHM, 5%, 0.25W	01121	CB4715
A10R887	311-1555-00		RES., VAR, NONWIR: 100K OHM, 20%, 0.5W	73138	91-77-0
A10R911	301-0184-00	B010100 B021199X	RES., FXD, CMPSN: 180K OHM, 5%, 0.50W	01121	EB1845
A10R912	315-0104-00	B010100 B021199X	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
A10R914	301-0184-00	B010100 B021199X	RES., FXD, CMPSN: 180K OHM, 5%, 0.50W	01121	EB1845
A10R915	321-0230-00	B010100 B021199X	RES., FXD, FILM: 2.43K OHM, 1%, 0.125W	91637	MFF1816G24300F
A10R916	315-0223-00	B010100 B021199X	RES., FXD, CMPSN: 22K OHM, 5%, 0.25W	01121	CB2235
A10R917	315-0154-00	B010100 B021199X		01121	CB1545
A10R918	315-0753-00	B010100 B021199X	RES., FXD, CMPSN: 75K OHM, 5%, 0.25W	01121	CB7535
		**************************************	DEC DUE CHECK IN COME PER A FACE		

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B010100 B021199X RES., FXD, CMPSN: 1M OHM, 5%, 0.50W

01121 EB1055

A10R920

301-0105-00

A10RT356	307-0125-00			RES., THERMAL: 500 OHM, 10%, 25 DEG C
A10S901	260-1849-00			SWITCH, PUSH: DPDT, 4A, 250VAC, W/ BRKT
A10T448	120-1401-00			XFMR, TRIG:
A10T925	120-1384-00	во10100 в	3021199X	TRANSFORMER, RF: TOROID, 2 WINDS
A10T940	120-1348-00			XFMR, PWR, SDN&SU: HIGH VOLTAGE
A10T942	120-1347-00			TRANSFORMER, RF: DRIVER SATURATING POT CORE
A10TP444	214-0579-00			TERM, TEST POINT: BRS CD PL
A10TP500	214-0579-00			TERM, TEST POINT: BRS CD PL
A10TP501	214-0579-00			TERM, TEST POINT: BRS CD PL
A10TP854	214-0579-00	XB019850		TERM, TEST POINT: BRS CD PL
A10TP915	214-0579-00	B010100 B	3021199X	TERM, TEST POINT: BRS CD PL
A10TP920	214-0579-00	B010100 B	3021199X	TERM, TEST POINT: BRS CD PL
A10TP921	214-0579-00	B010100 B	3021199X	TERM, TEST POINT: BRS CD PL
A10TP934	214-0579-00			TERM, TEST POINT: BRS CD PL
A10TP951	214-0579-00			TERM, TEST POINT: BRS CD PL
A10TP952	214-0579-00	XB019850		TERM, TEST POINT: BRS CD PL
A10U170	156-1294-00			MICROCIRCUIT, LI: FIVE NPN TRANSISTOR ARRAY
A10U197	156-0048-00			MICROCIRCUIT, LI: FIVE NPN TRANSISTOR ARRAY
A10U270	156-1294-00			MICROCIRCUIT, LI: FIVE NPN TRANSISTOR ARRAY
A10U305	156-0728-00	B010100 B	3019249	MICROCIRCUIT, DI: QUAD 2-INP POS AND GATES
A10U305	156-0728-02	B019250		MICROCIRCUIT, DI: QUAD 2 IPUT STATE W/OC
A10U310	156-0721-00	B010100 B	8012542	MICROCIRCUIT, DI: ST POS-NAND GATES W/TP OUT
A10U310	156-0721-02	B012543		MICROCIRCUIT, DI: QUAD 2-IN NAND SCHMITT TRI
A10U315	156-0384-00	B010100 B	3019249	MICROCIRCUIT, DI: QUAD 2-INPUT NAND GATE
A10U315	156-0384-02	B019250		MICROCIRCUIT, DI: QUAD 2-INP NAND GATE
A10U317	156-0388-00	B010100 B	3019249	MICROCIRCUIT, DI: DUAL D-TYPE FLIP-FLOP
A10U317	156-0388-03	B019250		MICROCIRCUIT, DI: DUAL D FLIP-FLOP
A10U421	156-1294-00			MICROCIRCUIT, LI: FIVE NPN TRANSISTOR ARRAY
A10U460	156-0534-00			MICROCIRCUIT, LI: DUAL DIFF AMPL, 14 LD DIP
A10U480	156-0205-00			MICROCIRCUIT, DI: QUAD 2-INPUT NOR GATE
A10U507	156-0158-00			MICROCIRCUIT, LI: DUAL OPERATIONAL AMPLIFIER
A10U603	156-1611-00			MICROCIRCUIT, DI: DUAL D TYPE EDGE-TRIGGERED
A10U607	156-0180-04	B010100 B	018549	MICROCIRCUIT, DI: QUAD 2-INPUT NAND GATE
A10U607	156-0382-02	во18550		MICROCIRCUIT, DI: QUAD 2-INP NAND GATE
A10U620	156-0875-00	B010100 B	3017149	MICROCIRCUIT, DI: DUAL 2 WIDE 21NP A01 GATE
A10U620	156-0875-02	B017150		MICROCIRCUIT, DI: DUAL 2-W/2 INP AOI GATES
A10U640	156-0405-00	B010100 B	011849	MICROCIRCUIT, DI: DUAL RETRIG MONOSTABLE MV

50157	2D1595
31918	OBD
54937	OBD
80009	120-1384-00
00003	120-1364-00
80009	120-1348-00
80009	120-1347-00
80009	214-0579-00
80009	214-0579-00
80009	214-0579-00
80009	214-0579-00
00007	214 03/7 00
80009	214-0579-00
80009	214-0579-00
80009	214-0579-00
80009	214-0579-00
80009	214-0579-00
80009	214-0579-00
80009	156-1294-00
02735	CA3046
80009	156-1294-00
27014	DM74LS09
80009	156-0728-02
27014	DM74LS132N
04713	SN74LS132NDS
80009	156-0384-00
01295	SN74LS03
80009	156-0388-00
07263	74LS74A
80009	156-1294-00
80009	156-0534-00
04713	MC10102 (P OR L)
18324	MC1458N
07263	74F74
01295	SN74SOONP3
01295	SN74LS00
27014	DM74LS51(N OR J)
01295	SN74LS51
07263	9602 (PC OR DC)
0/203	7004 (FU UK DU)

A10W196	131-0566-00	XB019850	BUS	CONDUCTOR: DUMMY	RES.2.375.22	AWG	55210	L-2007-1
A10W197	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W198	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W199	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W296	131-0566-00	YR019850	RIIS	CONDUCTOR: DUMMY	RES 2 375 22	AWG	55210	L-2007-1
A10W297	131-0566-00	REGULTOSO		CONDUCTOR: DUMMY				L-2007-1
A10W298	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W299	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W300	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W301	131-0566-00			CONDUCTOR : DUMMY				L-2007-1
A10W308	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W309	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2, 375, 22	AWG	55210	L-2007-1
A10W310	131-0566-00			CONDUCTOR: DUMMY			55210	L-2007-1
A10W311	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W312	131-0566-00			CONDUCTOR: DUMMY			55210	L-2007-1
A10W314	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W315	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W380	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W392	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W397	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W399	131-0566-00			CONDUCTOR: DUMMY			55210	L-2007-1
A10W418	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W421	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W422	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W430	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W431	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1
A10W432	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W444	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W447	131-0566-00	B010100 B019849X					0.000	L-2007-1
A10W448	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W470	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	100 miles 100 miles	L-2007-1
A10W472	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG		L-2007-1
A10W507	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W508	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375,22	AWG	55210	L-2007-1
A10W519	131-0566-00			CONDUCTOR: DUMMY				L-2007-1
A10W564	131-0566-00			CONDUCTOR: DUMMY			20122	L-2007-1
A10W571	131-0566-00		BUS	CONDUCTOR: DUMMY	RES, 2.375, 22	AWG	55210	L-2007-1

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Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code Mfr Part Number
A 1003606	121 0566 00		PHO COMPLETED DIRACT PEO O 275 00 ALIC	55210 x 2007 1
A10W606	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W616	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W640	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W646	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W650	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W652	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W674	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W696	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W704	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W762	131-0566-00	XB019850	BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W763	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W764	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W835	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W836	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W840	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W841	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W842	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W843	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG  BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A1UW043	131-0366-00		BUS COMDUCTOR: DUFFIT RES, 2.373, 22 AWG	JJ210 L-2007-1
A10W844	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W845	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W846	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W847	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W854	131-0566-00	B010100 B012542X	BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W877	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W878	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W887			BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W964	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W965	131-0566-00 131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W966	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
			BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W967	131-0566-00		DOU COMPOSION. DOINT NEO, 2.373, 22 ANG	33210 H 2007 I
A10W968	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W969	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W975	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W976	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W982	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W985	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
A10W986	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG	55210 L-2007-1
			LINK, TERM CONNE: 22 AWG, 2.25" LONG	80009 131-1817-00
A10W1010	131-1817-00		DINK, IBMI COMB. 22 ANG, 2.25 DONG	00007 131-1017-00
THRU				
A10W1039	131-1817-00		LINK, TERM CONNE: 22 AWG, 2.25" LONG	80009 131-1817-00

REV MAY 1982 8-19

A11CR705	152-0141-02		SEMICOND DEVICE: SILICON, 30V, 150MA
A11CR706	152-0141-02		SEMICOND DEVICE: SILICON, 30V, 150MA
A11DS618	150-1029-00		LT EMITTING DIO: GREEN, 565NM, 35MA
A11J1000	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD
			(QTY 4)
A11J2000	131-0787-00		CONTACT, ELEC: 0.64 INCH LONG
			(QTY 10)
A11R100	307-0107-00		RES., FXD, CMPSN: 5.6 OHM, 5%, 0.25W
A11R101	315-0750-00		RES., FXD, CMPSN: 75 OHM, 5%, 0.25W
A11R102	315-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.25W
A11R190	311-2147-00		RES., VAR, NONWIR: PNL, 5K OHM, 20%, 0.50W
A11R191	321-0257-00		RES., FXD, FILM: 4.64K OHM, 1%, 0.125W
A11R200	307-0107-00		RES., FXD, CMPSN: 5.6 OHM, 5%, 0.25W
A11R201	315-0750-00		RES., FXD, CMPSN: 75 OHM, 5%, 0.25W
A11R202	315-0105-00		RES., FXD, CMPSN: 1M OHM, 5%, 0.25W
A11R290	311-2147-00		RES., VAR, NONWIR: PNL, 5K OHM, 20%, 0.50W
A11R291	321-0257-00		RES., FXD, FILM: 4.64K OHM, 1%, 0.125W
A11R395	311-2147-00		RES., VAR, NONWIR: PNL, 5K OHM, 20%, 0.50W
A11R401	315-0820-00		RES., FXD, CMPSN: 82 OHM, 5%, 0.25W
A11R402	321-0807-00		RES., FXD, FILM: 900K OHM, 1%, 0.125W
A11R403	321-0617-00		RES., FXD, FILM: 111K OHM, 1%, 0.125W
A11R404	321-0468-00		RES., FXD, FILM: 732K OHM, 1%, 0.125W
A11R405	315-0101-00		RES., FXD, CMPSN: 100 OHM, 5%, 0.25W
A11R455	311-2149-00		RES., VAR, NONWIR: PNL, 250 OHM, 20%, 0.50W
A11R530	315-0124-00	B010100 B017399	RES., FXD, CMPSN: 120K OHM, 5%, 0.25W
A11R530	315-0114-00	B017400	RES., FXD, CMPSN: 110K OHM, 5%, 0.25W
A11R531	315-0124-00		RES., FXD, CMPSN: 120K OHM, 5%, 0.25W
A11R532	315-0434-00		RES., FXD, CMPSN: 430K OHM, 5%, 0.25W
A11R536	315-0182-00		RES., FXD, CMPSN:1.8K OHM, 5%, 0.25W
A11R537	321-0239-00		RES., FXD, FILM: 3.01K OHM, 1%, 0.125W
A11R538	321-0126-00		RES., FXD, FILM: 200 OHM, 1%, 0.125W
A11R557	311-2148-00		RES., VAR, NONWIR: PNL, 20K OHM, 20%, 0.50W
A11R645	315-0912-00		RES., FXD, CMPSN: 9.1K OHM, 5%, 0.25W
A11R646	315-0123-00		RES., FXD, CMPSN: 12K OHM, 5%, 0.25W
A11R726	311-2147-00		RES., VAR, NONWIR: PNL, 5K OHM, 20%, 0.50W
AIIR/20			
A11R807	311-2147-00		RES., VAR, NONWIR: PNL, 5K OHM, 20%, 0.50W
A11R808	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W
A11R891	311-1562-00		RES., VAR, NONWIR: 2K OHM, 20%, 0.50W

53184 XC209G 22526 47357  22526 47359  01121 CB56G5 01121 CB1055 01121 W8615  91637 MFF1816G46400F 01121 CB7505 01121 CB1055 01121 W8615  91637 MFF1816G46400F 01121 W8615 91637 MFF1816G46400F 01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245		
22526 47359  01121 CB56G5 01121 CB1055 01121 W8615  91637 MFF1816G46400F 01121 CB7505 01121 CB7505 01121 CB7505 01121 CB1055 01121 CB1015 01121 CB1015 01121 CB1015 01121 CB1015 01121 CB1015 01121 CB1245 01121 CB1145 01121 CB1245	53184	XC209G
01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615  91637 MFF1816G46400F 01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F 01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245	22526	47357
01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615  91637 MFF1816G46400F 01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F 01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245		
01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615  91637 MFF1816G46400F 01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F 01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245		
01121 CB7505 01121 W8615  91637 MFF1816G46400F 01121 CB56G5 01121 CB7505 01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F  01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1825  91637 MFF1816G30100F	22526	4/359
01121 CB7505 01121 W8615  91637 MFF1816G46400F 01121 CB56G5 01121 CB7505 01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F  01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1825  91637 MFF1816G30100F	01121	CB56G5
01121 CB1055 01121 W8615  91637 MFF1816G46400F 01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F  01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1825  91637 MFF1816G30100F 91637 MFF1816G30100F 91637 MFF1816G30100F 91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB9125	01121	CB7505
91637 MFF1816G46400F 01121 CB56G5 01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015 01121 CB1015 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1825 91637 MFF1816G30100F 91637 MFF1816G30100F 91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB9125		CB1055
01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245	01121	W8615
01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245	91637	MFF1816G46400F
01121 CB7505 01121 CB1055 01121 W8615 91637 MFF1816G46400F 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245	01121	CB56G5
01121 CB1055 01121 W8615 91637 MFF1816G46400F  01121 W8615 01121 CB8205 91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1825  91637 MFF1816G30100F 91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB9125		
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91637 HFF1104F90002F 91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1825  91637 MFF1816G30100F 91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB1235	01121	
91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB245 01121 CB4345 01121 CB1825  91637 MFF1816G30100F 91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB1235	01121	CB8205
91637 MFF1816G11102F 24546 NA4D7323F 01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB245 01121 CB4345 01121 CB1825  91637 MFF1816G30100F 91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB1235	91637	HFF1104F90002F
01121 CB1015  01121 W8612 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1245 01121 CB1825  91637 MFF1816G301000 91637 MFF1816G200R00 01121 W8616 01121 CB9125 01121 CB1235	91637	MFF1816G11102F
01121 W8612 01121 CB1245 01121 CB1145 01121 CB1245 01121 CB4345 01121 CB1825 91637 MFF1816G301000 91637 MFF1816G200R00 01121 W8616 01121 CB9125 01121 CB1235	24546	NA4D7323F
01121 CB1245 01121 CB1145 01121 CB1245 01121 CB4345 01121 CB1825 91637 MFF1816G301000 91637 MFF1816G200R00 01121 W8616 01121 CB9125 01121 CB1235	01121	CB1015
01121 CB1245 01121 CB1145 01121 CB1245 01121 CB4345 01121 CB1825 91637 MFF1816G301000 91637 MFF1816G200R00 01121 W8616 01121 CB9125 01121 CB1235	01121	W8612
01121 CB1145 01121 CB1245 01121 CB4345 01121 CB1825 91637 MFF1816G301000 91637 MFF1816G200R00 01121 W8616 01121 CB9125 01121 CB1235	01121	CB1245
01121 CB1245 01121 CB4345 01121 CB1825 91637 MFF1816G301000 91637 MFF1816G200R00 01121 W8616 01121 CB9125 01121 CB1235	01121	CB1145
01121 CB4345 01121 CB1825 91637 MFF1816G301000 91637 MFF1816G200R00 01121 W8616 01121 CB9125 01121 CB1235	01121	CB1245
01121 CB1825 91637 MFF1816G30100B 91637 MFF1816G200R0B 01121 W8616 01121 CB9125 01121 CB1235		CB4345
91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB1235	01121	
91637 MFF1816G200R0F 01121 W8616 01121 CB9125 01121 CB1235	91637	MFF1816G30100F
01121 W8616 01121 CB9125 01121 CB1235		
01121 CB9125 01121 CB1235		
01121 CB1235		CB9125
01121 W8615		
01121 CB5125		
73138 91-84-0	73138	91-84-0

01295 1N4152R 01295 1N4152R A11W638 131-0566-00 BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG

55210 L-2007-1

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**REV MAY 1982** 

283-U1/5-UU	UAP, FAD, CER DI; TUPE, DA, ZUUV	1/70/	0101841000001003
			8101B210X7R0270K
			SA205E104MAA
			189-0503-075
281-0214-00	CAP., VAR, CER DI: 0.5-3PF, 400V		2502A0R503VP02F0
283-0154-00	CAP., FXD, CER DI: 22PF, 5%, 50V	72982	8111B061C0G220J
281-0078-00	CAP., VAR, AIR DI:1.4-7.3PF, 750V		189-0503-075
281-0214-00	CAP., VAR, CER DI:0.5-3PF.400V	5,175,71	2502A0R503VP02F0
283-0108-00	CAP., FXD, CER DI: 220PF. 10%, 200V	7.7.7.7	272C13
283-0158-00	CAP., FXD, CER DI: 1PF.10%.50V		100-050-NPO-109B
283-0000-00	CAP., FXD, CER DI:0.001UF,+100-0%,500V	59660	831-519-Z5U-102P
283-0330-00	CAP., FXD, CER DI:100PF.5%, 50V	51642	150-050-NPO-101J
290-0808-00	CAP., FXD, ELCTLT: 2.7UF, 10%, 20V		162D275X9020CD2
283-0000-00	CAP., FXD, CER DI:0.001UF.+100-0%.500V		831-519-Z5U-102P
			831-519-25U-102P
			8121N075X7R0103M
283-0220-00	CAP., FXD, CER DI:0.01UF, 20%, 50V		8121N075X7R0103M
283-0160-00	CAPFXD.CER DI:1.5PF.10%.50V	72982	8101A058C0K159B
	CAP., FXD, CER DI: 10PF, 5%, 200V		8101B210C0G0100J
			8101B210X7R0270K
			SA205E104MAA
281-0202-00	CAP., VAR, PLSTC: 1.5-5.5PF, 100V	80031	2807C1R406MM02F
295-0194-00	CAP SET.MATCHED: 2 EA 1.0UF.1.5%.50V	90201	TTX 100 + 100
			8035D2AADC1G100K
			100-050-NPO-109B
			8121N08325U0104Z
281-0202-00	CAP., VAR, PLSTC: 1.5-5.5PF, 100V	80031	2807C1R406MM02F
281-0775-00	CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
	CAP., FXD, CER DI:0.1UF, 20%, 50V	04222	SA205E104MAA
	CAP., FXD, CER DI: 10PF, 10%, 100V	72982	8035D2AADC1G100K
		72982	8035D9AADC1G470K
281-0151-00	CAP., VAR, CER DI:1-3PF, 100V		518-600A1-3
281-0756-00	CAP., FXD, CER DI: 2.2PF, 0.5%, 200V	12969	CGB2R2DFN
	CAP. FXD, CER DI: 0.1UF, +80-20%, 12V	91418	MX0104Z1205R5
		91418	MX0104Z1205R5
			DE140
152-0246-00	SEMICOND DEVICE: Sw, 51, 40V, 200MA	03508	DE 140
	283-0154-00 281-0078-00 281-0214-00 283-0108-00 283-0158-00 283-0330-00 290-0808-00 283-0000-00 283-0220-00 283-0220-00 283-0160-00 283-0220-00 283-0175-00 283-021-00 281-0775-00 283-0158-00 283-0158-00 283-0631-00 281-0775-00 283-0631-00 281-0775-00 283-0631-00 281-0775-00 283-0631-00 281-0775-00 283-0631-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00 281-0775-00	283-0201-00 281-0775-00 281-0775-00 281-0775-00 281-078-00 281-0214-00  281-0214-00  283-0154-00  283-0154-00  283-0154-00  283-0154-00  283-0154-00  283-0154-00  283-0154-00  283-0154-00  283-0154-00  283-0154-00  283-0158-00  283-0158-00  283-0158-00  283-0158-00  283-0000-00	283-0201-00 CAP.,FXD,CER DI:27FF,10X,200V 72982 281-0775-00 CAP.,VAR,AIR DI:1.4-7.3PF,750V 281-0214-00 CAP.,VAR,AIR DI:1.4-7.3PF,750V 74970 281-0214-00 CAP.,VAR,AIR DI:1.4-7.3PF,750V 74970 281-0078-00 CAP.,VAR,AIR DI:1.4-7.3PF,750V 74970 281-0078-00 CAP.,VAR,AIR DI:1.4-7.3PF,750V 74970 281-0078-00 CAP.,VAR,CER DI:22PF,5X,50V 72982 281-0078-00 CAP.,VAR,CER DI:10.5-3PF,400V 80031 283-0108-00 CAP.,VAR,CER DI:10.5-3PF,400V 80031 283-0108-00 CAP.,FXD,CER DI:22PF,10X,200V 56289 283-0158-00 CAP.,FXD,CER DI:10PF,10X,50V 5660 283-0330-00 CAP.,FXD,CER DI:00PF,5X,50V 56289 283-0000-00 CAP.,FXD,CER DI:00PF,5X,50V 56289 283-0000-00 CAP.,FXD,CER DI:000PF,5X,50V 56289 283-0000-00 CAP.,FXD,CER DI:000PF,5X,50V 72982 283-0220-00 CAP.,FXD,CER DI:0.001UF,100-0X,500V 59660 283-0220-00 CAP.,FXD,CER DI:0.001UF,100-0X,500V 72982 283-0220-00 CAP.,FXD,CER DI:0.01UF,20X,50V 72982 283-0159-00 CAP.,FXD,CER DI:00PF,5X,20V 72982 283-0159-00 CAP.,FXD,CER DI:00PF,5X,20V 72982 283-0159-00 CAP.,FXD,CER DI:00PF,5X,20V 72982 283-0159-00 CAP.,FXD,CER DI:00PF,5X,20V 72982 283-0200-00 CAP.,FXD,CER DI:00PF,5X,50V 72982 283-0531-00 CAP.,FXD,CER DI:00PF,5X,20V 72982 283-0531-00 CAP.,FXD,CER DI:00PF,10X,100V 72982 283-0531-00 CAP.,FXD,CER DI:00PF,10X,100V 72982 283-0631-00 CAP.,FXD,CER DI:00PF,10X,100V 72982 281-075-00 CAP.,FXD,CER DI:00PF,10X,100V 72982 28

A12Q139	151-0216-00	TKANSISIUK: SILICUN, PNP
A12Q222	151-1124-00	TRANSISTOR: JFE, N-CHAN, SI, SEL
A120225	151-0711-00	TRANSISTOR: SILICON, NPN
A12Q233	151-0711-00	TRANSISTOR; SILICON, NPN
A120234	151-0712-00	TRANSISTOR: SILICON, NPN
A12Q239	151-0216-00	TRANSISTOR: SILICON, PNP
.110.111	144 1044 31	
A12Q629	151-0188-00	TRANSISTOR: SILICON, PNP
A12Q630A,B	151-1042-00	SEMICOND DVC SE: MATCHED PAIR FET
A12Q631	151-0190-00	TRANSISTOR: SILICON, NPN
A12Q634	151-0736-00	TRANSISTOR: SILICON, NPN
A12Q680A,B	151-1042-00	SEMICOND DVC SE: MATCHED PAIR FET
A12Q681	151-0190-00	TRANSISTOR: SILICON, NPN
A12Q684	151-0736-00	TRANSISTOR: SILICON, NPN
A12Q720	151-0190-00	TRANSISTOR: SILICON, NPN
A12Q730	151-0712-00	TRANSISTOR: SILICON, NPN
A12Q731	151-0712-00	TRANSISTOR: SILICON, NPN
A12Q736	151-0711-00	TRANSISTOR: SILICON, NPN
A12R103	315-0240-00	RES., FXD, CMPSN: 24 OHM, 5%, 0.25W
A12R105	321-0807-01	RES.,FXD,FILM:900K OHM,0.5%,0.125W
A12R106	317-0330-00	RES., FXD, CMPSN: 33 OHM, 5%, 0.125W
A12R107	321-1389-01	RES., FXD, FILM:111K OHM, 0.5%, 0.125W
A12R108	315-0620-00	RES., FXD, CMPSN: 62 OHM, 5%, 0.25W
A12R110	315-0101-00	RES., FXD, CMPSN: 100 OHM, 5%, 0.25W
A12R111	321-0790-01	RES., FXD, FILM: 990K OHM, 0.5%, 0.125W
A12R112	315-0120-00	RES.,FXD,CMPSN:12 OHM,5%,0.25W
A12R114	321-1289-01	RES., FXD, FILM:10.1K OHM, 0.5%, 0.125W
A12R115	315-0910-00	RES., FXD, CMPSN: 91 OHM, 5%, 0.25W
A12R116	321-0385-04	RES., FXD, FILM: 100K OHM, 0.1%, 0.125W
A12R117	321-0807-04	RES., FXD, FILM: 900K OHM, 0.1%, 0.125W
A12R119	315-0107-00	RES.,FXD,CMPSN:100M OHM,5%,0.25W
A12R120	315-0104-00	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W
A12R12U	315-0104-00	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W
A12R121	301-0122-00	RES.,FXD,CMPSN:1.2K OHM,5%,0.25W
A12R123	315-0100-00	
A12R123		RES., FXD, CMPSN: 10 OHM, 5%, 0.25W
A12R124 A12R125	315-0102-00	RES., FXD, CMPSN:1K OHM, 5%, 0.25W
MIZRIZJ	321-0131-00	RES.,FXD,FILM:226 OHM,1%,0.125W
A12R126	321-0126-00	RES., FXD, FILM: 200 OHM, 1%, 0.125W
A12R127	315-0470-00	RES., FXD, CMPSN: 47 OHM, 5%, 0.25W

04713 SPS8224 04713 SPS8224 04713 SPS8223 04713 SPS8803 04713 SPS6868K 01295 SKA5390 07263 S032677 04713 SPS8317 01295 SKA5390 07263 S032677 04713 SPS8317 07263 S032677 04713 SPS8223 04713 SPS8223 04713 SPS8224 01121 CB2405 91637 MFF1816G90002D 01121 BB3305 91637 MFF1816G11102D 01121 CB6205 01121 CB1015 91637 HFF1104G99002D 01121 CB1205 91637 MFF1816G10101D 01121 CB9105 91637 MFF1816D10002B 24546 NC55C9003B 01121 CB1075 01121 CB1045 01121 CB4355 01121 EB1225 01121 CB1005 01121 CB1025 91637 MFF1816G226R0F 91637 MFF1816G200R0F 01121 CB4705

22229 F2942

A12R148	315-0111-00	RES., FXD, CMPSN: 110 UHM, D&, U.ZDW	VIIZI	CIIII
A12R149	315-0101-00	RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	
A12R203	315-0240-00	RES., FXD, CMPSN: 24 OHM, 5%, 0.25W	01121	CB2405
A12R205	321-0807-01	RES., FXD, FILM: 900K OHM, 0.5%, 0.125W	91637	
A12R206	317-0330-00	RES., FXD, CMPSN: 33 OHM, 5%, 0.125W	01121	вв3305
A12R207	321-1389-01	RES., FXD, FILM: 111K OHM, 0.5%, 0.125W	91637	MFF1816G11102D
A12R208	315-0620-00	RES.,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A12R210	315-0101-00	RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
A12R211	321-0790-01	RES.,FXD,FILM:990K OHM,0.5%,0.125W	91637	HFF1104G99002D
A12R212	315-0120-00	RES., FXD, CMPSN:12 OHM, 5%, 0.25W	01121	CB1205
A12R214	321-1289-01	RES., FXD, FILM:10.1K OHM, 0.5%, 0.125W	91637	MFF1816G10101D
A12R215	315-0910-00	RES., FXD, CMPSN:91 OHM, 5%, 0.25W	01121	СВ9105
A12R216	321-0385-04	RES., FXD, FILM: 100K OHM, 0.1%, 0.125W	91637	MFF1816D10002B
A12R217	321-0807-04	RES., FXD, FILM: 900K OHM, 0.1%, 0.125W	24546	NC55C9003B
A12R219	315-0107-00	RES., FXD, CMPSN: 100M OHM, 5%, 0.25W	01121	CB1075
A12R220	315-0104-00	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
A12R221	315-0435-00	RES., FXD, CMPSN: 4.3M OHM, 5%, 0.25W	01121	СВ4355
A12R222	301-0122-00	RES., FXD, CMPSN:1.2K OHM, 5%, 0.50W	01121	EB1225
A12R225	321-0131-00	RES., FXD, FILM: 226 OHM, 1%, 0.125W	91637	MFF1816G226R0F
A12R226	321-0126-00	RES., FXD, FILM: 200 OHM, 1%, 0.125W	91637	MFF1816G200R0F
A12R227	315-0470-00	RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
A12R231	321-0254-00	RES., FXD, FILM: 4.32K OHM, 1%, 0.125W	91637	MFF1816G43200F
A12R232	321-0229-00	RES., FXD, FILM: 2.37K OHM, 1%, 0.125W	91637	MFF1816G23700F
A12R233	315-0101-00	RES., FXD, CMPSN:100 OHM, 5%, 0.25W	01121	CB1015
A12R234	315-0680-00	RES., FXD, CMPSN: 68 OHM, 5%, 0.25W	01121	CB6805
A12R235	315-0472-00	RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
A12R236	307-0106-00	RES., FXD, CMPSN: 4.7 OHM, 5%, 0.25W	01121	CB47G5
A12R237	315-0100-00	RES., FXD, CMPSN:10 OHM, 5%, 0.25W	01121	CB1005
A12R238	311-1559-00	RES., VAR, NONWIR: 10K OHM, 20%, 0.50W	73138	91-81-0
A12R239	307-0710-00	RES NTWK, FXD, FI: ATTENUATOR	80009	307-0710-00
A12R240	315-0132-00	RES., FXD, CMPSN: 1.3K OHM, 5%, 0.25W	01121	CB1325
A12R241	311-2133-00	RES., VAR, NONWIR: PNL, 500 OHM, 20%, 0.50W	12697	CM41766
A12R242	315-0304-00	RES., FXD, CMPSN: 300K OHM, 5%, 0.25W	01121	CB3045
A12R243	315-0301-00	RES., FXD, CMPSN: 300 OHM, 5%, 0.25W	01121	CB3015
A12R244	315-0111-00	RES.,FXD,CMPSN:110 OHM,5%,0.25W	01121	CB1115
A12R245	311-0609-00	RES., VAR, NONWIR: 2K OHM, 10%, 0.50W	73138	82-26-1
A12R246	311-0607-00	RES., VAR, NONWIR: 10K OHM, 10%, 0.50W		82-25-2
A12R247	315-0393-00	RES., FXD, CMPSN: 39K OHM, 5%, 0.25W		СВ3935
A12R246	311-0607-00	RES., VAR, NONWIR: 10K OHM, 10%, 0.50W	73138	82-25-2

ALZKOOU	213-0310-00	RED. FAU, OFFE DN. JI VIII, JA, V. LJW
A12R681	301-0242-00	RES., FXD, CMPSN: 2.4K OHM, 5%, 0.50W
A12R682	311-1248-00	RES., VAR, NONWIR: 500 OHM, 10%, 0.50W
A12R683	321-0228-00	RES., FXD, FILM: 2.32K OHM, 1%, 0.125W
A12R684	321-0232-00	RES., FXD, FILM: 2.55K OHM, 1%, 0.125W
A12R685	315-0102-00	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W
A12R686	315-0682-00	RES., FXD, CMPSN: 6.8K OHM, 5%, 0.25W
A12R691	315-0470-00	RES., FXD, CMPSN: 47 OHM, 5%, 0.25W
A12R720	315-0221-00	RES., FXD, CMPSN: 220 OHM, 5%, 0.25W
A12R721	315-0101-00	RES., FXD, CMPSN: 100 OHM, 5%, 0.25W
A12R722	315-0152-00	RES.,FXD,CMPSN:1.5K OHM,5%,0.25W
A12R723	315-0682-00	RES., FXD, CMPSN: 6.8K OHM, 5%, 0.25W
A12R724	315-0392-00	RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W
A12R725	315-0822-00	RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W
A12R728	315-0822-00	RES., FXD, CMPSN: 8.2K OHM, 5%, 0.25W
A12R729	321-0159-00	RES., FXD, FILM: 442 OHM, 1%, 0.125W
A12R730	315-0561-00	RES., FXD, CMPSN: 560 OHM, 5%, 0.25W
A12R731	315-0911-00	RES., FXD, CMPSN: 910 OHM, 5%, 0.25W
A12R732	321-0206-00	RES., FXD, FILM: 1.37K OHM, 1%, 0.125W
A12R733	311-1562-00	RES., VAR, NONWIR: 2K OHM, 20%, 0.50W
A12R734	321-0295-00	RES., FXD, FILM: 11.5K OHM, 1%, 0.125W
A12R736	315-0272-00	RES., FXD, CMPSN: 2.7K OHM, 5%, 0.25W
A12R737	315-0362-00	RES., FXD, CMPSN: 3.6K OHM, 5%, 0.25W
A12R738	315-0100-00	RES., FXD, CMPSN:10 OHM, 5%, 0.25W
A12R739	315-0560-00	RES., FXD, CMPSN: 56 OHM, 5%, 0.25W
A12R741	315-0100-00	RES., FXD, CMPSN: 10 OHM, 5%, 0.25W
A12RT144	307-0125-00	RES., THERMAL: 500 OHM, 10%, 25 DEG C
A12RT244	307-0125-00	RES., THERMAL: 500 OHM, 10%, 25 DEG C
A12S734		(PART OF R629)
A12S105A,B	260-2025-00	SWITCH, ROTARY: VERTICAL ATTENUATOR
A12S2O5A, B	260-2025-00	SWITCH, ROTARY: VERTICAL ATTENUATOR
A12S630A, B, C	260-2023-00	SWITCH, ROTARY: TIME/DIV A/B
A12U120	156-1551-00	MICROCIRCUIT, LI: OPNL AMPL
A12U145	155-0227-00	MICROCIRCUIT, LI: VERTICAL PREAMP
A12U220	156-1551-00	MICROCIRCUIT, LI: OPNL AMPL
A12U245	155-0227-00	MICROCIRCUIT, LI: VERTICAL PREAMP
A12VR122	152-0168-00	SEMICOND DEVICE: ZENER, 0.4W, 12V, 5%
A12VR130	152-0217-00	SEMICOND DEVICE: ZENER, 0.4W, 8.2V, 5%

91637 MFF1816G23200F 91637 MFF1816G25500F 01121 CB1025 01121 CB6825 01121 CB4705 01121 CB2215 01121 CB1015 01121 CB1525 01121 CB6825 01121 CB3925 01121 CB8225 01121 CB8225 91637 MFF1816G442R0F 01121 CB5615 01121 CB9115 91637 MFF1816G13700F 73138 91-84-0 91637 MFF1816G11501F 01121 CB2725 01121 CB3625 01121 CB1005 01121 CB5605 01121 CB1005 50157 2D1595 50157 2D1595 80009 260-2025-00 80009 260-2025-00 80009 260-2023-00 02735 90593 80009 155-0227-00 02735 90593 80009 155-0227-00 04713 SZG35009K4 04713 SZG20

01121 EB2425 73138 72-23-0

A13Q002	121-0130-00		TRANSISTOR. SILITOON, NEW	V1 EVJ	0034011
A130664	151-0190-00		TRANSISTOR: SILICON, NPN		S032677
A130690	151-0190-00		TRANSISTOR: SILICON, NPN		\$032677
A13R552	315-0510-00		RES., FXD, CMPSN: 51 OHM, 5%, 0.25W		CB5105
A13R553	315-0472-00		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W		CB4725
A13R554	315-0391-00		RES., FXD, CMPSN: 390 OHM, 5%, 0.25W	01121	CB3915
A13R555	315-0302-00		RES., FXD, CMPSN: 3K OHM, 5%, 0.25W		CB3025
A13R556	315-0100-00		RES., FXD, CMPSN: 10 OHM, 5%, 0.25W		CB1005
A13R560	321-0207-00		RES., FXD, FILM: 1.4K OHM, 1%, 0.125W		MFF1816G14000F
A13R561	321-0197-00		RES., FXD, FILM: 1.1K OHM, 1%, 0.125W		MFF1816G11000F
A13R562	321-0203-00		RES., FXD, FILM: 1.27K OHM, 1%, 0.125W		MFF1816G12700F
A13R563	321-0201-00		RES.,FXD,FILM:1.21K OHM,1%,0.125W	91637	MFF1816G12100F
A13R564	315-0242-00		RES., FXD, CMPSN: 2.4K OHM, 5%, 0.25W	01121	CB2425
A13R566	315-0101-00		RES., FXD, CMPSN: 100 OHM, 5%, 0.25W	01121	CB1015
A13R567	315-0821-00		RES., FXD, CMPSN: 820 OHM, 5%, 0.25W	01121	CB8215
A13R569	315-0123-00		RES., FXD, CMPSN: 12K OHM, 5%, 0.25W	01121	CB1235
A13R571	315-0104-00		RES., FXD, CMPSN: 100K OHM, 5%, 0.25W	01121	CB1045
A13R573	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A13R574	315-0185-00		RES., FXD, CMPSN: 1.8M OHM, 5%, 0.25W	01121	CB1855
A13R575	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W	01121	CB5125
A13R579	315-0511-00		RES., FXD, CMPSN: 510 OHM, 5%, 0.25W	01121	CB5115
A13R581	321-0191-00		RES., FXD, FILM: 953 OHM, 1%, 0.125W	91637	MFF1816G953R0F
A13R582	315-0820-00		RES.,FXD,CMPSN:82 OHM,5%,0.25W	01121	CB8205
A13R584	301-0470-00		RES.,FXD,CMPSN:47 OHM,5%,0.50W		EB4705
A13R585	315-0511-00		RES., FXD, CMPSN: 510 OHM, 5%, 0.25W		CB5115
A13R587	315-0511-00		RES., FXD, CMPSN: 510 OHM, 5%, 0.25W		CB5115
A13R590	315-0511-00		RES., FXD, CMPSN: 510 OHM, 5%, 0.25W		CB5115
A13R591	315-0361-00		RES., FXD, CMPSN: 360 OHM, 5%, 0.25W		CB3615
A13R593	315-0242-00		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A13R594	315-0361-00		RES., FXD, CMPSN: 360 OHM, 5%, 0.25W		CB3615
A13R641	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W		CB1025
A13R644	315-0752-00	B010100 B010684	RES., FXD, CMPSN: 7.5K OHM, 5%, 0.25W	1 2 1 2 1 2 1 2 1 2 1 2 1	CB7525
A13R644	315-0102-00	B010685	RES., FXD, CMPSN: 1K OHM, 5%, 0.25W		CB1025
A13R648	315-0331-00		RES., FXD, CMPSN: 330 OHM, 5%, 0.25W		CB3315
A13R650	315-0392-00		RES., FXD, CMPSN: 3.9K OHM, 5%, 0.25W	01121	СВ3925
A13R652	315-0162-00		RES., FXD, CMPSN: 1.6K OHM, 5%, 0.25W		CB1625
A13R653	321-0271-00		RES., FXD, FILM: 6.49K OHM, 12, 0.125W	91637	the state of the s
A13R654	311-1238-00		RES., VAR, NONWIR: 5K OHM, 10%, 0.50W	73138	72-27-0

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A13R690	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W
A13R693	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W
A13R694	315-0512-00		RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W
A13R695	315-0512-00		RES.,FXD,CMPSN:5.1K OHM,5%,0.25W
A13R696	315-0621-00		RES., FXD, CMPSN: 620 OHM, 5%, 0.25W
A13R697	315-0621-00		RES., FXD, CMPSN: 620 OHM, 5%, 0.25W
A13U555	156-1349-00		MICROCIRCUIT, LI: DUAL INDEP DIFF AMPL
A13U585	156-0205-00		MICROCIRCUIT, DI: QUAD 2-INPUT NOR GATE
A13U648	156-1381-00		MICROCIRCUIT, LI: XSTR ARRAY
A13U665	156-0382-00	В010100 В019249	MICROCIRCUIT, DI: QUAD 2-INPUT NAND GATE
A13U665	156-0382-02	B019250	MICROCIRCUIT, DI: QUAD 2-INP NAND GATE
A13U670	156-0382-00	B010100 B019249	MICROCIRCUIT, DI: QUAD 2-INPUT NAND GATE
A13U670	156-0382-02	B019250	MICROCIRCUIT, DI: QUAD 2-INP NAND GATE
A13U690	156-0385-00	B010100 B019249	MICROCIRCUIT, DI: HEX. INVERTER
A13U690	156-0385-02	B019250	MICROCIRCUIT, DI: HEX INVERTER
A13U693	156-0480-00	B010100 B012542	MICROCIRCUIT, DI: QUAD 2-INPUT AND GATE
A13U693	156-0480-02	B012543	MICROCIRCUIT, DI: QUAD 2 INP & GATE
A13U696	156-1611-00		MICROCIRCUIT, DI: DUAL D TYPE EDGE-TRIGGERED
A13VR584	152-0195-00	B010100 B012542	SEMICOND DEVICE: ZENER, 0.4W, 5.1V, 5%
A13VR584	152-0662-00	B012543	SEMICOND DEVICE: ZENER, 0.4W, 5V, 1%
A13W556	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W661	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W662	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W665	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W670	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W671	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W672	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W689	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W690	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W692	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W693	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W694	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W695	131-0566-00		BUS CONDUCTOR: DUMMY RES, 2.375, 22 AWG
A13W1001	131-0589-00		TERMINAL, PIN: 0.46 L X 0.025 SQ
			(OTY 27)

01121 CB5125 01121 CB5125 01121 CB6215 01121 CB6215 02735 CA3054 04713 MC10102 (P OR L) 02735 CA3096AE-17 01295 SN74LS00(N OR J) 01295 SN74LS00 01295 SN74LS00(N OR J) 01295 SN74LS00 80009 156-0385-00 01295 SN74LS04 01295 SN74LS08(N OR J) 01295 SN74LS08NP3 07263 74F74 04713 SZ11755 04713 SZG195 55210 L-2007-1 22526 48283-029

01121 CB5125 01121 CB5125

A18CR931	152-0061-00	XB022000	SEMICOND DEVICE: SILICON, 1/3V, 100MA
A18CR933	152-0661-00	XB022000	SEMICOND DEVICE: RECT, SI, 600V, 3A, FAST
A18E933	276-0640-00	XB022000	CORE, EM: TOROID, FERRITE, 0.375 OD X 0.187
A18L937	108-0422-00	XB022000	COIL, RF: FIXED, 82UH
A18L938	108-0422-00	XB022000	COIL, RF: FIXED, 82UH
A18P801	131-1048-00	XB022000	TERM.QIK DISC:CKT BD MT, 0.11 X 0.02
A18P802	131-1048-00	XB022000	TERM.QIK DISC:CKT BD MT, 0.11 X 0.02
A18P803	131-1048-00	XB022000	TERM.QIK DISC:CKT BD MT, 0.11 X 0.02
A10P804	131-1048-00	XB022000	TERM.QIK DISC:CKT BD MT, 0.11 X 0.02
A18Q915	151-0164-00	XB022000	TRANSISTOR: SILICON, PNP
A18Q917	151-0432-00	XB022000	TRANSISTOR: SILICON, NPN
A18Q931	151-0164-00	XB022000	TRANSISTOR: SILICON, PNP
A18Q933	151-1152-00	XB022000	TRANSISTOR: MOSFE, N-CHANNEL, SI, TO-220
A18Q935	151-0506-00	XB022000	SCR: SILICON
A18R903	315-0512-00	XB022000	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W
A18R904	315-0512-00	XB022000	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W
A18R907	315-0561-00	XB022000	RES., FXD, CMPSN: 560 OHM, 5%, 0.25W
A18R908	315-0561-00	XB022000	RES., FXD, CMPSN: 560 OHM, 5%, 0.25W
A18R911	303-0154-00	XB022000	RES., FXD, CMPSN: 150K OHM, 5%, 1W
A18R912	315-0104-00	XB022000	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W
A18R913	315-0104-00	XB022000	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W
A18R914	315-0104-00	XB022000	RES., FXD, CMPSN: 100K OHM, 5%, 0.25W
A18R916	315-0302-00	XB022000	RES., FXD, CMPSN: 3K OHM, 5%, 0.25W
A18R917	315-0512-00	XB022000	RES., FXD, CMPSN: 5.1K OHM, 5%, 0.25W
A18R920	315-0203-00	XB022000	RES., FXD, CMPSN: 20K OHM, 5%, 0.25W
A18R921	321-0289-00	XB022000	RES., FXD, FILM: 10K OHM, 1%, 0.125W
A18R922	321-0379-00	XB022000	RES., FXD, FILM: 86.6K OHM, 1%, 0.125W
A18R923	315-0154-00	XB022000	RES., FXD, CMPSN: 150K OHM, 5%, 0.25W
A18R925	315-0682-00	XB022000	RES., FXD, CMPSN: 6.8K OHM, 5%, 0.25W
A18R927	315-0103-00	XB022000	RES., FXD, CMPSN: 10K OHM, 5%, 0.25W
A18R928	315-0391-00	XB022000	RES., FXD, CMPSN: 390 OHM, 5%, 0.25W
A18R929	315-0103-00	XB022000	RES., FXD, CMPSN: 10K OHM, 5%, 0.25W
A18R931	315-0302-00	XB022000	RES., FXD, CMPSN: 3K OHM, 5%, 0.25W
A18R933	308-0843-00	XB022000	RES., FXD WW:0.2 OHM, 5%, 1.0W
A18R934	308-0441-00	XB022000	RES., FXD, WW: 3 OHM, 5%, 3W
A18R935	315-0121-00	XB022000	RES., FXD, CMPSN: 120 OHM, 5%, 0.25W
A18R936	315-0470-00	XB022000	RES., FXD, CMPSN: 47 OHM, 5%, 0.25W
A18R937	301-0822-00	XB022000	RES., FXD, CMPSN: 8.2K OHM, 5%, 0.50W

80009 108-0422-00 00779 61134-1 00779 61134-1 00779 61134-1 00779 61134-1 01295 SKB3334 80009 151-0432-00 01295 SKB3334 04713 STP3002 03508 C106B2X283 01121 CB5125 01121 CB5125 01121 CB5615 01121 CB5615 01121 GB1545 01121 CB1045 01121 CB1045 01121 CB1045 01121 CB3025 01121 CB5125 01121 CB2035 91637 MFF1816G10001F 91637 MFF1816G86601F 01121 CB1545 01121 CB6825 01121 CB1035 01121 CB3915 01121 CB1035 01121 CB3025 91637 RS1AR2000JT/R 91637 CW2B-3R00J 01121 CB1215 01121 CB4705 01121 EB8225

04713 MR856 00779 1-480304-0 80009 108-0422-00

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A19R939	308-0123-00	ROTOTOO ROSTAAAX	KES., FAD, WW: ZU UMM, DA, DW
A19RT935	307-0125-00		RES., THERMAL: 500 OHM, 10%, 25 DEG C
A19VR933	152-0268-00	B010100 B015899	SEMICOND DEVICE: ZENER, 0.4W, 56V, 5%
A19VR933	152-0286-00	B015900 B021999X	SEMICOND DEVICE: ZENER, 0.4W, 75V, 5%
A19VR934	152-0149-00	B010100 B021999X	SEMICOND DEVICE: ZENER, 0.4W, 10V, 5%

50157 2D1595 80009 152-0268-00 80009 152-0286-00 04713 S2G35009K3

0.00.0000

R658	311-1183-01	RES., VAR, WW: PNL, 2K OHM, 5%, 2W		35408-91-202
V870	154-0838-00	ELECTRON TUBE: CRT, T4652-31-2	80009	154-0838-00

# **DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS**

# **Symbols**

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 is in 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.

American National Standard Institute 1430 Broadway New York, New York 10018

### **Component Values**

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

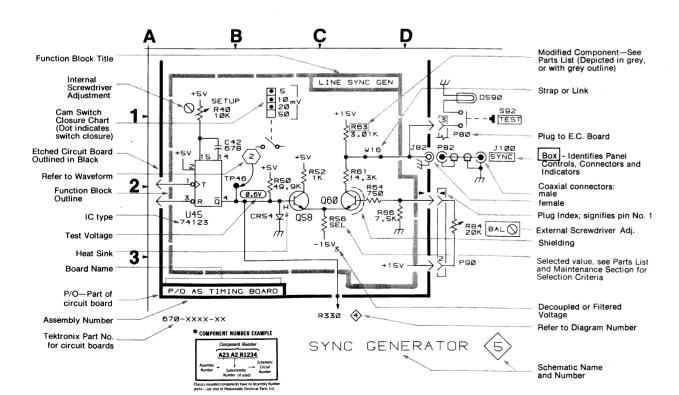
Resistors =  $Ohms(\Omega)$ .

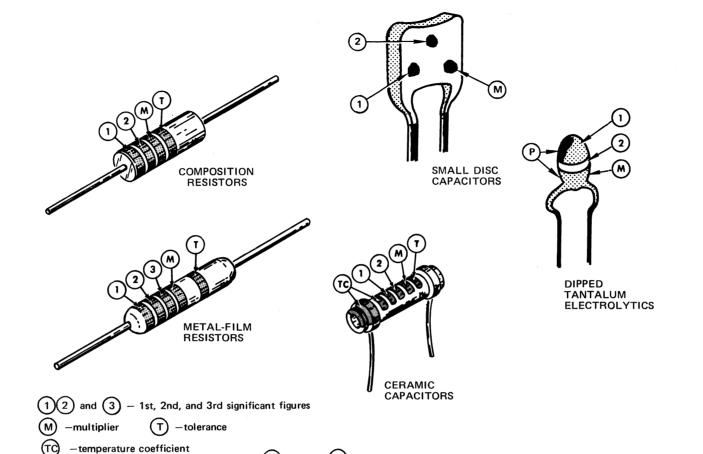
# The information and special symbols below may appear in this manual.—

### **Assembly Numbers and Grid Coordinates**

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number \*(see following illustration for constructing a component number).

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





COLOR	SIGNIFICANT	RESIS	STORS	CAPAC	ITORS		DIPPED
	FIGURES	MULTIPLIER	TOLERANCE	MULTIPLIER	TOLEI	RANCE	TANTALUM VOLTAGE
					over 10 pF	under 10 pF	RATING
BLACK	0	1		1	±20%	±2 pF	4 VDC
BROWN	1	10	±1%	10	±1%	±0.1 pF	6 VDC
RED	2	10 <sup>2</sup> or 100	± <b>2</b> %	10 <sup>2</sup> or 100	±2%		10 VDC
ORANGE	3	10 <sup>3</sup> or 1 K	±3%	10 <sup>3</sup> or 1000	±3%		15 V DC
YELLOW	4	10 <sup>4</sup> or 10 K	±4%	10 <sup>4</sup> or 10,000	+100% -9%		20 VDC
GREEN	5	10 <sup>5</sup> or 100 K	±1/2%	10 <sup>5</sup> or 100,000	±5%	±0.5 pF	25 VDC
BLUE	6	10 <sup>6</sup> or 1 M	±1/4%	10 <sup>6</sup> or 1,000,000			35 V DC
VIOLET	7		±1/10%				50 VDC
GRAY	8			10 <sup>-2</sup> or 0.01	+80% -20%	±0.25 pF	
WHITE	9			10 <sup>-1</sup> or 0.1	±10%	±1 pF	3 VDC
GOLD	-	10 <sup>-1</sup> or 0.1	±5%				
SILVER	-	10 <sup>-2</sup> or 0.01	±10%				
NONE	_		±20%		±10%	±1 pF	

T) and/or (TC) color code may not be present

P -polarity and voltage rating

Figure 9-1. Color codes for resistors and capacitors.

(1861-20A) 2662-48

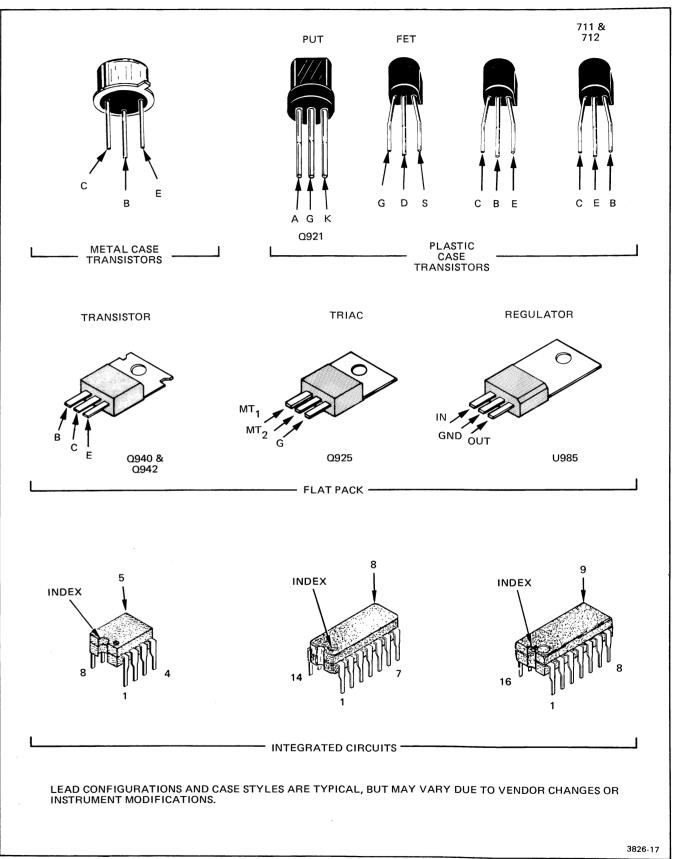
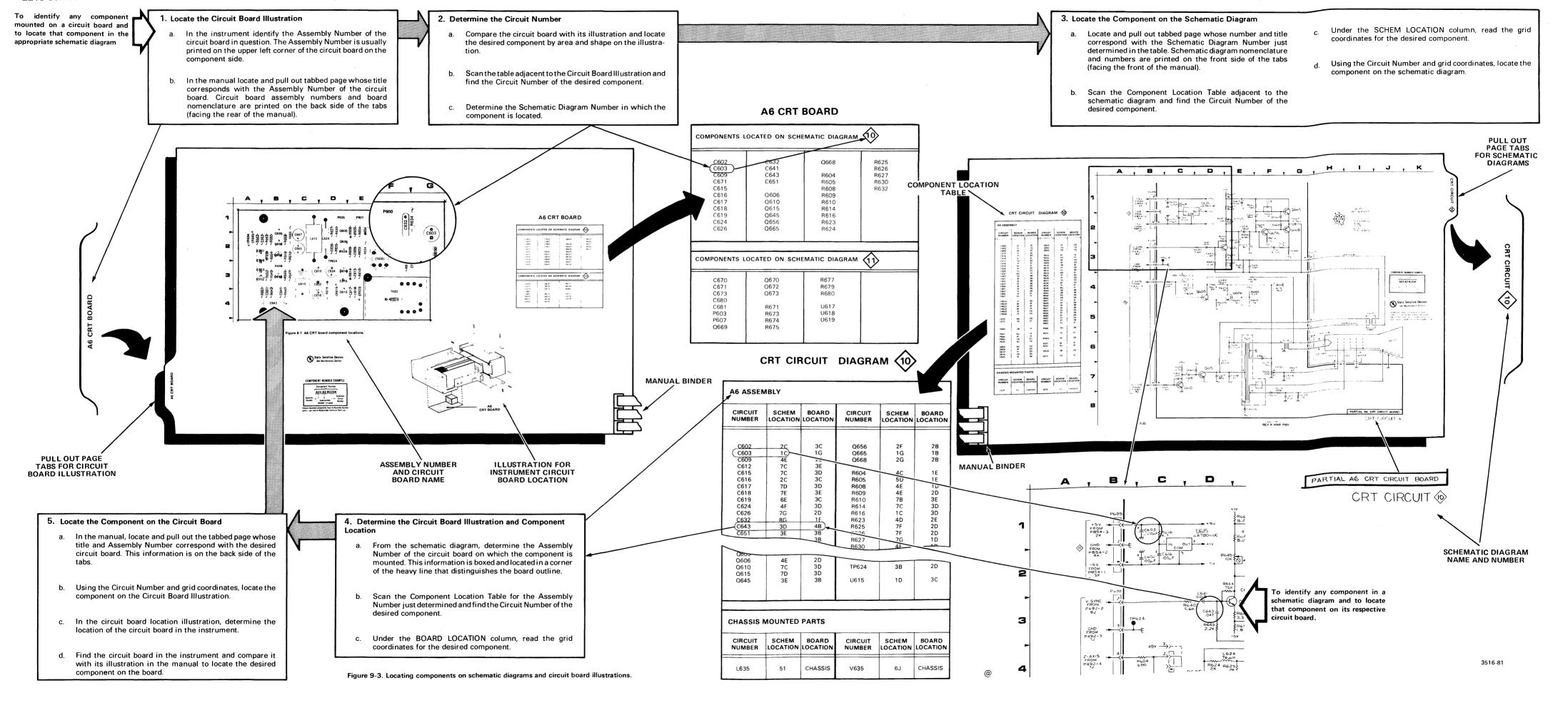
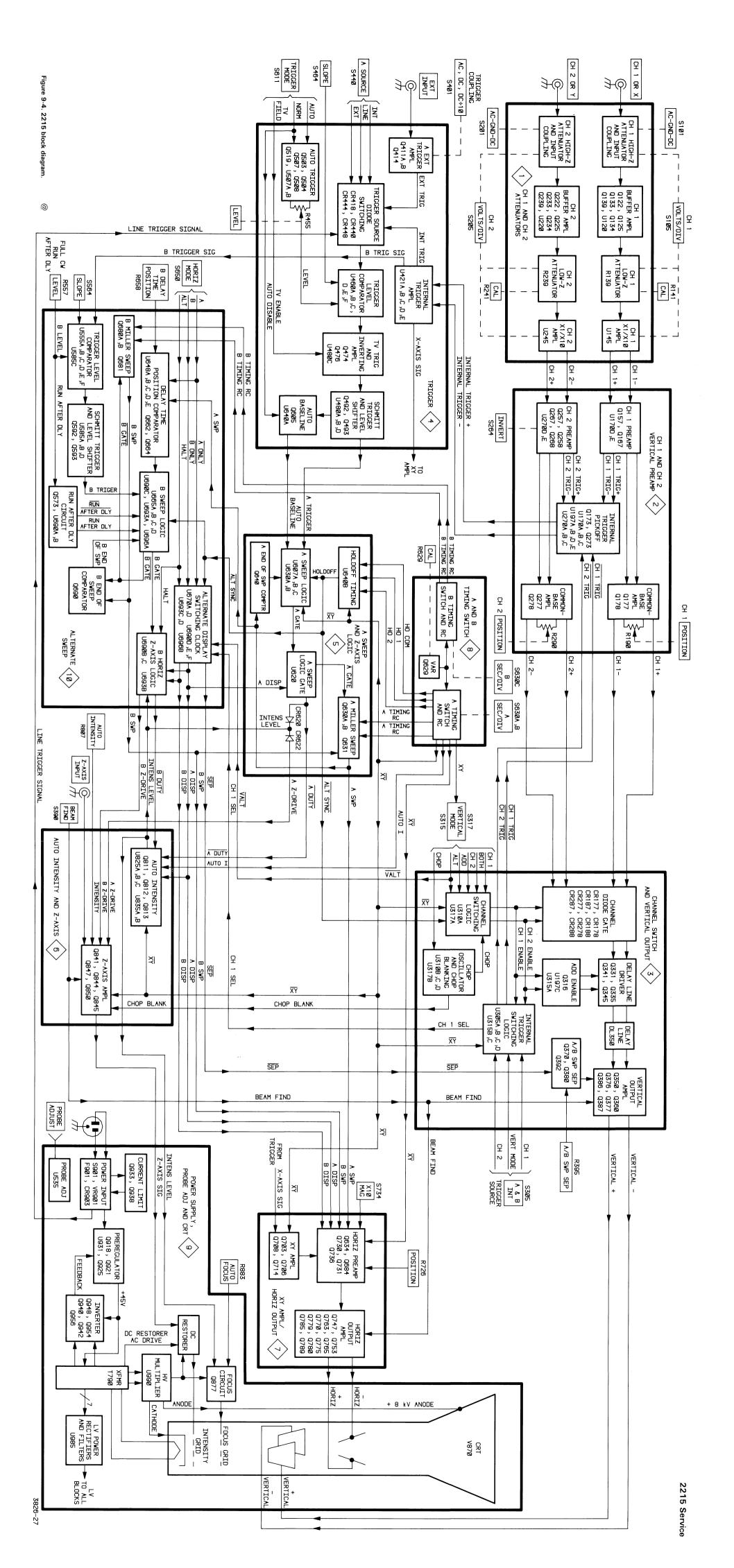


Figure 9-2. Semiconductor lead configurations

# 2215 Service





# TEST WAVEFORM AND VOLTAGE SETUPS

# **WAVEFORM MEASUREMENTS**

On the left-hand pages preceding the schematic diagrams are test waveform illustrations that are intended to aid in troubleshooting the instrument. To test the instrument for these waveforms, make the initial control settings as follows:

### Crt

**AUTO INTENSITY** 

Visible display

AUTO FOCUS

Best focused display

### Vertical (Both Channels, if applicable)

CH 2 INVERT

Off (button out)

VOLTS/DIV

10 mV

VOLTS/DIV Variable

CAL detent

AC-GND-DC

**GND** 

POSITION

Display Centered

VERTICAL MODE

CH 1

### Horizontal

**POSITION** 

Midrange

X10 MAG

Off (button in)

HORIZONTAL MODE

Α

A and B SEC/DIV

.5 ms

SEC/DIV Variable

CAL detent

B DELAY TIME POSITION 5.0

### **Trigger**

SLOPE (both

+

A LEVEL

Midrange

MODE

AUTO

A & B INT

VERT MODE

A SOURCE

INT

**B LEVEL** 

RUN AFTER DELAY-CW

VAR HOLDOFF

Min (fully ccw)

Changes to the control settings for specific waveforms are noted at the beginning of each set of waveforms. Input signals and hookups required are also indicated, if needed, for each set of waveforms.

# DC VOLTAGE MEASUREMENTS

Typical voltage measurements, located on the schematic diagram, were obtained with the instrument operating under the conditions specified in the Waweform Measurement setup. Control-setting changes required for specific voltages are indicated on each waveform page. Measurements are referenced to chassis ground with the exception of the Preregulator and Inverter voltages on diagram 9. Those voltages are referenced as indicated on the schematic diagram.

# RECOMMENDED TEST EQUIPMENT

Test equipment listed in Table 4-1 in the "Performance Check Procedure" section 4 of this manual, meets the required specifications for testing this instrument.

# POWER SUPPLY ISOLATION PROCEDURE

Each regulated supply has numerous feed points to external loads throughout the instrument. The power distribution diagram is used in conjunction with the schematic diagrams to determine those loads that can be isolated by removing service jumpers and those that cannot.

The power distribution diagram is divided into circuit boards. Each power supply feed to a circuit board is indicated by the schematic diagram number on which the voltage appears. The schematic diagram grid location of a service jumper or component is given adjacent to the component number on the power distribution diagram.

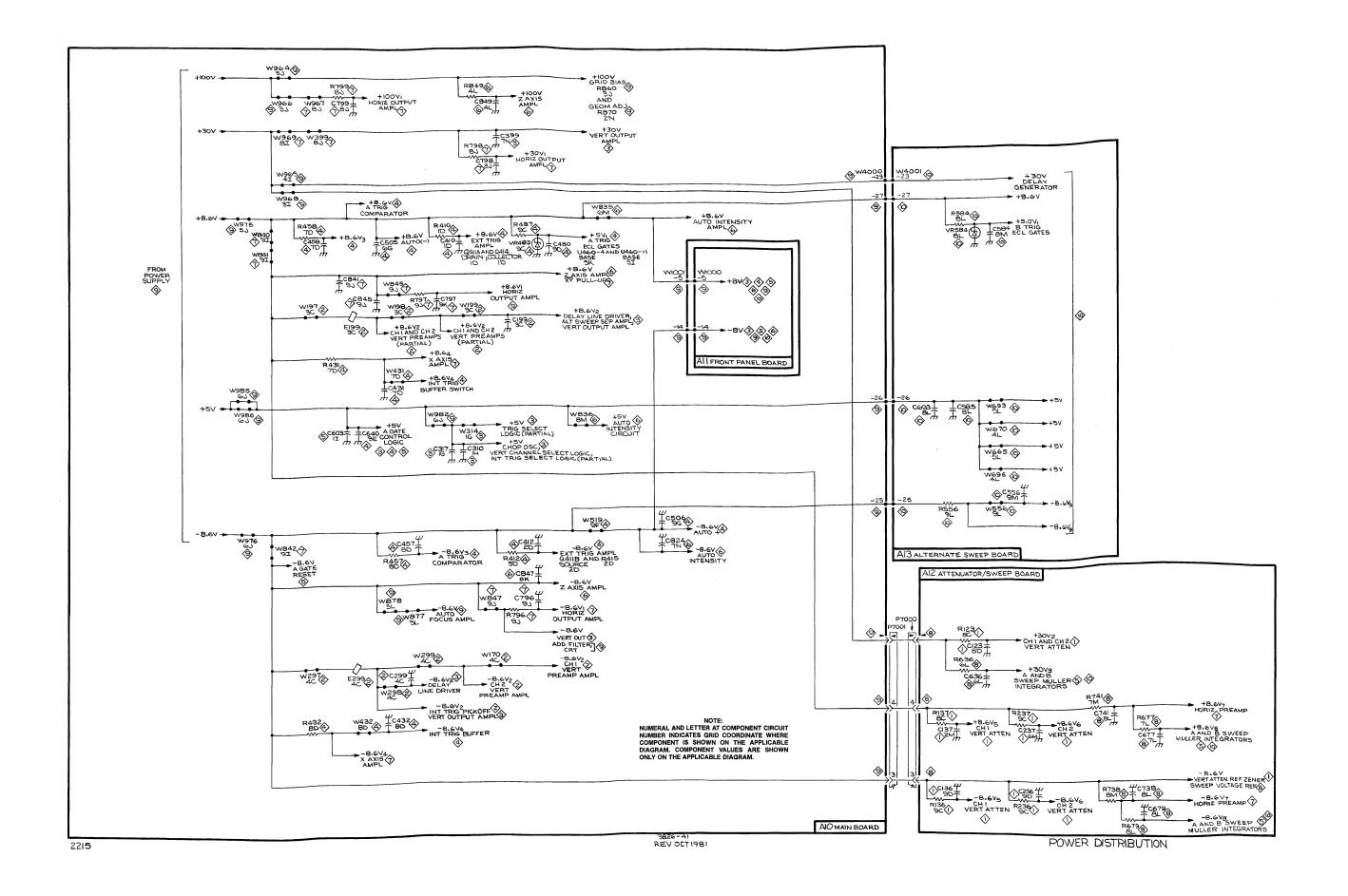
If a power supply comes up after lifting one of the main jumpers from the power supply to isolate that supply, it is very probable that a short exist in the circuitry on that supply line. By lifting jumpers farther down the line, the circuit in which a short exist may be located.

Typical resistance values to ground from the regulated supplies output as measured at the supply test points are:

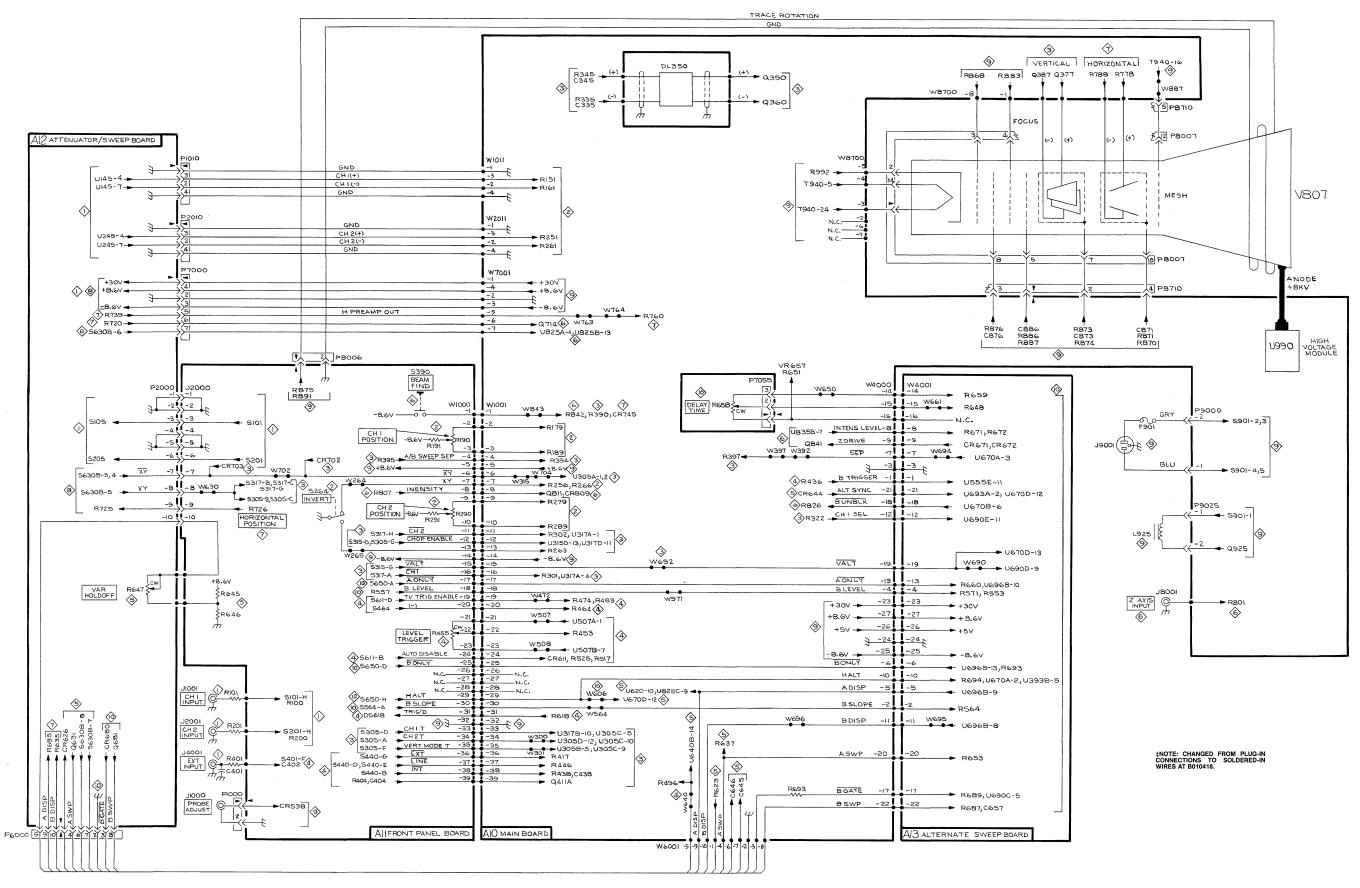
-8.6 V	114 Ω at TP50
+8.6 V	95 Ω at W97
+5 V	330 Ω at W98
+30 V	905 Ω at W96
+100 V	12.5 kΩ at W96

Resistance values significantly lower may indicate shorted components in the load. Values will vary between instruments.

Always set the POWER switch to OFF before soldering or unsoldering service jumpers or other components and before attempting to measure component resistance values.



A DIVIRIBUTION



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Figure 9-5. A12—Attenuator/Sweep board.



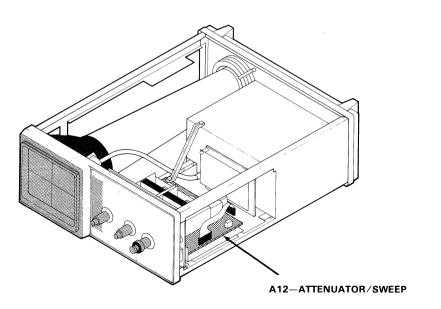
### COMPONENT NUMBER EXAMPLE

	Component Number
Assembly Number	A23, A2, R1234  Subassembly Number (if used)  Schematic Circuit Number

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

# A12—ATTENUATOR/SWEEP BOARD

C105						1				1		SCHEN NUMBE
C105	C104	1	C641	5	P6000-8	10	P110	1	P220	1	D602	7
C107								1				
C110								1				
Cili		1										
Ci112		l .										
C119		1		1		l		1 '				
C121	C119	1	C720	7	P7000-4			l i				
C123         1         C734         7         P7000-6         7         R127         1         R233         1         R722         7           C125         1         C736         7         P7000-7         8         R128         1         R234         1         R724         7           C132         1         C741         8         Q125         1         R130         1         R235         1         R724         7           C133         1         C741         8         Q125         1         R131         1         R236         1         R725         7           C134         1         CR19         1         Q133         1         R132         1         R238         1         R729         7           C136         1         CR626         5         Q139         1         R134         1         R238         1         R729         7           C137         1         CR626         5         Q139         1         R135         1         R240         1         R730         7           C139         1         CR630         5         Q222         1         R135         1	C121	1	C732	7	P7000-5			1				
C125         1         C736         7         P7000-7         8         R128         1         R234         1         R723         7           C132         1         C738         8         O122         1         R130         1         R235         1         R725         7           C134         1         CR119         1         O133         1         R131         1         R236         1         R725         7           C136         1         CR219         1         O134         1         R133         1         R238         1         R726         7           C137         1         CR626         5         O139         1         R133         1         R238         1         R730         7           C137         1         CR636         5         O122         1         R135         1         R239         1         R730         7           C139         1         CR636         5         O122         1         R135         1         R240         1         R730         7           C140         1         CR630         5         O222         1         R135         1	C123	1	C734	7	P7000-6	7	R127	1		1		
C132	C125	1	C736	7	P7000-7	8	R128	1		1		
C133	C132	1	C738	8	Q122	1	R130	1		1		
C134	C133	1	C741	8	Q125	1						
C136	C134	1	CR119	1	Q133	1						
C137	C136	1	CR219	1	Q134	1						
C139         1         CR630         5         Q222         1         R135         1         R240         1         R731         7           C140         1         CR676         10         Q225         1         R136         1         R240         1         R731         7           C141         1         CR680         10         Q233         1         R136         1         R241         1         R733         7           C142         1         P1010-1         1         Q234         1         R138         1         R243         1         R734         7           C144         1         P1010-2         1         Q239         1         R139         1         R244         1         R736         7           C204         1         P1010-3         1         Q629         8         R140         1         R245         1         R737         7           C205         1         P1010-4         1         Q630         5         R141         1         R246         1         R738         8           C207         1         P2000-1         1         Q631         5         R141         1 </td <td></td> <td>1</td> <td></td> <td>5</td> <td></td> <td>1</td> <td></td> <td>1</td> <td></td> <td>1</td> <td></td> <td></td>		1		5		1		1		1		
C140         1         CR676         10         Q225         1         R136         1         R241         1         R732         7           C141         1         CR680         10         Q2234         1         R137         1         R242         1         R733         7           C144         1         P1010-1         1         Q234         1         R138         1         R243         1         R734         7           C144         1         P1010-3         1         Q629         8         R140         1         R243         1         R736         7           C204         1         P1010-3         1         Q630         5         R141         1         R245         1         R737         7           C205         1         P1010-4         1         Q630         5         R141         1         R246         1         R738         8           C207         1         P2000-1         1         Q631         5         R142         1         R246         1         R738         8           C207         1         P2000-2         1         Q680         10         R144 <th< td=""><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>		1										
C141         1         CR680         10         Q233         1         R137         1         R242         1         R733         7           C142         1         P1010-1         1         Q234         1         R138         1         R243         1         R734         7           C144         1         P1010-2         1         Q239         1         R139         1         R244         1         R736         7           C204         1         P1010-3         1         Q629         8         R140         1         R245         1         R737         7           C205         1         P1010-4         1         Q630         5         R141         1         R246         1         R738         8           C207         1         P2000-1         1         Q631         5         R141         1         R246         1         R739         7           C210         1         P2000-2         1         Q680         10         R144         1         R248         1         R741         8           C211         1         P2000-3         1         Q680         10         R144 <t< td=""><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td></t<>		1								1		
C142         1         P1010-1         1         Q234         1         R138         1         R243         1         R734         7           C144         1         P1010-2         1         Q239         1         R139         1         R244         1         R736         7           C204         1         P1010-3         1         Q629         8         R140         1         R245         1         R736         7           C205         1         P1010-4         1         Q630         5         R141         1         R246         1         R738         8           C207         1         P2000-1         1         Q631         5         R142         1         R247         1         R739         7           C210         1         P2000-2         1         Q680         10         R144         1         R248         1         R741         8           C210         1         P2000-3         1         Q680         10         R144         1         R249         1         R7144         1         C212         1         P2000-3         1         Q681         10         R145         1	C141	1	CR680	10	Q233	1		1		1		
C144         1         P1010-2         1         Q239         1         R139         1         R244         1         R736         7           C204         1         P1010-3         1         Q629         8         R140         1         R245         1         R737         7           C205         1         P1010-4         1         Q630         5         R141         1         R246         1         R737         7           C207         1         P2000-1         1         Q631         5         R142         1         R246         1         R739         7           C210         1         P2000-2         1         Q634         7         R143         1         R248         1         R741         8           C211         1         P2000-3         1         Q680         10         R144         1         R249         1         RT144         1           C211         1         P2000-3         1         Q680         10         R144         1         R249         1         RT144         1           C219         1         P2000-5         1         Q681         7         R146		1		1		l	1					
C204         1         P1010-3         1         Q629         8         R140         1         R245         1         R737         7           C205         1         P1010-4         1         Q630         5         R141         1         R246         1         R738         8           C207         1         P2000-1         1         Q631         5         R142         1         R247         1         R738         8           C210         1         P2000-2         1         Q634         7         R143         1         R247         1         R739         7           C211         1         P2000-3         1         Q680         10         R144         1         R249         1         RT144         1           C211         1         P2000-4         1         Q681         10         R145         1         R625         8         RT244         1           C212         1         P2000-5         1         Q684         7         R146         1         R627         8         S205         1           C221         1         P2000-6         1         Q720         7         R147		1	P1010-2	1				1		1		
C205         1         P1010-4         1         Q630         5         R141         1         R246         1         R738         8           C207         1         P2000-1         1         Q631         5         R142         1         R247         1         R738         8           C210         1         P2000-2         1         Q684         7         R143         1         R248         1         R741         8           C211         1         P2000-3         1         Q680         10         R144         1         R249         1         R7144         1           C212         1         P2000-4         1         Q681         10         R145         1         R625         8         RT244         1           C219         1         P2000-5         1         Q684         7         R146         1         R625         8         RT244         1           C221         1         P2000-6         1         Q720         7         R146         1         R626         8         S105         1           C221         1         P2000-7         8         Q730         7         R148		1								1		
C207         1         P2000-1         1         Q631         5         R142         1         R247         1         R739         7           C210         1         P2000-2         1         Q684         7         R143         1         R248         1         R741         8           C211         1         P2000-3         1         Q680         10         R144         1         R249         1         R7144         1           C212         1         P2000-4         1         Q681         10         R145         1         R625         8         RT244         1           C219         1         P2000-5         1         Q684         7         R146         1         R626         8         S105         1           C221         1         P2000-6         1         Q720         7         R147         1         R627         8         S205         1           C225         1         P2000-8         8         Q730         7         R148         1         R628         8         S630         8           C232         1         P2000-8         8         Q731         7         R149		1		1 1								
C210         1         P2000-2         1         Q634         7         R143         1         R248         1         R741         8           C211         1         P2000-3         1         Q680         10         R144         1         R249         1         RT144         1           C212         1         P2000-4         1         Q681         10         R145         1         R625         8         RT244         1           C219         1         P2000-5         1         Q684         7         R146         1         R626         8         S105         1           C221         1         P2000-6         1         Q720         7         R147         1         R627         8         S205         1           C225         1         P2000-8         8         Q730         7         R148         1         R628         8         S630         8           C232         1         P2000-8         8         Q731         7         R148         1         R628         8         S630         8           C233         1         P2000-9         7         Q736         7         R203		1					t	1				
C211         1         P2000-3         1         Q680         10         R144         1         R249         1         RT144         1           C212         1         P2000-4         1         Q681         10         R145         1         R625         8         RT244         1           C219         1         P2000-5         1         Q684         7         R146         1         R626         8         S105         1           C221         1         P2000-6         1         Q720         7         R147         1         R626         8         S105         1           C225         1         P2000-7         8         Q730         7         R148         1         R628         8         S630         8           C232         1         P2000-8         8         Q731         7         R149         1         R629         8         S734         7           C233         1         P2000-10         5         R103         1         R203         1         R630         5         U120         1           C234         1         P2010-1         1         R105         1         R206				1								
C212         1         P2000-4         1         Q681         10         R145         1         R625         8         RT2444         1           C219         1         P2000-5         1         Q684         7         R146         1         R626         8         S105         1           C221         1         P2000-6         1         Q720         7         R147         1         R627         8         S205         1           C225         1         P2000-7         8         Q730         7         R148         1         R628         8         S630         8           C232         1         P2000-8         8         Q731         7         R149         1         R629         8         S734         7           C233         1         P2000-9         7         Q736         7         R203         1         R629         8         S734         7           C234         1         P2000-10         5         R103         1         R205         1         R631         5         U145         1           C234         1         P2010-1         1         R105         1         R206		1				1				1		_
C219         1         P2000-5         1         Q684         7         R146         1         R626         8         S105         1           C221         1         P2000-6         1         Q720         7         R147         1         R627         8         S205         1           C225         1         P2000-7         8         Q730         7         R148         1         R628         8         S630         8           C232         1         P2000-8         8         Q731         7         R149         1         R629         8         S734         7           C233         1         P2000-9         7         Q736         7         R203         1         R630         5         U120         1           C234         1         P2000-10         5         R103         1         R205         1         R631         5         U145         1           C236         1         P2010-1         1         R106         1         R206         1         R631         5         U145         1           C237         1         P2010-2         1         R106         1         R207 <t< td=""><td></td><td>1</td><td>P2000-4</td><td></td><td>1</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></t<>		1	P2000-4		1	1						
C221         1         P2000-6         1         Q720         7         R147         1         R627         8         S205         1           C225         1         P2000-7         8         Q730         7         R148         1         R628         8         S630         8           C232         1         P2000-8         8         Q731         7         R149         1         R629         8         S734         7           C233         1         P2000-9         7         Q736         7         R203         1         R630         5         U120         1           C234         1         P2000-10         5         R103         1         R205         1         R631         5         U145         1           C236         1         P2010-1         1         R105         1         R206         1         R631         5         U145         1           C237         1         P2010-2         1         R106         1         R207         1         R634         7         U220         1           C239         1         P2010-3         1         R107         1         R208 <t< td=""><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>  ;</td></t<>		1		1								;
C225         1         P2000-7         8         Q730         7         R148         1         R628         8         S630         8           C232         1         P2000-8         8         Q731         7         R149         1         R629         8         S734         7           C233         1         P2000-9         7         Q736         7         R203         1         R630         5         U120         1           C234         1         P2000-10         5         R103         1         R205         1         R631         5         U145         1           C236         1         P2010-1         1         R105         1         R206         1         R633         7         U220         1           C237         1         P2010-2         1         R106         1         R207         1         R634         7         U245         1           C239         1         P2010-3         1         R107         1         R208         1         R635         7         VR122         1           C241         1         P2010-4         1         R108         1         R210         <		1	P2000-6									;
C232         1         P2000-8         8         Q731         7         R149         1         R629         8         S734         7           C233         1         P2000-9         7         Q736         7         R203         1         R630         5         U120         1           C234         1         P2000-10         5         R103         1         R205         1         R631         5         U145         1           C236         1         P2010-1         1         R105         1         R206         1         R633         7         U220         1           C237         1         P2010-2         1         R106         1         R206         1         R634         7         U245         1           C239         1         P2010-3         1         R106         1         R207         1         R634         7         U245         1           C241         1         P2010-4         1         R108         1         R208         1         R635         7         VR122         1           C242         1         P6000-1         5         R110         1         R210         <		1	P2000-7	8				1				
C233         1         P2000-9         7         Q736         7         R203         1         R630         5         U120         1           C234         1         P2000-10         5         R103         1         R205         1         R631         5         U145         1           C236         1         P2010-1         1         R105         1         R206         1         R633         7         U220         1           C237         1         P2010-2         1         R106         1         R207         1         R634         7         U245         1           C239         1         P2010-3         1         R107         1         R208         1         R635         7         VR122         1           C241         1         P2010-4         1         R108         1         R210         1         R636         8         VR130         1           C242         1         P6000-1         5         R110         1         R211         1         R676         8         VR222         1           C244         1         P6000-2         10         R111         1         R212		1	P2000-8					1				
C234         1         P2000-10         5         R103         1         R205         1         R631         5         U145         1           C236         1         P2010-1         1         R106         1         R206         1         R633         7         U220         1           C237         1         P2010-2         1         R106         1         R207         1         R634         7         U245         1           C239         1         P2010-3         1         R107         1         R208         1         R635         7         VR122         1           C241         1         P2010-4         1         R108         1         R210         1         R636         8         VR130         1           C242         1         P6000-1         5         R110         1         R211         1         R676         8         VR222         1           C244         1         P6000-2         10         R111         1         R212         1         R677         8         VR629         8           C625         8         P6000-3         10         R112         1         R214		1	P2000-9									
C236         1         P2010-1         1         R105         1         R206         1         R633         7         U220         1           C237         1         P2010-2         1         R106         1         R207         1         R634         7         U245         1           C239         1         P2010-3         1         R107         1         R208         1         R635         7         VR122         1           C241         1         P2010-4         1         R108         1         R210         1         R636         8         VR130         1           C242         1         P6000-1         5         R110         1         R211         1         R676         8         VR222         1           C244         1         P6000-2         10         R111         1         R212         1         R677         8         VR629         8           C625         8         P6000-3         10         R112         1         R214         1         R678         8         W116         1           C626         8         P6000-4         5         R114         1         R215		1	P2000-10			1		1				1
C237         1         P2010-2         1         R106         1         R207         1         R634         7         U245         1           C239         1         P2010-3         1         R107         1         R208         1         R635         7         VR122         1           C241         1         P2010-4         1         R108         1         R210         1         R636         8         VR130         1           C242         1         P6000-1         5         R110         1         R211         1         R676         8         VR222         1           C244         1         P6000-2         10         R111         1         R212         1         R677         8         VR629         8           C625         8         P6000-3         10         R112         1         R214         1         R678         8         W1629         8           C626         8         P6000-4         5         R114         1         R215         1         R679         8         W734         7           C628         8         P6000-5         5         R115         1         R216		1	P2010-1	1	R105	l				_	-	1
C239         1         P2010-3         1         R107         1         R208         1         R635         7         VR122         1           C241         1         P2010-4         1         R108         1         R210         1         R635         7         VR122         1           C242         1         P6000-1         5         R110         1         R211         1         R676         8         VR222         1           C244         1         P6000-2         10         R111         1         R212         1         R677         8         VR629         8           C625         8         P6000-3         10         R112         1         R214         1         R678         8         W116         1           C626         8         P6000-4         5         R114         1         R215         1         R679         8         W734         7           C628         8         P6000-5         5         R115         1         R216         1         R680         10           C630         5         P6000-6         5         R116         1         R217         1         R681		1	P2010-2	1		1	1	1				1
C241         1         P2010-4         1         R108         1         R210         1         R636         8         VR130         1           C242         1         P6000-1         5         R110         1         R211         1         R676         8         VR222         1           C244         1         P6000-2         10         R111         1         R212         1         R677         8         VR629         8           C625         8         P6000-3         10         R112         1         R214         1         R678         8         W116         1           C626         8         P6000-4         5         R114         1         R215         1         R679         8         W734         7           C628         8         P6000-5         5         R115         1         R216         1         R680         10           C630         5         P6000-6         5         R116         1         R217         1         R681         10		1	P2010-3	1								
C242         1         P6000-1         5         R110         1         R211         1         R676         8         VR222         1           C244         1         P6000-2         10         R111         1         R212         1         R677         8         VR629         8           C625         8         P6000-3         10         R112         1         R214         1         R678         8         W116         1           C626         8         P6000-4         5         R114         1         R215         1         R679         8         W734         7           C628         8         P6000-5         5         R115         1         R216         1         R680         10           C630         5         P6000-6         5         R116         1         R217         1         R681         10		1										1
C244         1         P6000-2         10         R111         1         R212         1         R677         8         VR629         8           C625         8         P6000-3         10         R112         1         R214         1         R678         8         W116         1           C626         8         P6000-4         5         R114         1         R215         1         R679         8         W734         7           C628         8         P6000-5         5         R115         1         R216         1         R680         10           C630         5         P6000-6         5         R116         1         R217         1         R681         10		1		1		ſ						
C625         8         P6000-3         10         R112         1         R214         1         R678         8         W116         1           C626         8         P6000-4         5         R114         1         R215         1         R679         8         W734         7           C628         8         P6000-5         5         R115         1         R216         1         R680         10           C630         5         P6000-6         5         R116         1         R217         1         R681         10					-					_		
C626         8         P6000-4         5         R114         1         R215         1         R679         8         W734         7           C628         8         P6000-5         5         R115         1         R216         1         R680         10           C630         5         P6000-6         5         R116         1         R217         1         R681         10				i e				1				
C628 8 P6000-5 5 R115 1 R216 1 R680 10 C630 5 P6000-6 5 R116 1 R217 1 R681 10					1					-		
C630 5 P6000-6 5 R116 1 R217 1 R681 10											,5-	<b>'</b>
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			. 3000 /									



**REV OCT 1981** 

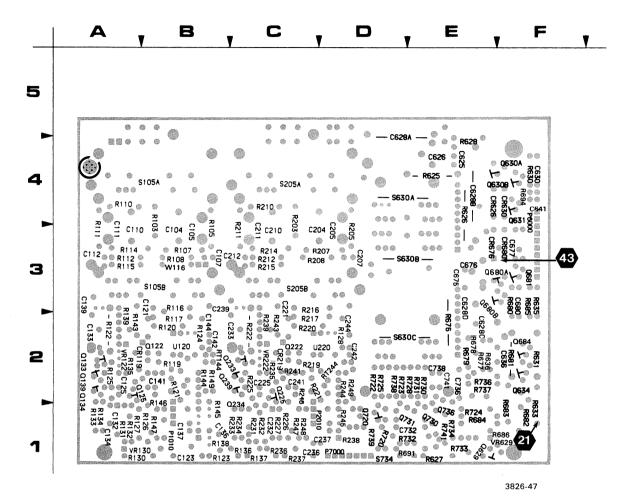
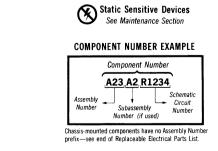


Figure 9-6. Circuit view of A12—Attenuator/Sweep board.



# CH 1 & CH 2 ATTENUATORS



CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C101	3C	3B	J2000-2	2C	3B	R100	2B	3A	S101	2B	3B
C102	2C	3B	J2000-3	2C	3B	R102	2C	3B	S201	7B	3C
C202	6B	3C	J2000-4	7C	3C	R200	6B	3C			
			J2000-5	7C	3C	R202	6C	3C			
J2000-1	зс	3A	J2000-6	6C	3C	1					

Partial A11 also shown on diagrams 2, 3, 4, 5, 6, 7, 8, 9 and 10.

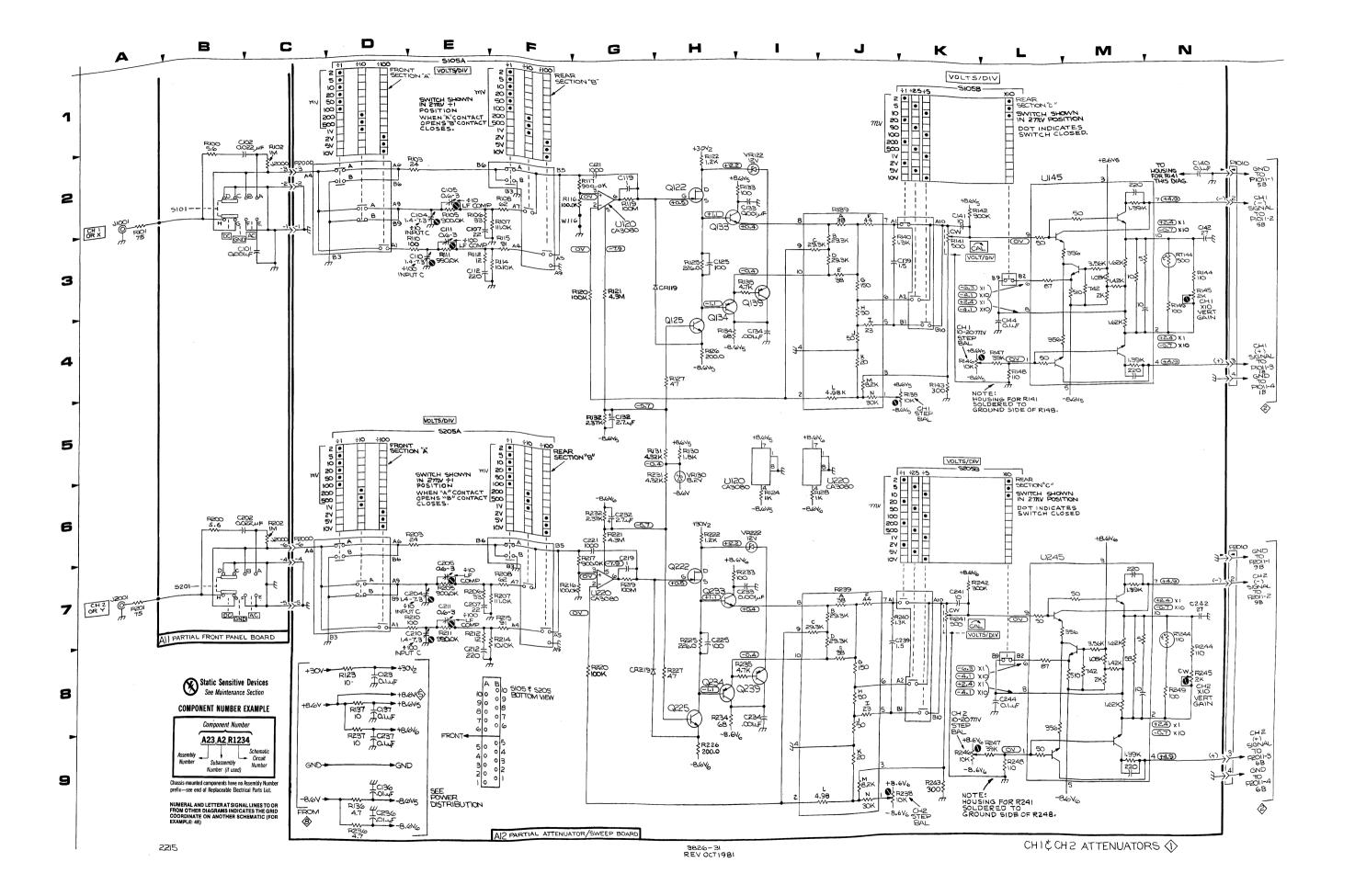
# ASSEMBLY A12

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C104	2E	3B	P1010-1	2N	1B	R123	8C	1B	R225	8H	2C
C105	2E	3B	P1010-2	2N	1B	R124	61	2B	R226	9H	1C
C107	3E	3B	P1010-3	4N	1B	R125	3H	2A	R227	8H	1C
C110	3E	3A	P1010-4	4N	1B	R126	4H	1B	R231	6H	1C
C111	3E	3A	P2000-1	3C	4A	R127	4H	1A	R232	6G	1C
C112	3E	3A	P2000-2	2C	4A	R128	6J	2D	R233	71	1C
C119	2G	2B	P2000-3	2C	4B	R130	5H	1A	R234	8H	1C
C121	2G	2B	P2000-4	7C	4C	R131	5H	1A	R235	81	2C
C123	8D	1B	P2000-5	7C	4C	R132	5G	1A	R236	9C	1C
C125	3Н	2A	P2000-6	6C	4C	R133	21	1A	R237	9C	1C
C132	5G	1A	P2010-1	6N	1C	R134	4H	1A	R238	9K	1D
C133	21	2A	P2010-2	7N	1C	R135	31	2A	R239	7J	2C
C134	41	1A	P2010-3	9N	1 C	R136	9C	1C	R240	7K	2C
C136	9D	1C	P2010-4	9N	1C	R137	8C	1C	R241	7K	2C
C137	8D	1B				R138	5K	1B	R242	7K	2D
C139	3.J	3A	Q122	2H	2B	R139	2J	2A	R243	9K	2C
C140	2N	1B	Q125	4H	1A	R140	3K	2A	R244	8N	2D
C141	2K	2B	Q133	2H	2A	R141	3K	2B	R245	8N	1D
C142	2N	2B	Q134	4H	2A	R142	2K	2B	R246	9K	2C
C144	4L	2B	Q139	31	2A	R143	4K	2A	R247	9L	1 c
C204	7E	3C	Q222	7H	2C	R144	3N	2B	R248	9L	1C
C205	7E	3D	Q225	8H	2C	R145	3N	1B	R249	8N	2D
C207	7E	3D	Q233	7H	2C	R146	4K	2B			
C210	8E	3C	Q234	8H	2C	R147	4L	1B	RT144	3N	2B
C211	7E	3C	Q239	81	2C	R148	4L	1B	RT244	8N	2D
C212	8E	3C				R149	3N	2B			
C219	7G	2C	R103	2E	3B	R203	6E	4C	S105A	1E	3B
C221	6G	2C	R105	2E	3B	R205	7E	3D	S105B	1K	3B
C225	8H	2C	R106	2E	3B	R206	7E	3D	S205A	5E	3C
C232	6G	1 C	R107	3F	3B	R207	7F	3C	S205B	5K	3C
C233	71	2C	R108	2F	3B	R208	7F	3C	02000		
C234	81	1C	R110	3E	4A	R210	7E	4C	U120	2G	2B
C236	9D	1C	R111	3E	3A	R211	8E	2C	U145	2L	2B
C237	8D	1D	R112	3E	3A	R212	8E	3C	U220	7G	2D
C239	87	3C	R114	3F	3A	R214	8F	3C	U245	7 L	2D
C241	7K	2C	R115	3F	3A	R215	7F	3C	1		
C242	7N	2D	R116	2G	3B	R216	7G	3C	VR122	21	2A
C244	8L	2D	R117	2G	2B	R217	7G	2C	VR130	6H	1A
<i></i>			R119	2G	2B	R219	7G	2C	VR222	61	2C
CR119	3Н	2A	R120	3G	2B	R220	8G	2C	1222	1	
CR219	8G	2C	R121	3G	2B	R221	6G	2C	W116	2G	3В
31,210	""		R122	2H	2A	R222	6H	2C	*****		55

Partial A12 also shown on diagrams 5, 7, 8 and 10.

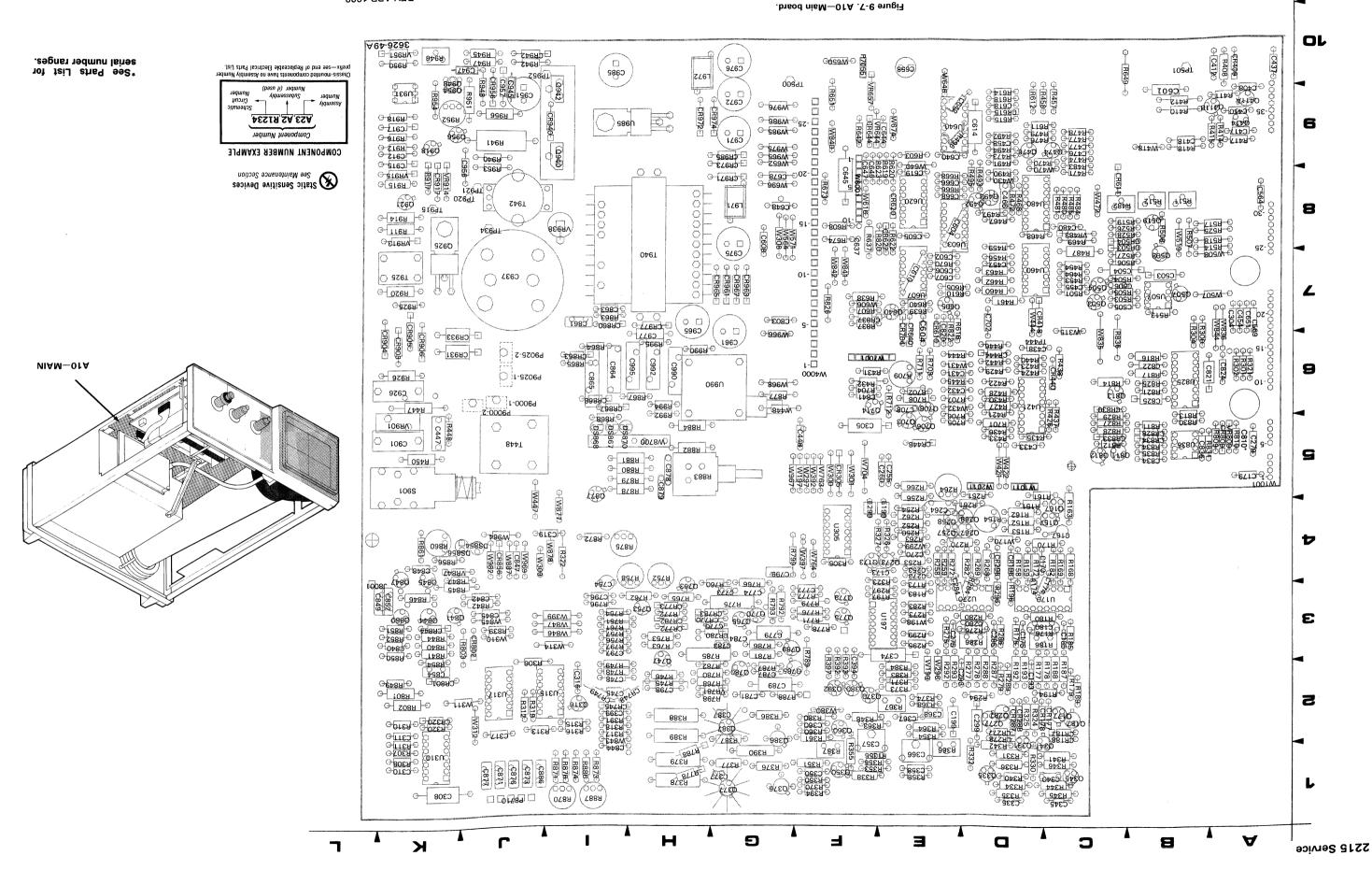
# CHASSIS MOUNTED PARTS

CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD
NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION
J1001 J2001	2A 7A	CHASSIS CHASSIS	R101 R201	2A 7A	CHASSIS CHASSIS						



६ CH 2 ATTENUATORS

Color   Colo	7 7	272A 7273 7275	L L L	Q703 Q703	7	E599 E199	6	2260 9260	Þ	8190	7 7	C170
CORPORATION	7	8275	L								7.	
Corporation	2			00.47		1.40-						
Color   Colo					6	7267	6		g	C <b>9</b> 37	7	C175
Color   Colo	2	TTZA	L	<b>747</b> 0	2		6	C662			Z	
Color   Colo	۵ 7.				٥ 2						7 7	
Color   Colo	7				5				g	C <b>9</b> 42	2	
Color   Colo	7	R282	L	0770	5	P2011-1*‡	3	CR187			2	
1900   1900	ζ 7.											
1000   1000	7	R285	L	087 <u>0</u>	5	P2011-4*‡	3	CR277	οι	Ce21	7	C560
1000   1000	7	82A	L	<b>G785</b>	g	‡•1-10099	3	CR278			2	C564
1000   1000	ζ 7.										7	
10   10   10   10   10   10   10   10	7	R289	9	0812	g		7		ε	8490	7	C575
10   10   10   10   10   10   10   10	2		9		g		3	CB305			7	
CORPORATION	7 7										7	
Color   Colo	2	852A	9	<b>084</b> 2	10	‡*8-10099	Þ	CB418	L	C748	7	C585
CORD		9628	9	7480	L	‡•6-1009 <b>d</b>	t	CB440	L		7	C593
CORD							i		\ \ \ \ \ \ \ \		1	
Correct   Corr									l			
CROP	3	R301	6	<b>0921</b>	6	‡*6-10079	t	CB204	L	LLLO	3	C308
CROS									l			
CROSS	3								L	C783	3	
CCOR   10   CCOR	3	905Я	6	8460	9	‡*7-10079	g	CB620			ε	C31 \
COOR 10 (20)1 6 (20)1 6 (20)2 7 (10)26 7 (10)26 7 (10)26 2 (20)2 6 (20)2 6 (20)2 7 (10)26 7 (20)2 6 (20)2 7 (2												
CROP									L	9620	ε	
CROP   10   CROP   20   CROP	3	R311	7	B152	6	1-01789	3	CB704			ε	
CQ00												
Ceople   10   Ceople   20											3	
CROM 10 (26)1 6 (26)2 7 (26)2 8 (26)2 9 (26)2 7 (26)2 8 (26)1 3 (26)2 9 (26)2	3	8316	7	69 l H	6		L	CR770			ε	
C6008         10         C631         6         D8882         6         Q602         7         H258         7         H311         3           C600         p         C602         6         D6884         6         Q620         7         H258         7         H268         3           C600         p         C602         p         C603												
CROPA   CROP												
CROSS   CROS	3	<b>H32</b> 0	7	8918	6	P9025-2	L	CR782	9	C854	ε	C374
CROPAD   C												
CROPAD   C												
CROPADED	3										ε	C399
CCORD   CCOR	3	R325	7	471A	7		9	CB828	L	C8 <del>4</del> 1	Þ	C408
CCORD   CCOR											l .	
CCQOB         10         C311         3         D2882         6         OPQD         ¢         USQB         5         USQB         5         USQB         5         USQB         7         USQB         7         USQB         7         USQB         7         USQB         7         USQB         3         USQB         3         USQB         3         USQB         3         USQB         3         USQB         3         USQB         4         USQB         7         USQB         3         USQB         3         USQB         4         USQB         7         USQB         3         USQB         3         USQB         4         USQB         7         USQB         3         USQB         4         USQB         7         USQB         3         USQB											1	
Ceord   10	3	เธยม	7	8718	7	0268		CB837	9		Þ	C418
Ceord   10   Ceord	3	R332	7	67 f A	7		9	CB844	9	C848		
CeQ08         10         C631         3         D2892         3         OQ00         7         H503         5         H31         3           CeQ01         2         C692         3         D2882         6         OC913         7         H508         7         H308         3           CeQ09         2         C692         3         C8824         6         OC90         7         H508         7         H508         3           CeQ07         2         C692         3         C8824         6         OC90         7         H508         7         H508         3           CeQ07         2         C692         3         C883         3         C893         4         H508         3         1308         3         1308         3         1308         3         1308         3         1308         3         130												
Ceord         10         C63/1         6         D2880         6         O60P         7         H569         5         H31         3           Ceord         P         Coard         P         D288et         P         O70P         7         H328         7         H320         3           Ceord         P         Coard         P         Coard         P         Coard         P         H320											l .	
CCOR   10   COA1   0   D2882   0   CCOP   0   ECCOP	3	85£A	7	8185	3	ฮรรเ			6	C861	Þ	C438
CCQ08         10         C6341         6         D28e2         6         OCQ02         7         H50e3         5         H31         3           CCQ01         P         C69e2         6         D28e2e         6         OCP03         7         H50e         5         H320         3           CCQ02         P         C69e1         6         CH68e2         6         OCP03         7         H50e3         7         H32e3         3           CCQ03         P         C69e4         6         CH63b1         6         OCP04         7         H50e3         7         H32e3         3           CCQ03         P         C69e4         6         CH63b1         6         OCP04         7         H50e3         7         H32e3         3           CCQ03         P         C69e4         6         CH63b1         6         CH63b2         6         CH64e3         7         H50e3         7	3	R340	7	9818	3		6	CB868	6	C863		
Cego 10 Ceb1 2 Desept 6 Oego 7 Here 5 Here 5 Here 5 Here 6 Cego 6 Cego 7 Here 5 Here 5 Here 6 Cego 7 Here 7												
Cego 10 (Col.1											1	
Cego	3	₽ <del>1</del> 28	7	Z618	3	<b>03</b> 80	6	906HO	6	C873	Þ	C427
Ceord 10 Ceord 2 Ceord 3 Deserve 6 Ceord 4 Bree 5 Brown 3 Brown 5 Ceord 2 Ceord 3 Ceord 2 Ceord 3 Ceord 2 Ceord 3 Ceord 3 Ceord 3 Ceord 3 Ceord 3 Ceord 3 Ceord 4 Ceord 3 Ceord 4 Ceord 5 Ceord 5 Ceord 5 Ceord 5 Ceord 6 Ceord 6 Ceord 6 Ceord 7 Ceor												
Cegos 10 Cegul 2 Cegul 3 Desec 6 Oeo 7 H50 5 H50 3 H301 3 Cegul 2 Cegul 2 Cegul 3 Desec 6 Oeo 7 H50 7 H50 7 H30 3 Cegul 2 Cegul 3 Cegul 4 Cegul 3 Cegul 4 Cegul 3 Cegul 4 Cegul 4 Cegul 4 Cegul 5 Cegul 6 Cegul 6 Cegul 6 Cegul 6 Cegul 6 Cegul 7 Cegul 7 Cegul 7 Cegul 6 Cegul 6 Cegul 6 Cegul 7 Cegu												
CCQ08         10         C631         8         D28e2         8         COQ02         ¢         U508         5         U531         3           CCQ02         2         C692         3         D28e4         6         C0216         ¢         U508         ¢         U508         5         U308         3           CCQ02         2         C692         3         C0892         6         C0892         6         C0892         3         U308         0         U308         U308         0         U308         0 </td <td>3</td> <td>F351</td> <td>7</td> <td>7618</td> <td>3</td> <td>0380</td> <td>6</td> <td>CB940</td> <td>6</td> <td>6282</td> <td><b>b</b></td> <td>C<b>4</b>77</td>	3	F351	7	7618	3	0380	6	CB940	6	6282	<b>b</b>	C <b>4</b> 77
Ceor 10 (Col.1												
CCOS         10         CODIT         0         D286V         0         OCOR         4         BCRB         5         BCRB         0         CRB												
CCQ08         10         C3J1         3         D28eV         3         CQQ2         4         B7e3         5         B3J1         3           CCQ0         2         C3eV         3         D28eV         6         O2e13         4         B7e8         5         B3J0         3           CCQ0         2         C3eV         3         CB2eV         6         O2e0A         4         B7e8         5         B43C         3           CCQ0         2         C3eV         3         CB3EV         6         O2e0A         4         B7eV         5         B49A         3           CCQ1         10         C3eV         3         CB3A         4         O2e0A         4         B7eV         5         B3eV         3           CCQ1         10         C3eV         3         CB3A         4         C4eV         5         B3eV         3           CCQ1         10         C3eV         3         CB3A         3         C4eV         4         B7e8         5         B3eV         3           CCQ0         2         C3eV         3         C4eV         4         C4eV         5         C4eV         5	3	9988	7	R253	Þ	0411	6	CB963	6	C612		C202
CCQ08         JO         C6341         6         D2862         6         OCQ02         ¢         U5060         5         U331         3           CCQ02         p         C6062         p         D2862         p         C7063         p         U330         p           CCQ02         p         C6062         p         D2862         p         C7063         p         U340         p         U340         p           CCQ03         p         C6062         p         C6032         p												
CCOS         10         CODJI         6         D2862         6         OCOS         7         HS769         7         HS71         3           CCOS         2         COSE         6         D2862         6         OCOSE         7         HS768         7         HS768         3           CCOS         2         COSE         3         CHB82         6         OCPO         4         HS768         7         HS768         3           CCOS         2         COSE         3         CHB32         3         OCPO         4         HS762         5         HS762         3           CCOS         2         COSE         3         CHB32         3         OCPO         4         HS762         5         HS762         3           CCOS         2         COSE         3         CHB32         3         OCPO         4         HS762         5         HS762         3           CCOS         3         CHB32         3         0         0												
Ce08         JO         C631         6         D2882         6         O602         t         B769         5         B31         3           Ce04         p         C692         p         D2882         p         O603         t         B768         p         B310         p           C602         p         D2882         p         O603         t         B764         p         B326         p           C604         p         C692         p         C693         p												
CeO8         JO         C63/1         6         D2862         6         OG02         4         B769         5         B3/1         3           CeO4         P         C602         P         C603         P         C603         P         B3/2         P         B3/2         P           CeO9         P         C603         P         C603         P         B3/2         P         B3/2         P           C604         P	3		7				6		6	.446O	1	
C608     JO     C60J     B     D286Q     B     O60Q     C7     C7 <td></td> <td>1</td> <td></td>											1	
Ce08     JO     C631     8     D28e2     8     Oe02     4     B7e8     5     B3J1     3       Ce03     2     C602     3     D28e2     6     Oe13     4     B7e8     5     B3J0     3       Ce09     2     C6e1     3     D28e2     6     Oe08     4     B7e8     5     B3e8     3												
Ce08 10 C631 6 D28e2 6 G602 4 B5e6 5 B331 3	3	8988	7		l .		9					
	c	1764	7	6074		0000					0.1	0000



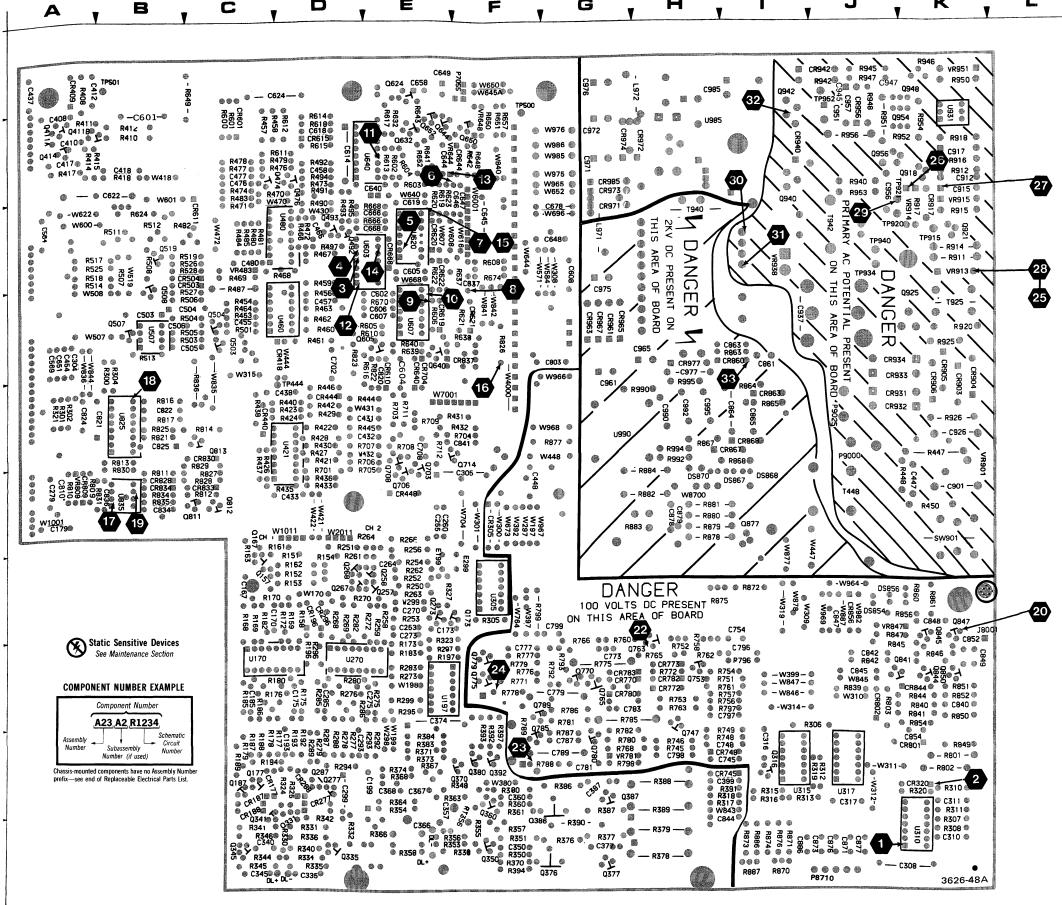


CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
R373	3	R485	4	R763	7	R879	9	VR915	9	W1001-7	2	W7001-2*‡	9
R374	3	R487	4	R765	7	R880	9	VR938	9	W1001-8	6	W7001-3*‡	9
R376	3	R490	4	R766	7	R881	9	VR951	9	W1001-9	2	W7001-4*‡	9
R377	3	R491	4	R768	7	R882	9	W170	2	W1001-10	2	W7001-5*‡	7
R378	3	R492	4	R771 R772	7 7	R883	9	W197	2	W1001-11 W1001-12	3 3	W7001-6*‡	7
R379 R380	3 3	R493 R494	4	R775	7	R884 R886	9 9	W198 W199	2 2	W1001-12	2	W7001-7*‡ W8700-1	6 9
R383	3	R495	4	R776	7	R887	. 9	W297	2	W1001-14	9	W8700-1	9
R384	3	R496	4	R777	7	R911	9	W298	2	W1001-15	3	W8700-3	9
R386	3	R497	4	R778	7	R912	9	W299	2	W1001-16	3	W8700-4	9
R387	3	R501	4	R779	7	R914	9	W300	3	W1001-17	10	W8700-5	9
R388	3	R503	4	R780	7	R915	9	W301	3	W1001-18	10	W8700-6	9
R389	3	R504	4	R781	7	R916	9	W308	3	W1001-19	4	W8700-7	9
R390	3	R505	4	R782	7	R917	9	W309	3	W1001-20	4	W8700-8	9
R391	3	R506 R507	4	R785 R786	7 7	R918 R920	9 9	W310	3 3	W1001-21 W1001-22	4 4		
R392 R393	3	R508	4	R787	7	R925	9	W311 W312	3	W1001-22 W1001-23	4		
R394	3	R511	4	R788	7	R926	9	W314	3	W1001-24	4		
R397	3	R512	4	R789	7	R940	9	W315	3	W1001-25	10		
R408	4	R513	4	R792	7	R941	9	W380	3	W1001-26	10		
R410	4	R514	4	R793	7	R942	9	W392	3	W1001-27	10		
R411	4	R517	4	R796	7	R945	9	W397	3	W1001-28	10	1	
R412	4	R518	4	R797	7	R946	9	W399	7	W1001-29	10		
R414	4	R519	4	R798	7	R947	9	W418	4	W1001-30	10		
R415	4	R525	4	R799	7 6	R948	9	W421	4	W1001-31 W1001-32	4 9	1	
R417 R418	4	R526 R527	4	R801 R802	6	R950 R951	9 9	W422 W430	4 4	W1001-32 W1001-33	3		
R421	4	R527	4	R803	6	R952	9	W430 W431	4	W1001-33	3		
R422	4	R603	5	R809	6	R953	9	W432	4	W1001-35	3		
R423	4	R605	4	R810	6	R954	9	W444	4	W1001-36	4		
R424	4	R607	10	R811	6	R956	9	W447	9	W1001-37	4		
R426	4	R608	5	R812	6	R990	9	W448	9	W1001-38	4	l	
R427	4	R610	4	R813	6	R992	9	W470	4	W1001-39	4		
R428	4	R611	4	R814	6	R994	9	W472	4	W1011-1*‡	2		
R429 R430	4	R612 R614	4	R816 R817	6 6	R995 RT356	9 3	W507 W508	4 4	W1011-2*‡ W1011-3*‡	2 2		
R430	4	R615	4	R820	6	S901	9	W519	4	W1011-3 ‡ W1011-4*‡	2	1	
R432	4	R616	6	R821	6	T448	9	W564	10	W2011-1*‡	2		
R433	4	R618	4	R822	6	T925	9	W571	10	W2011-2*‡	2		
R435	4	R619	5	R825	6	T940	9	W606	10	W2011-3*‡	2		
R436	4	R620	5	R826	6	T942	9	W616	5	W2011-4*‡	2		
R437	4	R622	5	R827	6	TP444	4	W640	5	W4000-1	10	ļ	
R438	4	R623	5	R828	6	TP500	9	W646	5	W4000-2	10		
R440	4	R637	5	R829	6	TP501	9	W650	10	W4000-3 W4000-4	9 10		
R442 R444	4 4	R638 R639	5 5	R830 R831	6 6	TP915 TP920	9 9	W652 W674	3 5	W4000-4 W4000-5	7		
R445	4	R640	5	R834	6	TP921	9	W696	7	W4000-6	10		
R446	4	R642	5	R835	6	TP934	9	W704	3	W4000-7	3		
R447	9	R649	10	R836	6	TP952	9	W763	7	W4000-8	6		
R448	9	R651	10	R837	6	U170	2	W764	7	W4000-9	6		
R450	9	R666	5	R839	6	U197	2	W835	6	W4000-10	10		
R453	4	R668	5	R840	6	U197	3	W836	6	W4000-11	7		
R454	4	R670	5	R841	6	U270	2	W840	7	W4000-12	3		
R456	4	R673	10	R842	6	U305	3	W841	7	W4000-12 W4000-13	10 10		
R457	4 4	R674 R701	10 7	R844 R845	6	U310	3	W842	7	W4000-13 W4000-14	10		
R458 R459	4	R701 R702	7	R845 R846	6 6	U315 U317	3 3	W843 W844	6 6	W4000-14	10		
R460	4	R702	7	R847	6	U421	4	W845	7	W4000-16	10		
R461	4	R704	7	R849	6	U460	4	W846	7	W4000-17	10		
R462	4	R705	7	R850	6	U480	4	W847	7	W4000-18	6		
R463	4	R706	7	R851	6	U507	4	W877	9	W4000-19	10		
R464	4	R707	7	R852	6	U603	5	W878	9	W4000-20	10		
R466	4	R708	7	R854	6	U607	5	W887	9	W4000-21	10 10		
R467	4	R709	7	R856	6	U640A	4	W964	9	W4000-22 W4000-23	10 9		
R468 R469	4 4	R711 R712	7	R860 R861	9	U640B U640	5 5	W965 W966	9	W4000-23 W4000-24	9		
R470	4	R712 R745	7	R863	9	U825	6	W967	7	W4000-25	9		
R470	4	R746	7	R864	9	U835	6	W968	9	W4000-26	9		
R472	4	R748	7	R865	9	U931	9	W969	7	W4000-27	9		
R473	4	R749	7	R867	9	U985	9	W975	9	W6001-1*‡	5		
R474	4	R751	7	R868	9	U990	9	W976	9	W6001-2*‡	10		
R476	4	R752	7	R870	9	VR483	4	W982	9	W6001-3*‡	10		
R477	4	R753	7	R871	9	VR644	5	W985	9	W6001-4*‡	5		
R478	4	R754	7	R872	9	VR657	10	W986	9	W6001-5*‡	5		
R479	4	R756	7	R873	9	VR781	7	W1001-1	6	W6001-6*‡	5 5		
R480 R481	4 4	R757 R758	7	R874 R875	9	VR809 VR847	6	W1001-2	2	W6001-7*‡ W6001-8*‡	5 10		
R481	4	R760	7	R875 R876	9	VR847 VR901	6 9	W1001-3	2	W6001-8*‡ W6001-9*‡	10 7		
R482	4	R760 R761	7	R876 R877	9	VR901 VR913	9	W1001-4 W1001-5	3 9	W6001-9 ‡ W6001-10*:			
R484	4	R762	7	R878	9	VR914	9	W1001-5 W1001-6	3	W7001-10	9		
	. 1				·		١ ١	** 1001-0	3		,		

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Figure 9-8. Circuit view of A10-Main board.

# CH 1 & CH 2 VERTICAL PREAMPS



CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C167	2F	4C	Q173	ЗН	4F	R193	3M	2D	R296	71	3D
C170	3F	4C	Q177	1L	2C	R194	3L	2C	R297	5G	3E
C173	3H	4E	Q187	5L	2C	R196	41	3D	R299	5G	3E
C174	3J	4C	Q257	6E	4E	R197	5G	3E			
C175	1J	3D	Q258	7D	4E	R250	7E	4E	U170A	31	3C
C179	3M	5A	Q267	9E	4D	R251	6C	5D	U170B	41	3C
C180	3F	3C	Q268	8D	4D	R252	6C	4E	U170C	21	3C
C185	51	3C	Q273	7H	4E	R253	7D	4E	U170D	1F	3C
C193	3L	2D	Q277	6L	2D	R254	7D	4E	U170E	5F	3C
C199	3C	2E	Q287	9L	2D	R256	7C	5E	U197A	5G	3E
C253	8E	4E	D1 E1	10	45	R258	7F	4E	U197B	5H	3E
C255	7B	5E	R151 R152	1C 2D	4D 4D	R259	7F	4E	U197D	5H	3E
C260	8B	5E				R261	9C	5D	U197E	5H	3E
C264	7C	4E	R153	3E	4D	R262	9C	4E	U270A	71	3D
C270	7F	4E	R154	3D	4D	R263	8C	4E	U270B	91	3D
C273	7H	4E	R158	2F	4D	R264	7D	5E	U270C	61	3D
C275	61	3E	R159	2F	4D	R266	8C	5E	U270D	6F	3D
C279	8M	5A	R161	5C	5D	R268	8F	4D	U270E	9F	3D
C280	8F	3D	R162	3D	4D	R269	8F	4D			
C284	7J	3E	R163	3E	4C	R270	8F	4D	W170	4C	4D
C285	9Ĵ	3D	R168	3F	4C	R272	6J	4E	W197	3C	5F
C293	8L	2D	R169	4F	4C	R273	7H	3E	W198	3C	3E
C299	4C	2D	R170	3F	4C	R275	61	3E	W199	3C	2E
0255	70	20	R172	2J	4D	R276	6K	3D	W297	4C	5F
CR196	31	4D	R173	3H	4E	R277	6L	2D -	W298	4C	2E
CR296	71	4D	R174	2J	3D	R278	6L	2D	W299	4C	4E
CITZO	<i>"</i>	70	R175	1J	3D	R279	5L	2D	W1001-2	5M	5A
E199	зс	4E	R176	2L	3C	R280	8F	3D	W1001-3	1M	5A
E299	4C	4F	R177	1L	2D	R282	81	4D	W1001-7	7B	5A
,		5D	R178	1L	2C	R283	7F	3E	W1001-9	5M	6A
P1011-1*:		5D	R179 R180	1L	2C	R284	7J	4D	W1001-10	9M	6A
P1011-2*:		5D		3F	3C	R285	9J	3D	W1001-13	8B	6A
P1011-3*:		5D	R182	4I	4C	R286	8K	3D	W1011-1*	‡ 5B	5D
P1011-4*:		5D	R183	4G	3E	R287	9L	2D	W1011-2*	± 4B	5D
P2011-1*:		5D 5D	R185	51	3C	R288	9L	2D	W1011-3*	± 1B	5D
P2011-2*:		5D	R186	3K	3C	R289	9L	2D	W1011-4*		5D
P2011-3*:	1	5D	R187	5L	2C	R292	7M	2E	W2011-1*	± 9B	5D
P2011-4*:	1		R188 R189	5L	2C	R293	8M	2E	W2011-2*		5D
Q157	1E	4C		5L	2C	R294	7L	2D	W2011-3*	± 6B	5D
Q167	4E	4C	R192	3M	2D	R295	5G	3E	W2011-4*	± 6B	5D

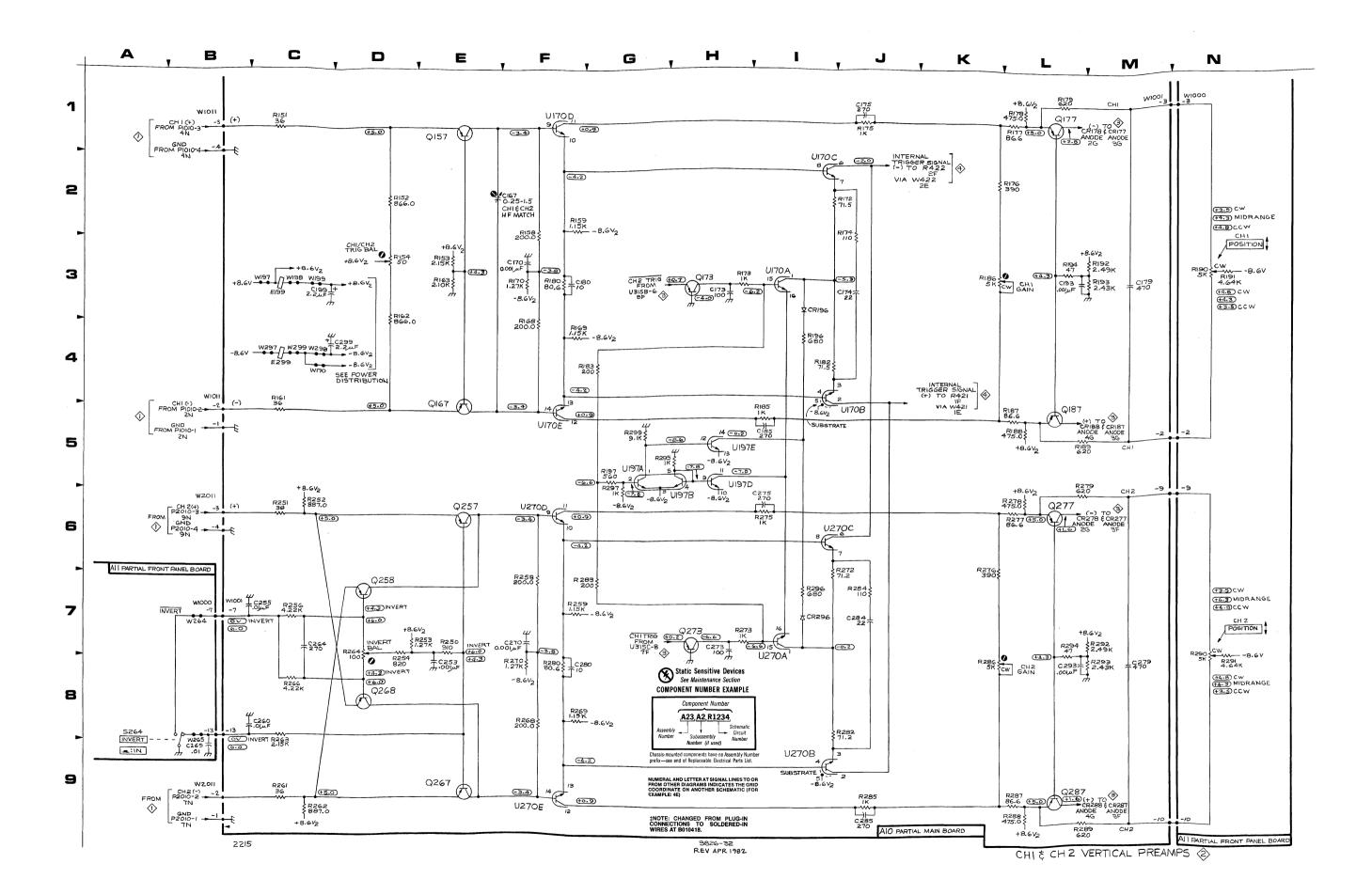
Partial A10 also shown on diagrams 3, 4, 5, 6, 7, 9 and 10.

# ASSEMBLY A11

1											
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C265	9B	1C	S264	8A	2C	W1000-2	5N	4A	W1000-1	0 9N	4B
R190	3N	1B				W1000-3	1 N	4A	W1000-1	3 8B	4B
R191	3N	1B	W264	7B	2B	W1000-7	7B	4A			
R290	7N	1C	W265	8B	2C	W1000-9	5N	4B			
R291	7N	1 C	1			l					

Partial A11 also shown on diagrams 1, 3, 4, 5, 6, 7, 8, 9 and 10.

\*See Parts List for serial number ranges.



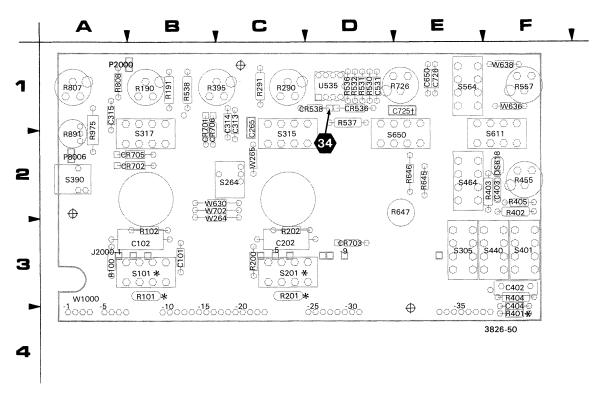
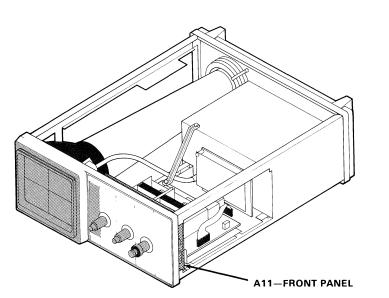


Figure 9-9. A11—Front Panel board.

\*CHASSIS MOUNTED

†Located on back of board.





# COMPONENT NUMBER EXAMPLE

	Component Number
	A23, A2, R1234.
Assembly Number	Subassembly Number (if used)

Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

# A11—FRONT PANEL BOARD

**REV OCT 1981** 

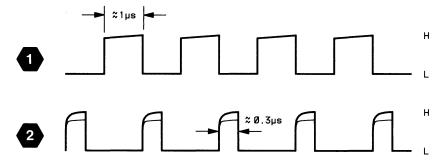
# 2215 CONTROL SETTINGS

# DC Voltage

VERTICAL MODE CH 1
TRIGGER MODE AUTO
AC-GND-DC (both) GND

# AC Waveforms

VERTICAL MODE BOTH-CHOP TRIGGER MODE AUTO



3826-14

# CHANNEL SWITCH & VERTICAL OUTPUT



ASSEMBI	LY A10										
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C304	9C	7A	Q360	8L	2F	R342	3H	2D	U197C	5G	3E
C305	5C	5F	Q370	2N	2F	R344	2H	1C	U305A	5D	4F
C308	9E	1K	Q376	6N	1G	R345	21	1C	U305B	7E	4F
C310	1H	1K	Q377	6N	1G	R346	2H	1C.	U305C	8E	4F
C311	9E	2K	O380	1M	2F	R348	8J	2F	U305D	8E	4F
C316	5G	21	Q386	8N	2G	R350	6L	1F	U310A	3D	2K
C317	1G	2J	Q387	9N	2G	R351	6M	1F	U310B	8F	2K
C319	9G	41	Q392	2M	2F	R353	7K	1F	U310C	8E	2K
C335	41	1D				R354	7J	2E	U310D	8E	2K
C340	3H	1C	R300	7C	7B	R355	7L	1F	U315A	5F	21
C345	21	1C	R301	2D	6A	R356	7L	1F	U315B	8F	21
C350	6L	1F	R302	4D	6A	R357	7L	1F	U315C	7F	21
C357	7L	2F	R304	3D	7B	R358	7K	1E	U315D	9F	21
C358	7K	2E	R305	5D	4F	R360	8L	2F	U317B	9D	2J
C360	9M	2F	R306	7E	3J	R361	9M	2F	l		
C366	8K	1E	R307	9E	1K	R363	8K	2F	W300	8D	5F
C367	8K	2E	R308	9D	1K	R364	8J	2E	W301	3D	5F
C368	7J	2E	R310	8E	2K	R366	7K	1E	W308	3C	8G
C374	1 N	3E	R311	9F	2K	R367	7K	2E	W309	3D	4J
C377	5N	1G	R312*	4F	2J	R368	7J	2E	W310	3D 3D	3J 2J
C387	9N	2G	R313*	5F	2J	R370	2N	1F	W311 W312	9D	2J 2J
C394	1L	3F	R315	5F	21	R371	2N	2E	W314	1G	31
C399 C678	7N 1D	21 8G	R316	5G 3E	21	R373	1N	2E	W314 W315	5C	7C
C678	ן וט	86	R317 R318	3E	21 21	R374 R376	1M 6N	2E 1G	W380	2M	2F
CR177	3G	2C	R319	9G	2J	R377	5N	1G	W392	2K	5F
CR177	2G	2C	R320	8G	25 2K	R378	6N	1H	W397	2L	4F
CR187	3G	2C	R321	8C	6A	R379	6N	1H	W652	1C	9G
CR188	4G	2C	R322	9G	41	R380	2M	2F	W704	5D	5F
CR277	3F	2D	R323	5G	4E	R383	1M	2E	W1001-4	1K	5A
CR278	2G	2C	R324	4G	2D	R384	1M	2E	W1001-6	5C	5A
CR287	3F	2D	R325	4G	2D	R386	9N	2G	W1001-11	4C	6A
CR288	4G	2D	R326	7G	4E	R387	9N	2G	W1001-12	8C	6A
CR305	7D	5F	R327	8G	4E	R388	8N	2H	W1001-15		6A
CR320	9G	2K	R330	3H	1D	R389	8N	2H	W1001-16		6A
CR704	6C	7E	R331	4H	1D	R390	8N	1G	W1001-33		9A
		1	R332	31	1D	R391	8N	21	W1001-34		9A
Q316	5G	21	R334	41	1 D	R392	1L	2F	W1001-35		9A
Q331	4H	2D	R335	41	1 D	R393	2M	2F	W4000-7	2K	7F 8F
Q335	4H	1D	R336	4H	1D	R394	1L	1F	W4000-12	9G	or or
Q341	2H	2C	R338	6J	1F	R397	2L	2F			
Q345	2H	1C	R340	4H	1D			4.5	l		
Q350	6L	1F	R341	3H	1C	RT356	8L	1F	I		

Partial A10 also shown on diagrams 2, 4, 5, 6, 7, 9 and 10.

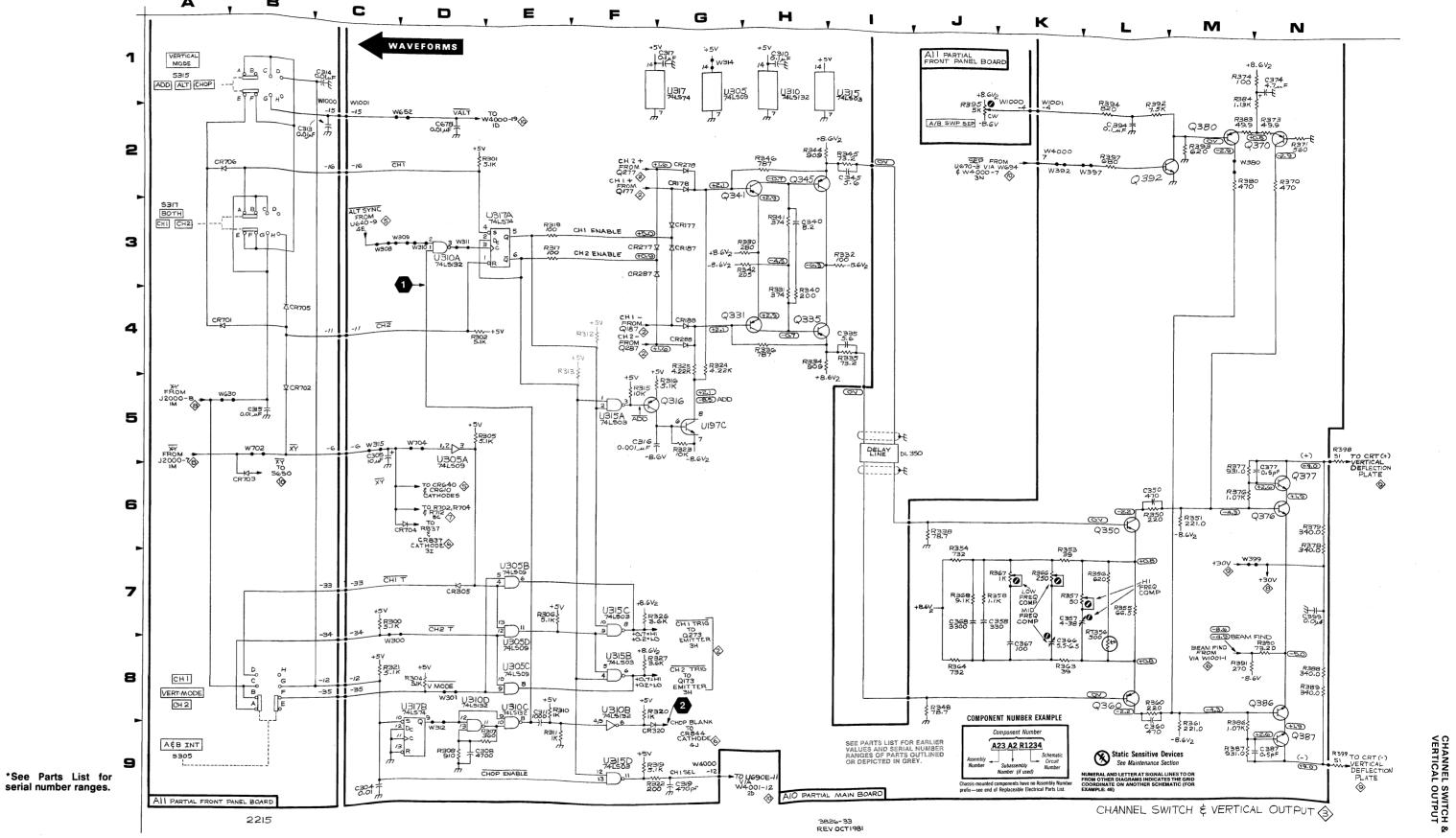
# **ASSEMBLY A11**

CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD
NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION
C313 C314 C315 CR701 CR702 CR703	2C 1C 5B 4A 5B 6B	1C 1C 1A 2B 2B 3D	CR705 CR706 R395 S305 S315	4B 2A 1J 9A 1A	2B 2B 1B 3E 2C	S317 W630 W702 W1000-4 W1000-6	3A 5B 5B 1K 5C	2B 2B 2B 4A 4A	W1000-11 W1000-12 W1000-15 W1000-16 W1000-33 W1000-34 W1000-35	8C 1C 2C 7C 7C	4B 4B 4B 4B 4E 4E 4E

Partial A11 also shown on diagrams 1, 2, 4, 5, 6, 7, 8, 9 and 10.

### CHASSIS MOUNTED PARTS

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARE
DL350	51	CHASSIS	R398	6N	CHASSIS	R399	9N	CHASSIS			







				ļ							
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATIO
2408	1D	9A	Ω605	6N	7E	R472	4J	8D	TP444	5H	6D
2410	1D	9A				R473	3J	9D			
C412	2D	10A	R408	2C	10A	R474	31	9C	U421A	1G	6D
2417	5D	9A	R410	1D	9B	R476	3J	9D	U421B	2G	6D
C418	5E	9B	R411	2D	9A	R477	3J	9C	U421C	2F	6D
C431	7D	6E	R412	3D	9B	R478	3J	9C	U421D	2F	6D
C432	8D	6E	R414	2D	9A	R479	3K	9D	U421E	1F	6D
C433	1G	5D	R415	2D	9A	R480	4K	8C	U460A	5J	7D
C437	5D	10A	R417	5D	9A	R481	5K	8C	U460B	6J	7D
C438	5G	6D	R418	5E	9B	R482	4J	8C	U460C	5K	7D
C454	6K	7A	R421	1F	6D	R483	41	9C	U460D	51	7D
C455	6K	7C	R422	2F	6D	R484	4K	8C	U460E	61	7D
C457	8D	7D	R423	2F	6D	R485	4K	8C	U460F	51	7D
C458	7D	9D	R424	2F	6D	R487	9C	8C	U480A	4K	8D
C466	41	8D	R426	3F	6C	R490	5L	9D	U480B	4K	8D
C476	31	9C	R427	2G	6D	R491	3L	9D	U480C	41	8D
C477	3J	9C	R428	2F	6D	R492	6L	9D	U480D	4K	8D
C480	9D	8C	R429	3G	6D	R493	4L	8D	U507A	7G	7B
C503	7F	7B	R430	1F	6D	R494	6L	9D	U507B	8G	7B
C504	8F	7C	R431	7D	6F	R495	4M	8D	U640A	6M	9E
C505	6G	7C	R432	8D	6F	R496	5L	9E			
C506	9G	7C	R433	1G	5D	R497	4K	8D	VR483	9C	8C
C614	5M	9D	R435	2H	5D	R501	5G	7C			
C618	7M	9D	R436	2H	5D	R503	7G	7C	W418	5E	9B
C640	9E	9E	R437	3G	6C	R504	9G	7C	W421	1E	5D
			R438	4G	6C	R505	7F	7C	W422	2E	5D
CR409	2C	10A	R440	4H	6D	R506	8F	7C	W430	5L	8D
CR418	5E	7D	R442	4H	6D	R507	8G	8B	W431	7D	6E
CR440	4H	6C	R444	5F	6E	R508	9G	8B	W432	8D	6E
CR444	5F	6D	R445	5F	6E	R511	8H	8B	W444	5G	7D
CR448	5E	5E	R446	5E	6D	R512	9Н	8B	W470	41	9C
CR503	7F	8C	R453	6K	7C	R513	7H	7B	W472	3D	8C
CR504	8F	8C	R454	5K	7C	R514	9Н	8A	W507	7H	7A
CR611	5N	8C	R456	61	7D	R517	8E	8A	W508	8H	8A
CR615	6M	9D	R457	8D	9C	R518	9E	8A	W519	9F	8B
011010	•		R458	7D	9C	R519	9F	8C	W1001-19	3C	7A
Q411A	1 D	9A	R459	6J	8D	R525	7E	8A	W1001-20	7K	7A
Q411B	2D	9A	R460	5J	7D	R526	8F	8C	W1001-21	7K	7A
Q414	1D	9A	R461	5J	7D	R527	7F	8C	W1001-22	7J	7A
Q474	31	90	R462	5K	7D	R528	8F	8C	W1001-23	8J	7A
Q476	3J	9D	R463	5K	7D	R605	6N	7E	W1001-24	6C	7A
Q492	4L	8D	R464	6K	7C	R610	5N	7E	W1001-31	7N	8A
Q492 Q493	4L	8D	R466	41	8D	R611	5N	9D	W1001-36	5C	9A
Q503	6F	7C	R467	4J	8D	R612	6N	9D	W1001-37	5C	9A
Q504	9F	7C	R468	4J	8D	R614	5M	9D	W1001-38	4C	9A
Q504 Q507	7H	7B	R469	4J	8C	R615	5M	9D	W1001-39	1C	9A
Q508	9H	8B	R470	31	9C	R618	7M	9D			
Q519	9F	8B	R471	41	9C	1	1	1	1		

Partial A10 also shown on diagrams 2, 3, 5, 6, 7, 9 and 10.

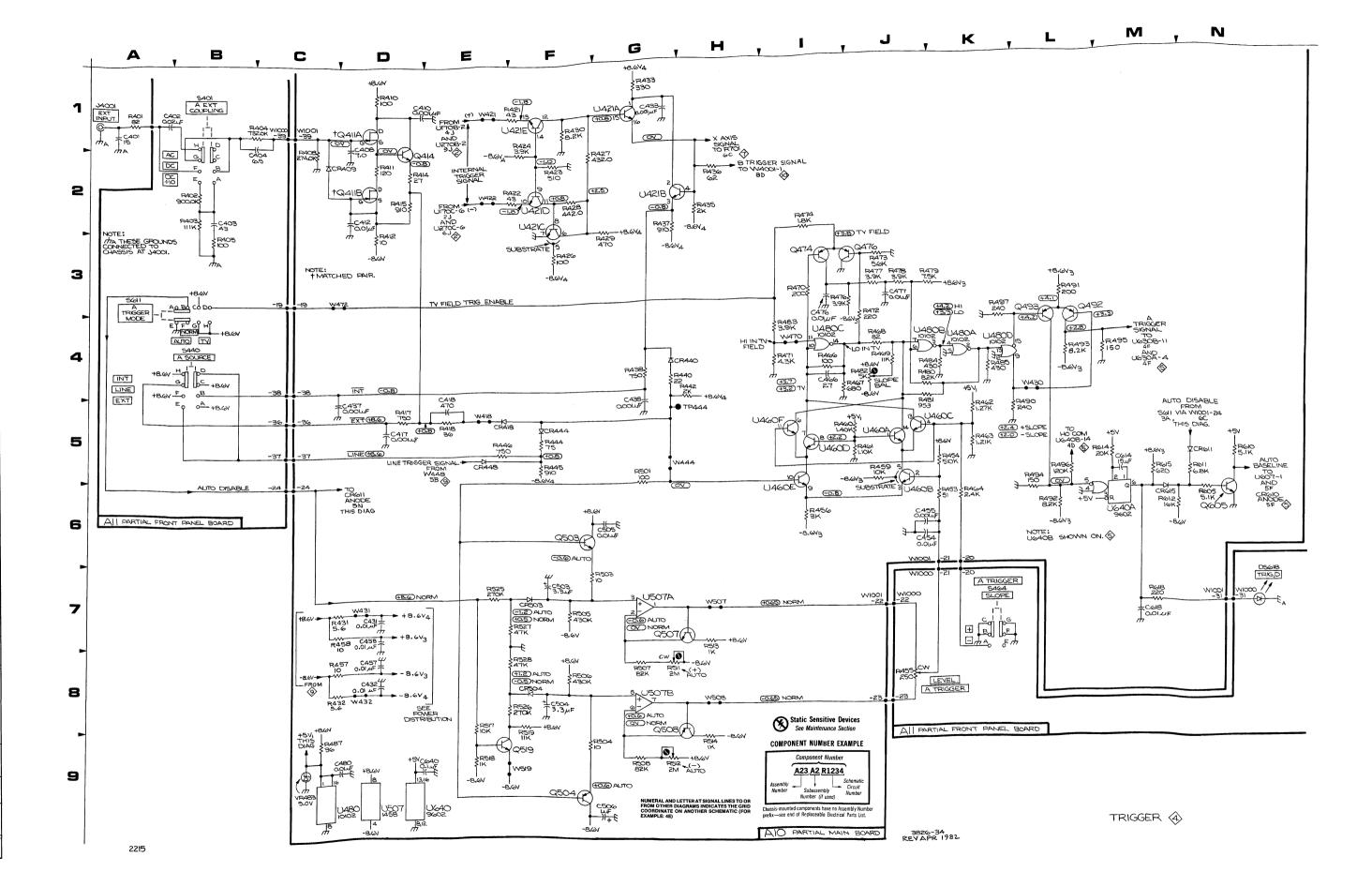
# ASSEMBLY A11

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C402	1A	3F	R403	2B	2F	S464	7K	2E	W1000-23	8J	4C
C403	2B	2F	R404	1C	3F	S611	3A	2F	W1000-24	6C	4D
C404	2C	4F	R405	3B	2F				W1000-31	7N	4D
			R455	8J	2F	W1000-19	3C	4C	W1000-36	5C	4E
DS618	7N	2F				W1000-20	7K	4C	W1000-37	5C	4E
			S401	1B	3F	W1000-21	7K	4C	W1000-38	4C	4E
R402	2B	2F	S440	4B	3F	W1000-22	7J	4C	W1000-39	1C	4F

Partial A11 also shown on diagrams 1, 2, 3, 5, 6, 7, 8, 9 and 10.

# CHASSIS MOUNTED PARTS

CIRCUIT	SCHEM	BOARD									
NUMBER	LOCATION	LOCATION									
C401	1A	CHASSIS	J4001	1A	CHASSIS	R401	1A	CHASSIS			





# 2215 CONTROL SETTINGS

# DC Voltages

HORIZONTAL MODE
A TRIGGER MODE
AUTO INTENSITY
A SEC/DIV

AUTO 1 ms

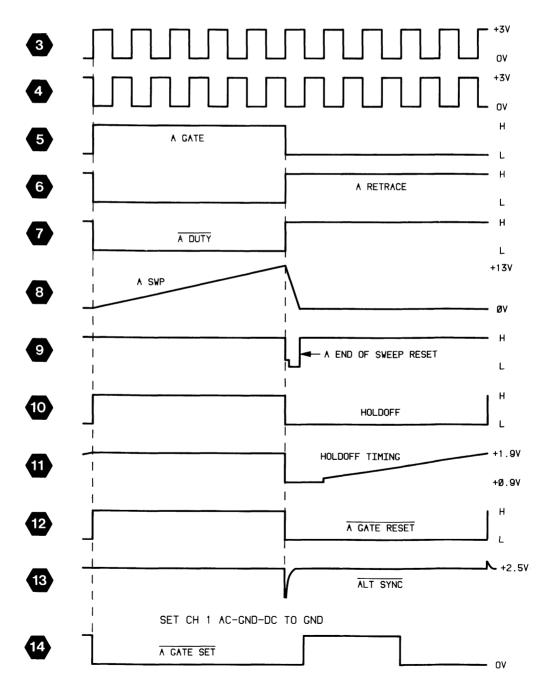
# AC Waveforms

VERTICAL MODE
HORIZONTAL MODE
A TRIGGER MODE
A TRIGGER SOURCE
A & B INT
CH 1 VOLTS/DIV
A TRIGGER LEVEL
CH 1 INPUT
AC-GND-DC

CH 1
HORIZONTAL
A UTO
DC

CH 1
DC

CH 1 1 V Midrange 1-kHz sine wave, 4V P-P



# SWEEP GENERATOR & LOGIC



ASSEMBL	Y A10							
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C602 C604 C606 C607 C619 C637 C642 C644 C645 C646 C647 C666 C668	5D 1G 5C 5C 1H 4H 5C 5B 3C 4B 4B 4E 4E 5D	7E 7E 7E 7E 7E 8E 8F 9E 8F 9F 8F 9F 7F 7E	NUMBER  P6001-1*‡ P6001-4*‡ P6001-5*‡ P6001-6*‡ P6001-7*‡  Q640  R603 R608 R619 R622 R623 R637 R638	4I 4L 3B 3B	8F 8F 8F 8F 8F 7E 9E 8F 9E 9E 8E 9E 8F	R668 R670 U603A U603B U607B U607C U607D U620 U640B VR644 W616 W640 W646 W674	4E 5D 4D 5C 5C 5C 5G 4G 5B 3C 5F 4B 5D	8E 7E 8E 8E 7E 7E 7E 7E 9E 9E 8F 9E 10E 9E
CR620 CR622 CR640 CR644	4H 4H 5A 3C	8E 8E 7E 9F	R639 R640 R642 R666	5C 4A 3C 4E	7E 7E 9F 8E	W6001-1*: W6001-4*: W6001-5*: W6001-6*: W6001-7*:	4L 3B 3B	8F 8F 8F 8F 8F

Partial A10 also shown on diagrams 2, 3, 4, 6, 7, 9 and 10.

### ASSEMBLY A11

CIRCUIT SCHEM BOARD CIRCUIT SCHEM BOARD CIRCUIT NUMBER LOCATION LOCATION NUMBER  J2000-10 2B 3E R645 1B 2E R647		BOARD LOCATION
12000-10 28 3E P645 1B 2E R647	LUCATION	LUCATION
R646 1B 2E	1A	2E

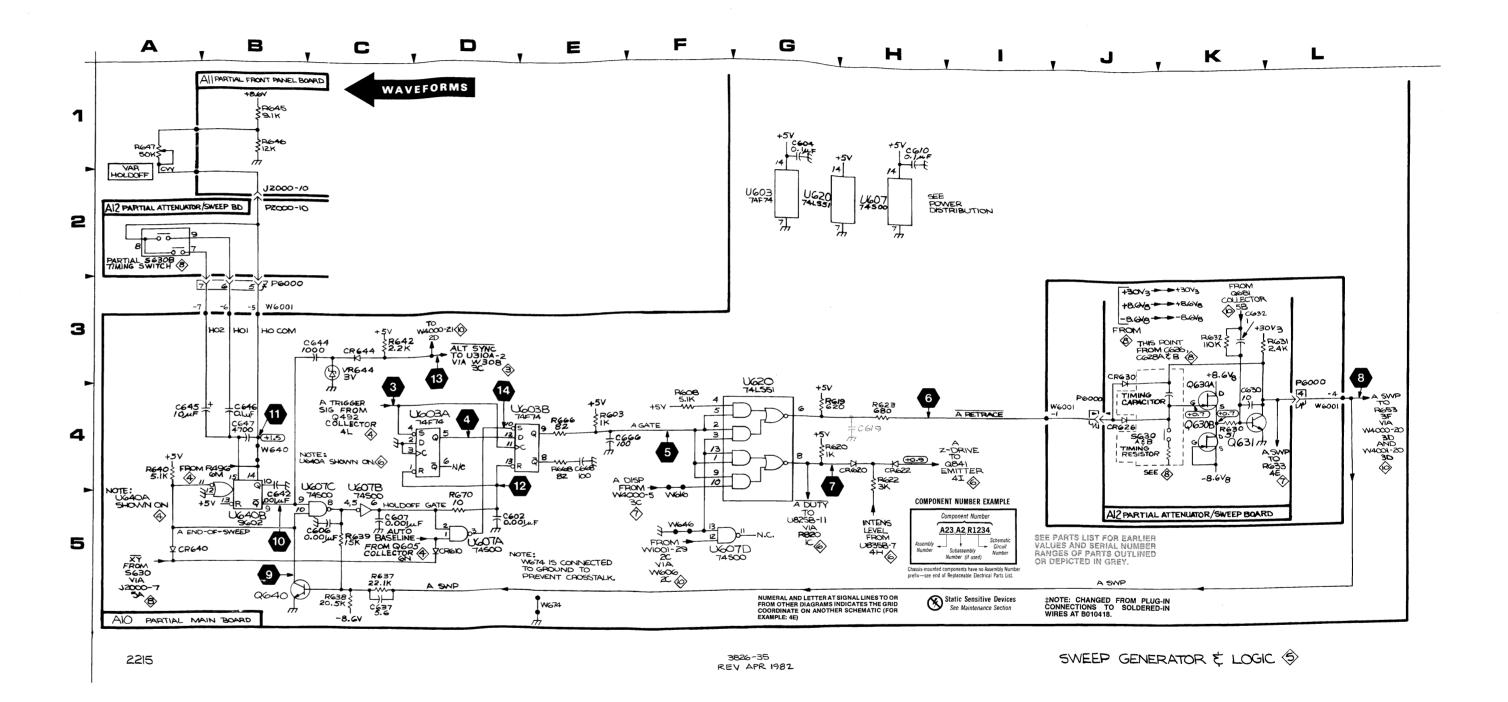
Partial A11 also shown on diagrams 1, 2, 3, 4, 6, 7, 8, 9 and 10.

### ACCEMBIV A

ASSEMBL	Y A12							
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C630	4K	4F	P6000-1	4J	4F	Q630B	4K	4F
C632	3K	4F	P6000-4	4L	3F	Q631	4K	4F
			P6000-5	3B	3F	1		ĺ
CR626	4J	4E	P6000-6	3B	3F	R630	4K	4F
CR630	<b>3</b> J	4F	P6000-7	3B	3F	R631	3L	2F
			1			R632	3K	4F
P2000-10	2B	4E	Q630A	4K	4F	l		

Partial A12 also shown on diagrams 1, 7, 8 and 10.

\*See Parts List for serial number ranges.



SWEEP GENERATO & LOGIC



# 2215 CONTROL SETTINGS

# DC VOLTAGES

HORIZONTAL MODE AUTO INTENSITY Midrange A SEC/DIV Ø.1 ms A TRIGGER MODE AUTO AC-GND-DC GND

# AC Waveforms

HORIZONTAL MODE ALT A SEC/DIV Ø.1 ms B SEC/DIV 5 µs A TRIGGER MODE AUTO AUTO INTEN Visible display A & B INT CH 1 TRIGGER SOURCE INT CH 1 AC-GND-DC DC CH 1 INPUT 1-kHz sine wave, 4V P-P B DELAY TIME POSITION 5.Ø B TRIGGER LEVEL RUN AFTER DLY

+3.8V 15 A DUTY Ø٧ <del>-</del> +3.8V 16 B DUTY Ø٧ +5.6V 17) +3.2V +3.80 A DISP Ø۷ Ø۷ **-** -1.5V AMPLITUDE VARIES WITH AUTO INTEN CONTROL INTENS LEVEL -57 B SWP 7 B SWP Z-AXIS Z-AXIS SIGNAL +581 AMPL I TUDE A INT SWP VARIES WITH SIGNAL Z-AXIS CRT AUTO INTEN SIGNAL 20 BLANKED +287 CONTROL +12V

3826-12

# OTO INTENSITY & 2-AXIS

# **AUTO INTENSITY & Z AXIS**

<b>6</b>

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD
	200/11/01/	200/1101	1101115211							200/11/01/	
C603	8K	7E	CR837	31	7F	R813	4F	6B	R849	4L	2K
C605	8L	8E	CR844	4J	3K	R814	3G -	6C	R850	4L	3K
C803	6C	7G	CR856	5M	4J	R816	3E	6B	R851	4L	3K
C810*	5H	5A	1			R817	4E	6B	R852	4L	3K
C820	1C	7E	DS854	5M	4J	R820	1C	8E	R854*	4M	3K
C821	1D	6A	DS856	6M	4J	R821	1D	6B	R856	5M	4K
C822	1C	6B	1			R822	1C	7E			
C824	7N	6A	P7001-7*±	1C	6F	R825	3D	6B	U825A	3D	6B
C825	3D	6B				R826	3C	7F	U825B	1D	6B
C834	3H	5B	Q811	3G	5C	R827	3F	5C	U825C	2E	6B
C836	7M	5B	Q812	3F	5C	R828	2F	5C	U835A	2E	5B
C840	5J	3K	Q813	3F	6C	R829	2F	6C	U835B	4H	5B
C842	51	3J	Q841	41	3K	R830	2G	5B	1		
C844	61	11	Q844	5J	3K	R831	2F	5A	VR809	6G	5A
C847	8K	4J	Q845	6J	4K	R834	3H	5B	VR847	6L	4K
C848	6L	4K	Q847	6L	4K	R835	3H	5B			
C849	4L	3K	Q850	5L	3K	R836	4H	6C	W835	6M	6C
C852	5L	3K				R837	31	7F	W836	8M	7A
C854	4M	2K	R616	2D	7E	R839	51	3J	W843	61	21
			R801	7E	2K	R840	5J	3K	W844	7K	7A
CR801	71	2K	R802	7G	2K	R841	5J	3K	W854*	4M	3K
CR802	7H	3J	R803	71	3J	R842	51	3J	W1001-1	8B	5A
CR809	6G	5A	R809	6H	5A	R844	4J	3K	W1001-8	6B	5A
CR828	2F	5B	R810	6H	5A	R845	6J	3K	W4000-8	1J	7F
CR830	2F	6C	R811	5G	5B	R846	5K	3K	W4000-9	6C	7F
CR833	4G	5C	R812	4F	5C	R847	5K	4K	W4000-18	3C	8F
CR834	3Н	5B							W7001-7*±	: 1C	6F

Partial A10 also shown on diagrams 2, 3, 4, 5, 7, 9 and 10.

ASSEMBLY A1	EMBLY A1	Y A1
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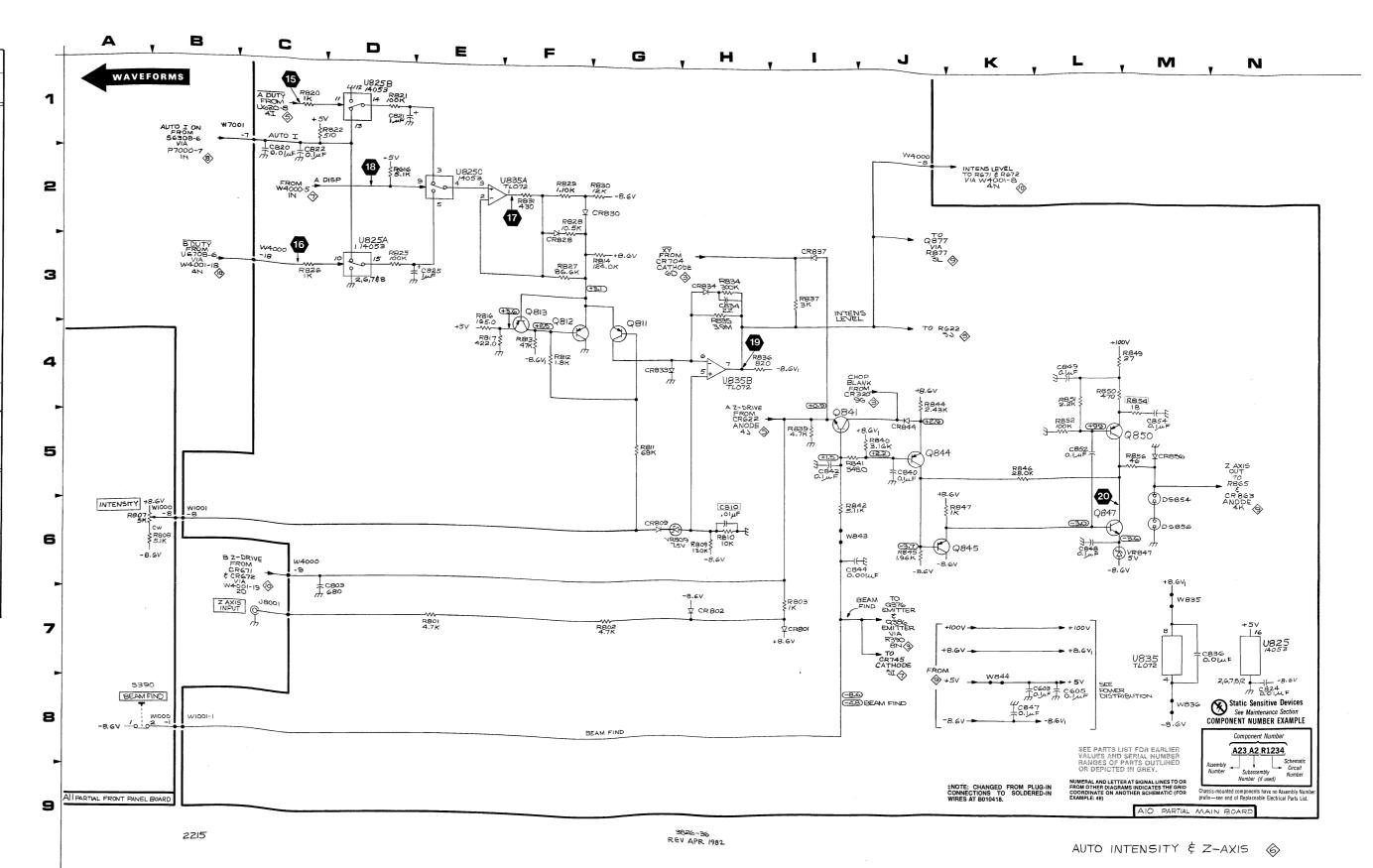
											1
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
R807 R808	6A 6A	1A 1A	S390	8A	2A	W1000-1 W1000-8	8B 6B	4A 4A			

Partial A11 also shown on diagrams 1, 2, 3, 4, 5, 7, 8, 9 and 10.

### CHASSIS MOUNTED PARTS

CHASSIS	MOUNTEL	PARIS										
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION .	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	
J8001	7C	CHASSIS										1

\*See Parts List for serial number ranges.



# 2215 CONTROL SETTINGS

# DC Voltages

HORIZONTAL MODE A
A TRIGGER MODE AUTO
AC-GND-DC GND

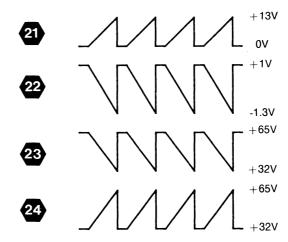
# AC Waveforms

HORIZONTAL MODE

VAR HOLDOFF
A TRIGGER MODE
AC-GND-DC (both)

AC-GND

Horizontal POSITION start of trace at extreme left of vertical line.



3826-13



# XY AMPLIFIER / HORIZ OUTPUT

$\langle 7 \rangle$

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATIO
C702	7D	7D	CR783	2L	3H	R711	8F	6E	R786	1 N	3G
C708	7D	6E				R712	6E	6E	R787	1 N	2G
C745	51	21	P6001-9*‡	3D	8F	R745	5J	2H	R788	2N	2G
C748	51	21	P6001-10*:	‡ 4D	8F	R746	5J	2H	R789	1N	3F
C754	5J	41	P7001-4*‡		6F	R748	51	21	R792	4N	3G
C770	5M	3G	P7001-5*‡	31	6F	R749	51	21	R793	4N	3G
C773	8M	3G	P7001-6*‡	6F	, 8F	R751	5J	31	R796	9J	31
C774	8M	3G	Q703	8D	5E	R752	5K	4H	R797	9J	31
C777	7N	3F	Q706	8D	5E	R753	7K	3H	R798	8J	2G
C779	7N	3G	Q708	7F	6E	R754	4K	31	R799	8J	4F
C781	2M	2G	Q714	7F	6F	R756	<b>7</b> J	31	VR781	2M	2G
C783	2M	3G	Q747	5J	3H	R757	7J	31			
C784	2M	3G	Q753	7K	3H	R758	7J	4H	W399	8J	31
C787	1 N	2G	Q763	3K	4H	R760	3J	4G	W696	4C	8G
C789	1 N	2G	Q765	5L	3G	R761	4J	31	W763	3J	5F
C796	9J	31	Q770	7L	3G	R762	4K	3H	W764	<b>3</b> J	4F
C797	9K	31	Q775	8N	3F	R763	2K	3H	W840	91	9F
C798	8:J	2H	Q779	7N	3F	R765	4L	3H	W841	91	7F
C799	8J	4G	Q780	2M		R766	5L	4G	W842	91	7F
C841	9J	6F	Q785		2G	R768	5M	2G	W845	9J	<b>3</b> J
C845	9J	3J		2N	2F	R771	8N	3F	W846	9J	31
			Q789	1N	3G	R772	7L	3H	W847	9J	31
CR745	51	21	R701	8B	5D	R775	8M	3G	W967	8J	5F
CR748	51	21	R702	7C	6E	R776	7N	3F	W969	81	4J
CR749	51	21	R703	8C	6E	R777	7N	3F	W4000-5	3C	7F
CR770	5M	3Н	R704	6B	6F	R778	8N	3F	W4000-11	4C	7F
CR772	5K	3н	R705	8D	5E	R779	7N	3F	W6001-9*‡		8F
CR773	7L	3H	R706	8E	6E	R780	2M	2G	W6001-10*		8F
CR780	5M	3G	R707	8E	6E	R781	2N	3G	W7001-4*‡		6F
CR782	5L	3H	R708	7D	6E	R782	3L	2G	W7001-5*‡		6F
011702	32	5.1	R709	7E	6E	R785	2M	3G	W7001-6*‡	: <b>6</b> F	6F

Partial A10 also shown on diagrams 2, 3, 4, 5, 6, 9 and 10.

	S	0	-	A	D	٠,	v	Λ	1	
٦	5	Э.		vı	в	L	Y	A	1	

CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOARD	CIRCUIT	SCHEM	BOAR
NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATION	NUMBER	LOCATION	LOCATI
C725 <b>†</b> C726	2D 2C	1E 1E	J2000-9	2D	3D	R726	2C	1E			

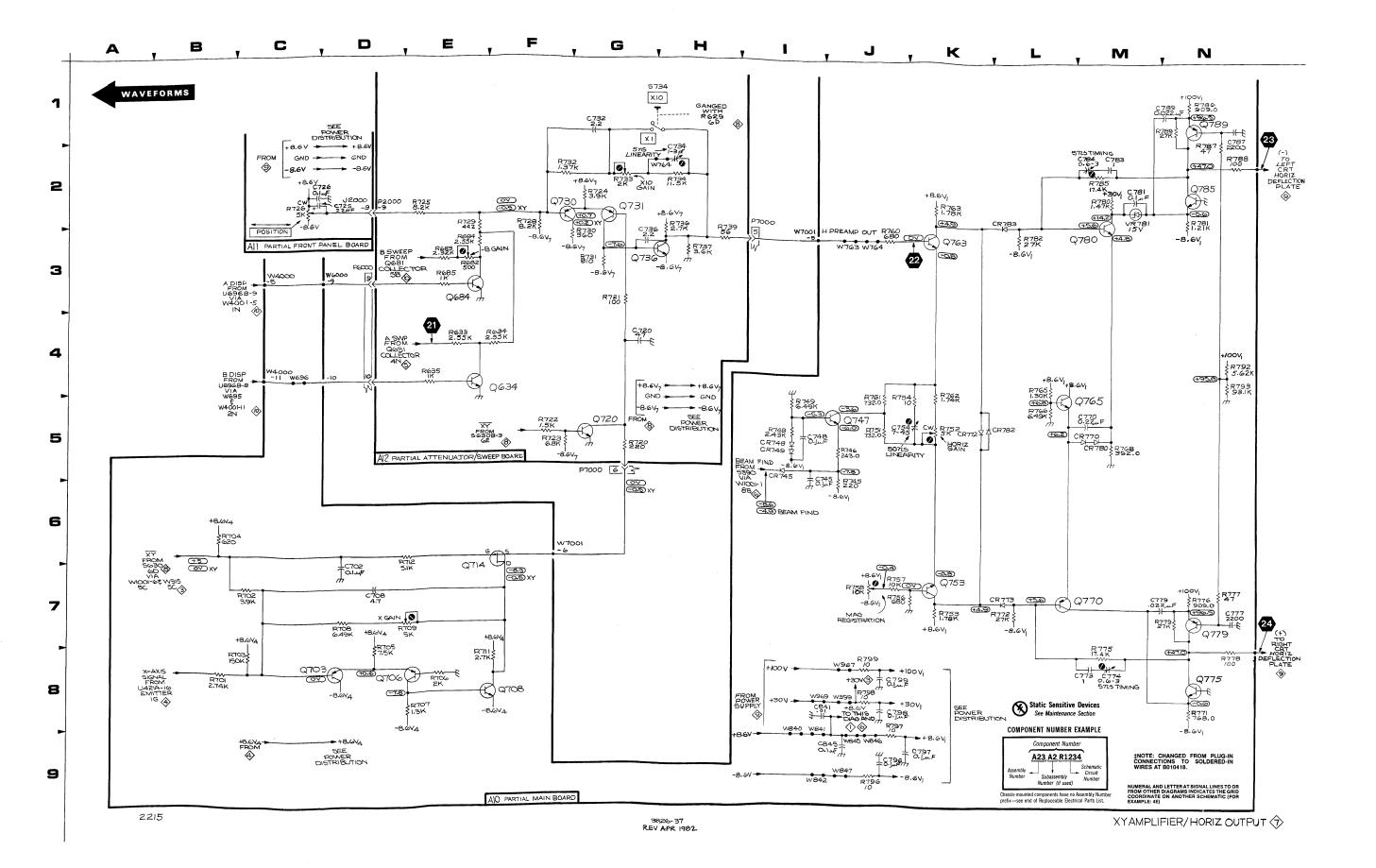
Partial A11 also shown on diagrams 1, 2, 3, 4, 5, 6, 8, 9 and 10.

# ASSEMBLY A12

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C720	4G	2D	Ω684	3E	2F	R685	3E	3F	R733	2G	1E
C732	1G	1D	Q720	5G	1D	R720	5G	1D	R734	2H	1E
C734	2H	2E	Q730	2F	1E	R721	3G	1E	R736	3Н	2E
C736	3G	2E	Q731	2G	1D	R722	5F	2D	R737	3H	2E
0.00			0736	3G	1E	R723	5F	2D	R739	3H	1D
P2000-9	2D	4D				R724	2G	1E			
P6000-9	3D	3F	R633	4E	1F	R725	2E	2D	S734	1 H	1D
P6000-10	4D	3F	R634	4F	1E	R728	2F ·	2E			
P7000-5	31	1D	R635	4E	3F	R729	2E	1E	W734	2E	1E
P7000-6	5G	1D	R682	3E	1F	R730	3G	2E			
1			R683	3E	1F	R731	3G	2E	1		
Q634	4E	2F	R684	3E	1E	R732	2F	1E			

Partial A12 also shown on diagrams 1, 5, 8 and 10.

†Located on back of board.



# TIMING SWITCH



ASSEMBL	Y A11				
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
J2000-7	1M	3D	J2000-8	1M	3D

Partial A11 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 9 and 10.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C625	3L	4E	R625	4F	4E
C626	3L	4E	R626	3E	4E
C628A	2K	4D	R627	7C	1E
C628B	2L	5E	R628	2L	4E
C628C	91	2E	R629	6C	1E
C628D	9J	2E	R636	6L	2E
C636	6L	2E	R676	8E	2E
C675	8J	3E	R677	7L	2E
C676	8J	3E	R678	91	2E
C677	7L	3F	R679	8L	2E
C679	8L	3F	R686	5C	1F
C738	8L	2E	R691	6C	1E
C741	7L	2E	R738	8M	2D
			R741	7M	1E
P2000-7	1M	4D			
P2000-8	1M	4D	S630A	2K	3D
P7000-1	6M	1D	S630B	2G	3D
P7000-2	7M	1D	S630C	9G	3D
P7000-3	8M	1D	S630	6E	3D
P7000-4	7M	1D			
P7000-7	1M	1D	VR629	6C	1F
Q629	6C	1F			

C B Н G M N 177 P7000 U825A-1 \$ U825B-13 AUTO I → XY TO R722  $\overline{X}\overline{Y}$ → 70 CR701 \$ CR702 7 4A 5B ><del>-8</del> ► 70 53/7 All PARTIAL FRONT PANEL BOARD S630B "A"TIMING TIMING SWITCH 5,45 TIMING C625 TIMING CAPACITORS TO GGBOA GATE 4M 41.2K 82.5K 412K RG25 2.49M FRONT 2 0 0 7 4 0 0 9 6 0 0 1/1 5630 A,B,C BOTTOM VIEW r ⑤ ⑥ \$THIS DIAG A AND B SEC/DIV SHOWN IN XY POSITION DOT INDICATES SWITCH CLOSED C636 \$ \$ \$\(\phi\) +8.6\(\rangle\) \(\frac{\cappa\_0}{\cappa\_0}\) \(\fra TIMING RESISTOR R676 412K 82.5K 9 2 W 82.5K 8 // 41.2K // // 3 8.25K 3 6 W 8.25K 2 5 9 2 C738 → -8.6V<sub>7</sub> 5 us TIMING C676 1 C675 Static Sensitive Devices
See Maintenance Section 6.679T COMPONENT NUMBER EXAMPLE 4.12K Component Number A23 A2 R1234 \* C628D \* C628C 0.0JuF BTIMING SEBOC TIMING SWITCH \* MATCHED SET AIZ PARTIAL ATTENUATOR/SWEEP BOARD TIMING SWITCH (8) 2215 3826-38 REV OCT 1981

©

2215 Service

Static Sensitive Devices
See Maintenance Section

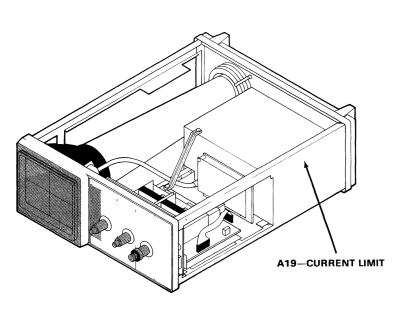
# COMPONENT NUMBER EXAMPLE

	Component Number
	A23,A2,R1234
Assembly Number	Subassembly Number (if used)

Figure 9-10. A19—Current Limit board.

# A19—CURRENT LIMIT BOARD

	CIRCUIT	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
Г	C938	9	Ω938	9
	CR932	9	R933	9
	CR934	9	R935	9
	CR935	9	R936	9
	F937	9	R937	9
	P801	9	R938	9
	P802	9	R939	9
	P803	9	RT935	9
	P804	9	VR933	9
	Q933	9	VR934	9
		i	ŧ	I



# **2215 CONTROL SETTINGS**

# DC Voltages

Preregulator and inverter voltages are referenced to test point noted adjacent to the voltage. Power supply output voltages are referenced to chassis ground.

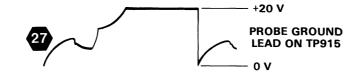
# AC Waveforms WARNING

Insrument must be connected to the ac-power source using 1:1 isolation transformer. Do not connect the test oscilloscope probe ground lead to the inverter circuit test points if the instrument is not isolated. AC-source voltage exist on reference points TP915 and TP934

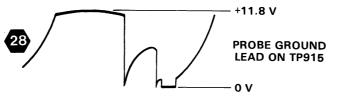








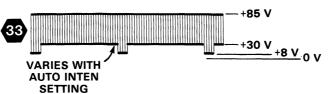


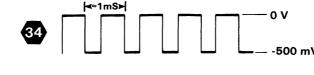






0.1 mS MIDRANGE MIN (FULLY CCW)





3826-19

**REV APR 1982** 

# POWER SUPPLY, PROBE ADJUST & CRT



ASSEMBL	Y A10										
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C447	4B	5K	CR967	4H	7G	R874	3N	11	TP934	2H	8J
C448	6B	5F	CR971	5H	8G	R875	4L	4H	TP952	5F	10J
C861	4J	71	CR972	5H	9H	R876	5N	11			
C863	4J	71	CR973	6H	9G	R877	3L	6G	U931	5E	9K
C864	3K	61	CR974	6H	9G	R878	3L	5H	U985	6J	91
C865	3K	61	CR977	2K	7H	R879	4L	5H	U990	2H	6G
C871	2N	1J	CR985	5J	9G	R880	4L	5H		i	
C873	3N	1J				R881	4L	5H	VR901	3B	5K
C876	5N	1J	DS867	2J	51	R882	5L	5H	VR913	зс	8K
C877	2L	1J	DS868	2K	51	R883	5L	5H	VR914	5D	8K
C878	4L	5H	DS870	7K	51	R884	5K	5H	VR915	6D	8K
C879	4L	5H				R886	4N	11	VR938	3E	81
C886	4N	1J	L971	51	8G	R887	4N	11	VR951	3F	10K
C901	2B	5K	L972	61	10H	R911	4C	8K			
C912	6C	9K				R912	6C	9K	W447	5B	5J
C915	6D	9K	P7001-1*‡	8L	6E	R914	4D	8K	W448	5B	6G
C917	4E	9K	P7001-2*±	8L	6E	R915	5C	8K	W877	3L	41
C926	3C	6K	P7001-3*‡	8L	6E	R916	4E	9K	W878	3L	41
C937	3E	7J	P7001-4*±	8L	6F	R917	4E	8K	W887	2L	4J
C945*	4E	10J	P8710-1	4N	1J	R918	5D	9K	W964	3,J	4J
C947*	4F	10J	P8710-2	3N	1J	R920	3D	7K	W965	41	9G
C951	3G	10J	P8710-3	5N	1J	R925	2D	7K	W966	30	7G
C956	3G	9J	P8710-4	2N	1J	R926	3C	6K	W968	31	6G
C957	4G	10J	P8710-5	2L	1J	R940	4G	9)	W975	5J	9G
C961	31	6G	P9000-1	2A	6J	R941	4G	9J	W976	6J	9G
C965	3H	7H	P9000-2	3A	6J	R942	4G	10J	W982	6J	4J
C971	51	9G	P9025-1	2B	6J	R945	3F	10J	W985	6J	9G
C972	61	9G	P9025-2	2C	6J	R946	3F	10K	W986	6J	9G
C975	51	8G	10020 2			R947	4F	10J	W1001-5	7F	5A
C976	61	10G	Ω877	3L	51	R948	4F	9J	W1001-14	7F	6A
C977	2L	7H	Q918	4D	9K	R950	3F	10K	W1001-32	7F	9A
C985	6J	101	Q921	3C	8K	R951	4F	9J	W4000-3	6L	6F
C990	21	6H	Q925	2C	8K	R952	5F	9K	W4000-23	6L	9F
C992	2.J	6H	Ω940	3G	91	R953	5F	9J	W4000-24	7L	9F
C995	2J	6H	Q942	4G	91	R954	4F	9K	W4000-25	7L	9F
		0	Q948	3F	10K	R956	3G	9J	W4000-26	6L	9F
CR860	3J	71	Q954	3F	10K	R990	21	6H	W4000-27	6L	9F
CR863	4K	61	Q956	4G	9K	R992	21	6H	W7001-1*‡	l	6E
CR867	2J	61				R994	2J	6H	W7001-2*±		6E
CR868	2K	61	R447	4B	6K	R995	2J	6H	W7001-3*‡	I	6E
CR903	3B	6K	R448	5B	5K	[			W7001-4*‡	ì	6F
CR904	4B	6K	R450	4B	5K	S901	2A	5K	W8700-1	5L	5H
CR905	4B	6K	R860	3J	4K				W8700-2	7L	5H
CR906	4B	6K	R861	4J	4K	T448	5B	5J	W8700-3	8L	5H
CR917	6D	8K	R863	4J	71	T925	3C	7K	W8700-4	8L	5H
CR931	3D	6K	R864	3J	61	T940	2H	7H	W8700-5	7L	51
CR933	2D	6K	R865	3K	61	T942	4H	8J	W8700-6	7L	5I
CR940	5G	91	R867	2J	6H				W8700-7	7L	51
CR942	5G	10J	R868	2J	61	TP500	7F	10G	W8700-8	5L	51
CR956	3G	9J	R870	2N	11	TP501	7F	10B	1	"-	
CR961	31	7G	R871	2N	11	TP915	3D	8K			
CR963	31	7G	R872	3L	41	TP920	4C	8K			
CR965	3H	7G	R873	3N	11	TP921	3D	8J			
,,,,,,,,,				"							

Partial A10 also shown on diagrams 2, 3, 4, 5, 6, 7 and 10.

\*See Parts List for



# POWER SUPPLY, PROBE ADJUST & CRT



CONT)

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION									
C531	8C	1D	P1000-2	8E	1B	R532	7C	1D	U535	8C	1D
			P8006-1	1N	2A	R536	8D	1D			
CR536	8D	1D	P8006-2	1N	2A	R537	8D	1D	W1000-5	7E	4A
CR538	8D	1D	l			R538	8D	1B	W1000-14	7E	4B
	1		R530	8C	1D	R891	1N	2A	W1000-32	7E	4E
P1000-1	8E	1B	R531	8C	1D	R975	1 N	2A			

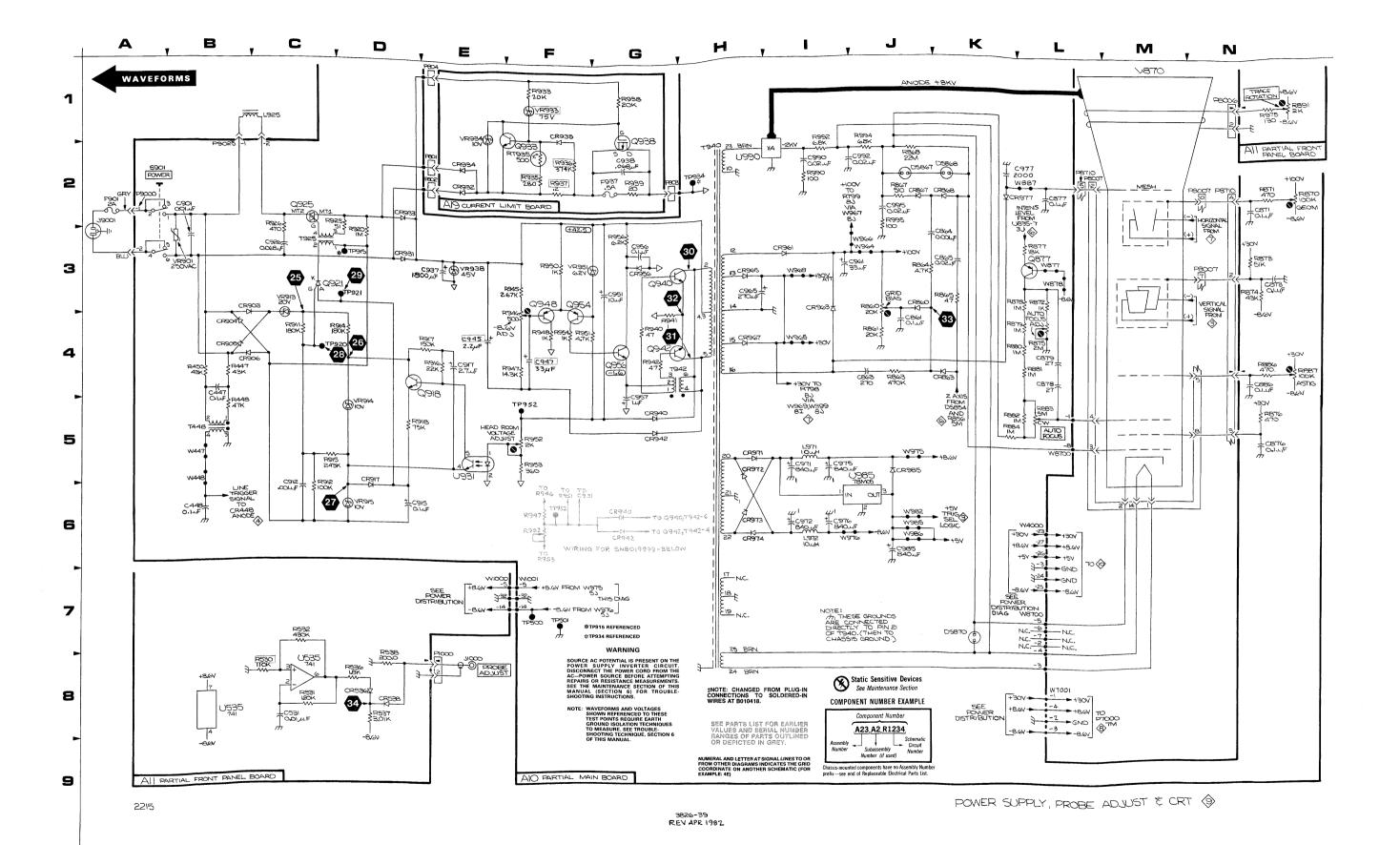
Partial A11 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 8 and 10.

# ASSEMBLY A19

NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM	BOARD LOCATIO
C938	2G	1B	P801	2E	1B	R933	1F	1C	RT935	2F	2B
			P802	2E	1B	R935	2F	2C		1	l
CR932	2E	1A	P803	2G	1B	R936	2F	2B	VR933	1F	2C
CR934	2E	1A	P804	1E	1B	R937	2F	2A	VR934	1E	2B
CR935	2F	2C				R938	1G	1B			
			Q933	1F	2B	R939	2G	2B		1	ļ
F937	2G	2A	Q938	1G	2B						1

### CHASSIS MOUNTED PARTS

CHASSIS	MOUNTEL	PARIS				<u> </u>			Ι		
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
F901	2A	CHASSIS	L925	1C	CHASSIS	P8007-4	5L	CHASSIS	P8007-12	ŀ	CHASSIS
J1000	8E	CHASSIS	P8007-1	6M	CHASSIS	P8007-5 P8007-7	4N 3N	CHASSIS CHASSIS	P8007-14	6M	CHASSIS
J9001	2A	CHASSIS	P8007-2 P8007-3	6 <b>M</b> 5L	CHASSIS CHASSIS	P8007-8 P8007-10	5N 2N	CHASSIS CHASSIS	V870	1 M	CHASSIS



/ER SUPPLY, PROBE UST & CRT



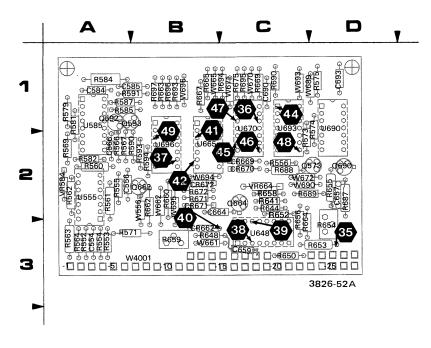


Figure 9-11. A13—Alt Sweep board.

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

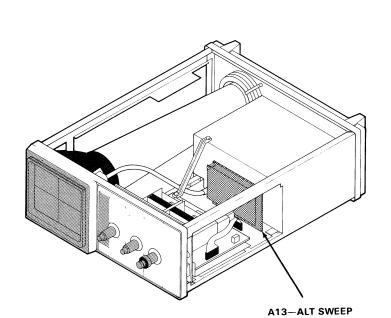
Component Number

Assembly Number (if used)

A23, A2, R1234

Schematic Circuit Number Number (if used)

Chassis-mounted components have no Assembly Numbe prefix—see end of Replaceable Electrical Parts List.



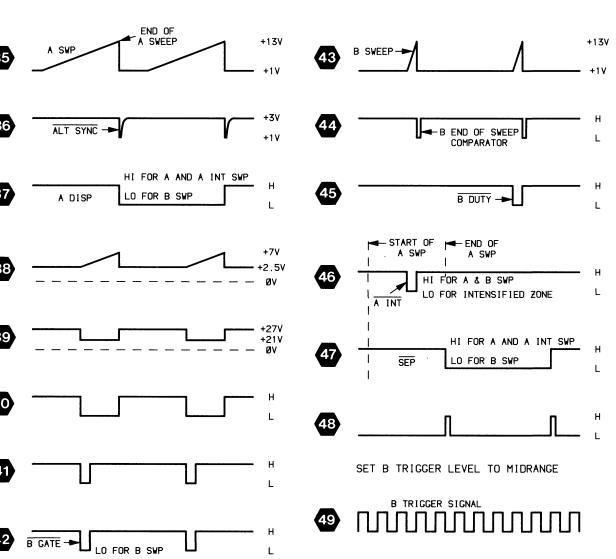
# A13—ALT SWEEP BOARD

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C554	10	R569	10	R671	10	W694	10
C556	10	R571	10	R672	10	W695	10
C566	10	R573	10	R675	10	W696	10
C584	10	R574	10	R687	10	W4001-1	10
C585	10	R575	10	R688	10	W4001-2	10
C657	10	R579	10	R689	10	W4001-3	10
C659	10	R581	10	R690	10	W4001-4	10
C664	10	R582	10	R693	10	W4001-5	10
C690	10	R584	10	R694	10	W4001-6	10
C693	10	R585	10	R695	10	W4001-7	10
CR662	10	R587	10	R696	10	W4001-8	10
CR669	10	R590	10	R697	10	W4001-9	10
CR670	10	R591	10	U555	10	W4001-10	10
CR671	10	R593	10	U585	10	W4001-11	10
CR672	10	R594	10	U648	10	W4001-12	10
Q573	10	R641	10	U665	10	W4001-13	10
Q592	10	R644	10	U670	10	W4001-14	10
Q593	10	R648	10	U690	10	W4001-15	10
Q662	10	R650	10	U693	10	W4001-16	10
Q664	10	R652	10	U696	10	W4001-17	10
Q690	10	R653	10	VR584	10	W4001-18	10
R552	10	R654	10	VR664	10	W4001-19	10
R553	10	R655	10	W556	10	W4001-20	10
R554	10	R656	10	W661	10	W4001-21	10
R555	10	R657	10	W662	10	W4001-22	10
R556	10	R659	10	W665	10	W4001-23	10
R560	10	R660	10	W670	10	W4001-24	10
R561	10	R662	10	W671	10	W4001-25	10
R562	10	R663	10	W672	10	W4001-26	10
R563	10	R664	10	W689	10	W4001-27	10
R564	10	R665	10	W690	10	1	
R566	10	R667	10	W693	10		
R567	10	R669	10				

**REV APR 1982** 

# 2215 CONTROL SETTINGS

DC Voltages		AC Waveforms	
A TRIGGER	NORM (sweep	A SEC/DIV B SEC/DIV	5 <b>0</b> µs 5 µs
AC-GND-DC (both)	GND	HORIZONTAL MODE B TRIGGER LEVEL B DELAY TIME POSITION	ALT CW-RUN AFTER DELAY 5.Ø
		A & B INT TRIGGER A SOURCE VERTICAL MODE	CH 1 INT CH 1
		TRIGGER MODE AC-GND-DC (both) CH 1 INPUT CH 1 VOLTS/DIV	AUTO DC 5-div, 1-kHz sine wave 5 mV



3826-11

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# **ALTERNATE B SWEEP**



ASSEMBLY	'A10										
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C564 C569 C601 C608 C648 C651 C658* P6001-2*‡ P6001-3*‡ P6001-8*‡ P7055-1 P7055-2 P7055-3	8C 9D 2C 3C 1C 1C 4D 6C 6C 5C 4C 3C	8A 7A 9B 8G 8G 7A 10E 8F 8F 10F 10F	R607 R649 R651 R673 R674 VR657 W564 W571 W606 W650 W1001-17 W1001-18	2C 1C 3D 6C 6D 3D 8D 9D 3D 4D 1C 9C	7F 10C 9F 8F 8F 9E 8G 7F 10F 6A 7A	W1001-25 W1001-26 W1001-27 W1001-28 W1001-29 W1001-30 W4000-1 W4000-4 W4000-6 W4000-10 W4000-13 W4000-13	2C 2C 2C 2C 2C 7A 8D 7D 9D 2D 2D 2D 2D 1D 4D	8A 8A 8A 8A 8A 6G 7F 7F 7F 8F 8F	W4000-15 W4000-16 W4000-17 W4000-19 W4000-20 W4000-21 W4000-22 W6001-2*‡ W6001-3*‡	3D 3D 6D 1D 3D 2D 5D 6C 6C 5C	8F 8F 8F 8F 9F 9F 8F 8F

Partial A10 also shown on diagrams 2, 3, 4, 5, 6, 7 and 9.

### **ASSEMBLY A11**

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C650	2C	1E	S650	2A	2E	W1000-18 W1000-25		4C 4D	W1000-29 W1000-30		4D 4D
R557	9C	1F	W636 W638	9C 8C	1F 1F	W1000-26 W1000-27	2C	4D 4D 4D	W1000-30	/ / /	40
S564	7C	1E	W1000-17		4C	W1000-27 W1000-28		4D			

Partial A11 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 8 and 9.

### **ASSEMBLY A12**

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C680	5B	3F	P6000-2 P6000-3	6C 6C	4F 3F	Q680A Q680B	5B 6B	3E 3E	R680 R681	5B 5B	3F 2F
CR676	6B	3E	P6000-8	5C	3F	Q681	5B	3F			
CR680	6B	3F									

Partial A12 also shown on diagrams 1, 5, 7 and 8.

\*See Parts List for serial number ranges.



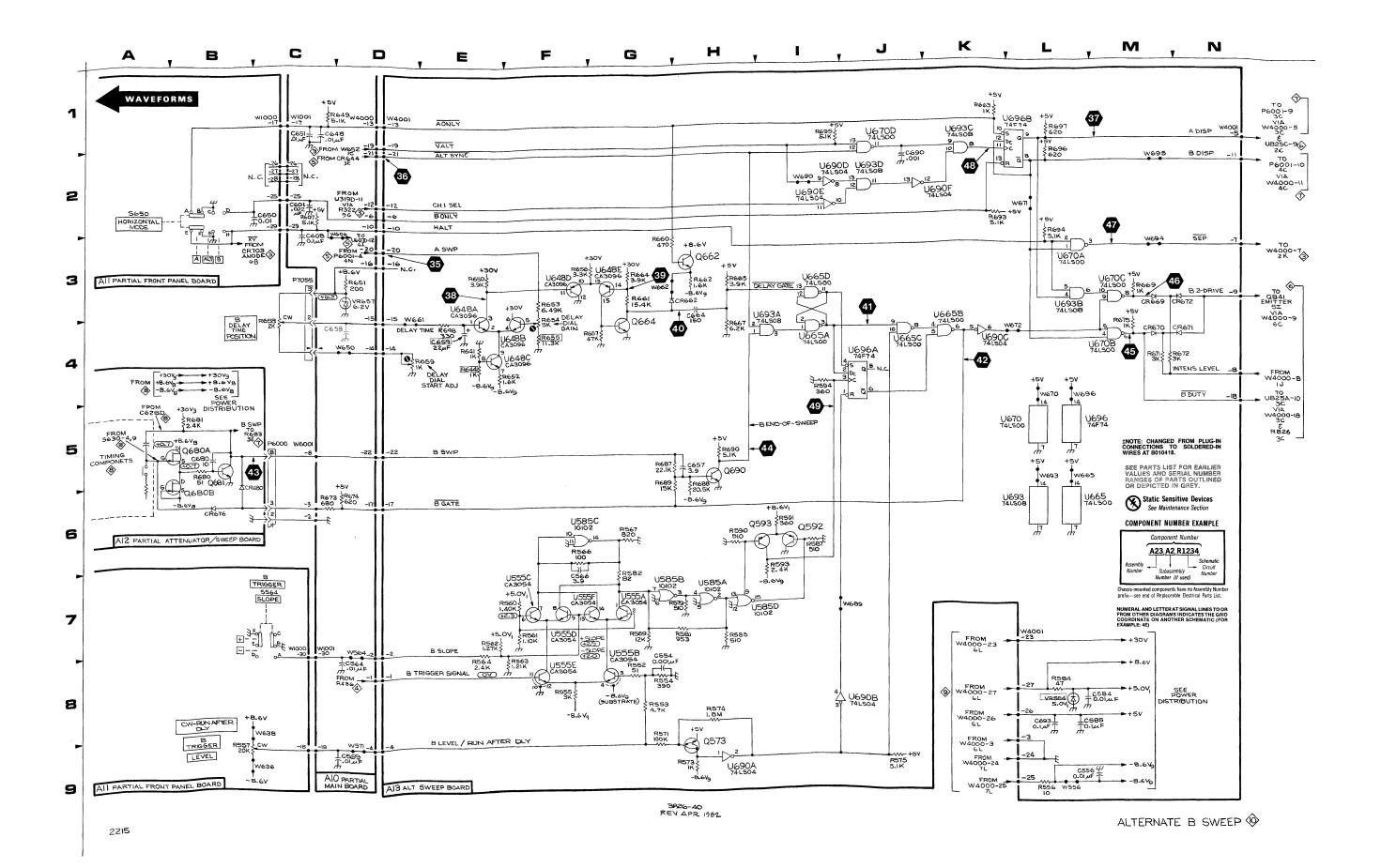
# ALTERNATE B SWEEP



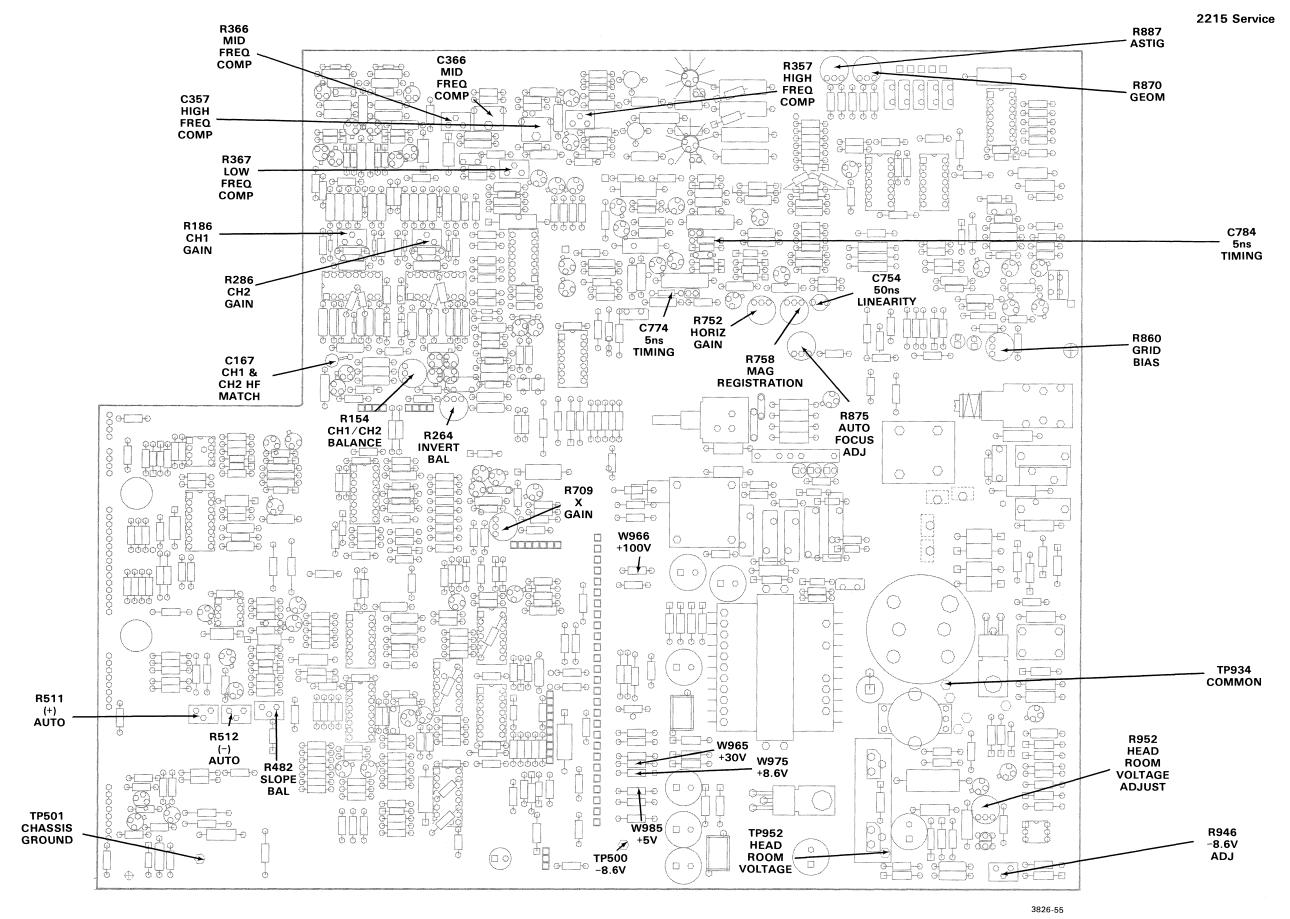
(CONT)

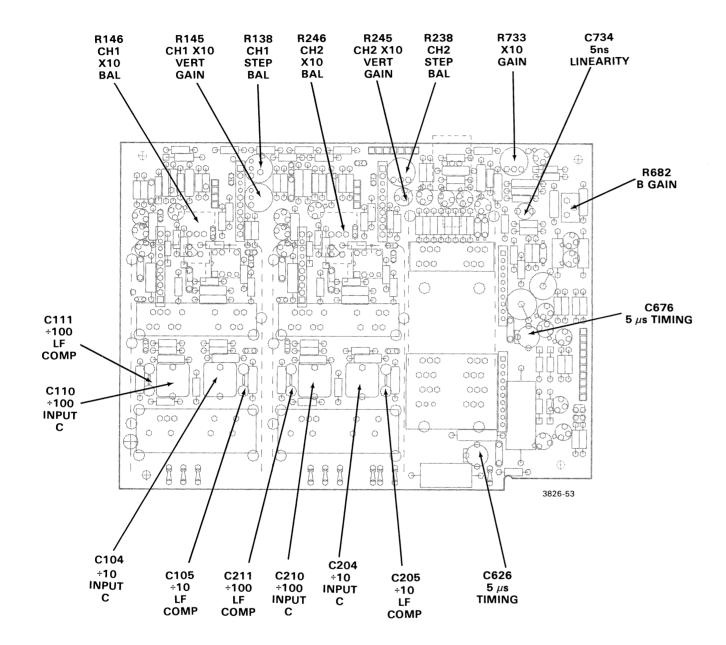
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATIO
C554	8G	3A	R579	7H	1A	U555A	7G	2A	W <b>6</b> 61	4E	3B
C556	9M	2A	R581	7H	1A	U555B	8G	2A	W662	3H	2B
C566	7F	2A	R582	7G	2A	U555C	7F	2A	W665	5L	1B
C584	8M	1A	R584	8L	1A	U555D	7F	2A	W670	4L	1C
C585	8L	1B	R585	7H	1A	U555E	8F	2A	W671	2L	1C
C657	5H	2D	R587	61	1A	U555F	7G	2A	W672	4L	2C
C659*	4E	3C	R590	6H	2B	U585A	7H	1A	W689	7J	1C
C664	3H	2B	R591	61	1A	U585B	7H	1A	W690	21	2C
C690	2J	1C	R593	61	2B	U585C	6F	1A	W693	5L	1C
C693	8L	1D	R594	41	2B	U585D	71	1A	W694	3M	2B
			R641	4E	2C	U648A	3E	3C	W695	2M	2B
CR662	3H	3B	R644*	4E	2C	U648B	4F	3C	W696	4L	1B
CR669	3M	2C	R648	4E	3B	U648C	4F	3C	W4001-1	8D	3A
CR670	4M	2C	R650	3E	3C	U648D	3F	3C	W4001-2	7D	3A
CR671	4N	2B	R652	4F	2C	U648E	3G	3C	W4001-3	8L	3A
CR672	3N	2B	R653	3F	3D	U665A	41	2B	W4001-4	9D	3A
			R654	4F	3D	U665B	4K	2B	W4001-5	1 N	3A
Q573	9H	2D	R655	4F	2D	U665C	4J	2B	W4001-6	2D	3A
Q592	61	1A	R656	3F	3C	U665D	31	2B	W4001-7	3N	3В
Q593	61	1B	R657	4G	2C	U670A	3L	1C	W4001-8	4N	3В
Q662	3Н	2B	R659	4D	2C	U670B	4M	1C	W4001-9	3N	3В
Q664	4G	2C	R660	3G	2B	U670C	3M	1C	W4001-10	2D	3B
Q690	5H	2D	R661	3G	2C	U670D	1J	1C	W4001-11	2N	3B
			R662	3H	2B	U690A	9Н	1D	W4001-12	2D	3B
R552	8G	3A	R663	1K	1B	U690B	8J	1D	W4001-13	1 D	3B
R553	8G	3A	R664	3G	3C	U690C	4K	1D	W4001-14	4D	3B
R554	8G	3A	R665	3H	1B	U690D	21	1D	W4001-15	3D	3C
R555	8F	2A	R667	4H	1B	U690E	21	1D	W4001-16	3D	3C
R556	9L	2C	R669	3M	1C	U690F	2K	1D	W4001-17	6D	3C
R560	7F	2A	R671	4M	2B	U693A	31	1C	W4001-18	5N	3C
R561	7F	2A	R672	4N	2B	U693B	3L	1C	W4001-19	1D	3C
R562	7E	2A	R675	4M	1C	U693C	1K	1C	W4001-20	3D	3C
R563	8F	3A	R687	5H	2D	U693D	2J	1C	W4001-21	2D	3C
R564	8E	3A	R688	5H	2C	U696A	4J	2B	W4001-22	5D	3C
R566	6F	2A	R689	5H	2C	U696B	1L	2B	W4001-23	7L	3D
R567	6G	2A	R690	5H	1C			-5	W4001-24	9L	3D
R569	7G	2A	R693	2K	1B	VR584*	8L	2A	W4001-25	9L	3D
R571	9G	3A	R694	3L	1C	V11304	"		W4001-26	8L	3D
R573	9Н	2C	R695	11	1C	W556	9L	2B	W4001-27	8L	3D
R574	8H	1D	R696	2L	1B	Wood	JL.	20			1
R575	9J	1D	R697	1L	1B						
CHASSIS	MOUNTED	PARTS	l				L				
CIRCUIT	CCHEMA	BOARD	CIRCUIT	SCHEM	BOARD	CIDOLUT -	COLUENA	DOADD	01001117	COLIENA	BOARI
CIRCUIT NUMBER	SCHEM LOCATION	LOCATION	NUMBER	LOCATION	BOARD LOCATION	CIRCUIT - NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	LOCATION
R658	4C	CHASSIS									

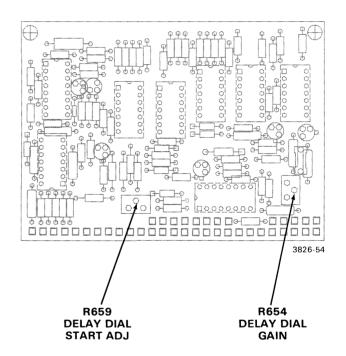
\*See Parts List for serial number ranges.



LTERNATE B SWEEP 슋







### GENERAL NOTES

- A. Use schematic diagrams, the overall block diagram, circuit board illustrations, and circuit descriptions when analyzing instrument malfunctions and locating test points. The schematic diagrams include typical waveforms and voltages that are intended as an aid in troubleshooting.
- B. Always set the POWER switch to OFF and unplug the line cord before swapping, removing, or replacing components, and before connecting or disconnecting instrument leads and cables.
- C. When analyzing circuit malfunctions, consider connectors and cables as possible causes of failure.

### SPECIFIC NOTES

1. Set initial front-panel controls as follows:

VERTICAL MODE	CH 1
VOLTS/DIV	Ø.1V
VOLTS/DIV Variable	Cal detent
AC-GND-DC	AC
Vertical POSITION	Midrange
A TRIGGER MODE	AUTO
A & B INT	VERT MODE
A SOURCE	INT
A SEC/DIV	Ø.1ms
A SEC/DIV Variable	Cal detent
X10 Magnification	Off (Cal button in)
AUTO INTENSITY	Midrange
AUTO FOCUS	Midrange
Horizontal POSITION	Midrange
POWER Switch	Off (button out)

Verify the low-voltage power supplies at the following test points:

SUPPLY	TEST POINT	TOLERANCE
-8.6V	TP5 <b>ØØ</b>	-8.56 to -8.64V
+8.6V	W975	8.34 to 8.86V
+5V	W985	4.75 to 5.25V
+3ØV	W965	28.5 to 31.5V
+100V	W966	95 to 105V

### NOTE

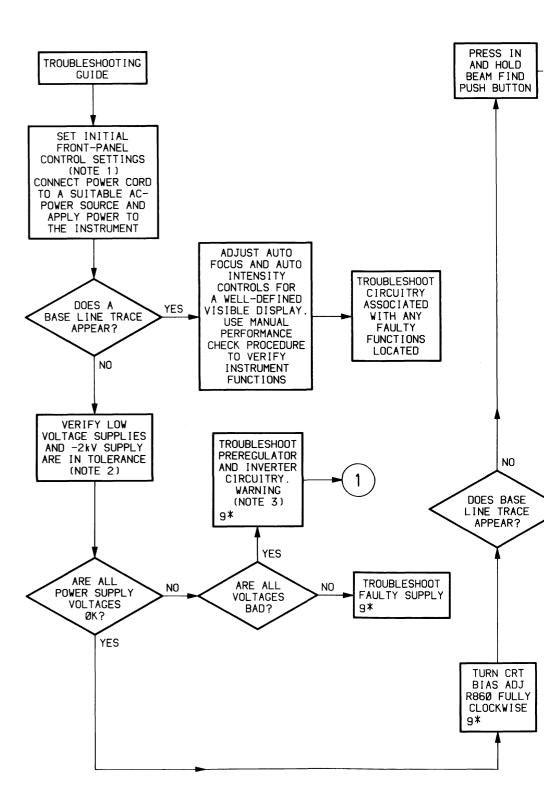
A HV probe is required to measure the -2kV supply. Turn off the power and make the test equipment connections to the oscilloscope. Set the voltmeter to read at least -3kV, then turn the oscilloscope power back on to take the reading. After obtaining the reading, turn off the oscilloscope power to disconnect the test equipment connections, and replace the crt socket cover.

Verify the -2kV supply at pin 2 of the crt socket. The voltage should be between -1900 and -2100V.

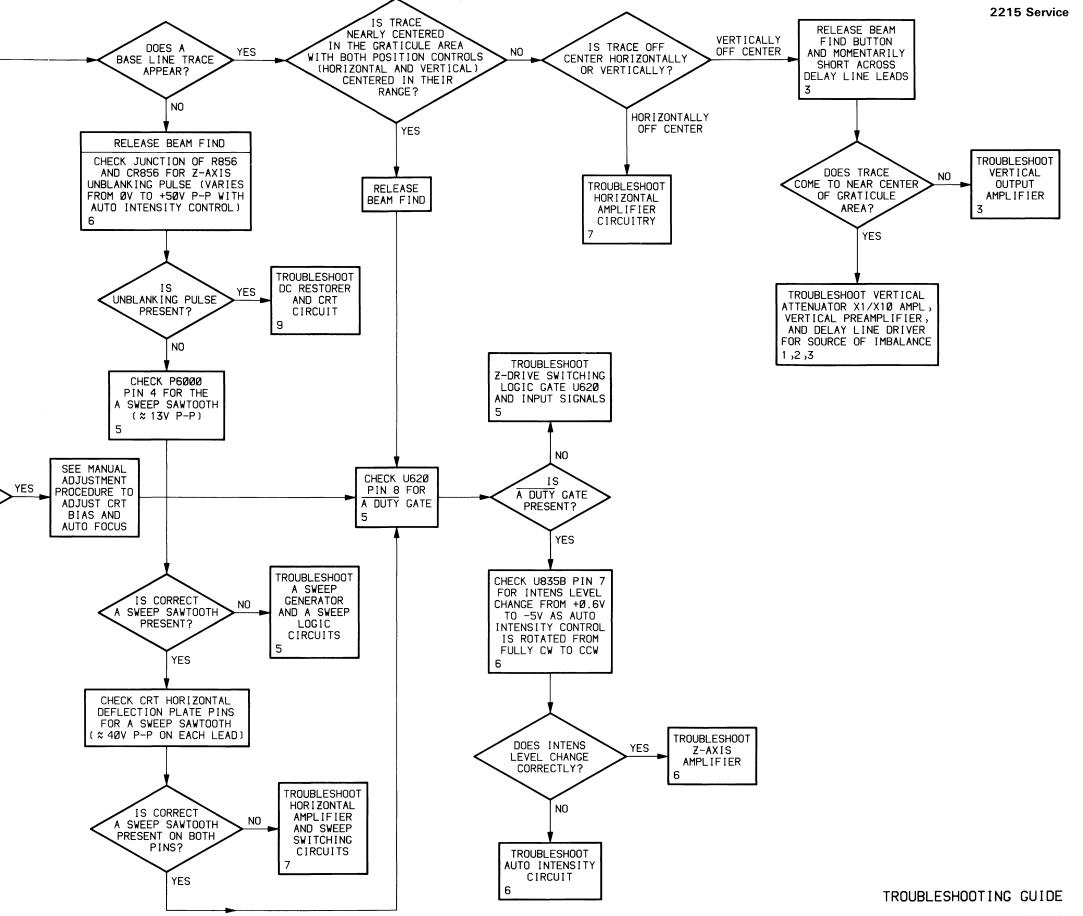
# WARNING

3.

The Preregulator and Inverter circuits have a floating common reference with respect to chassis ground. Ac-source potential is present on the common reference points. Connect the instrument to the ac-power source through an isolation transformer to prevent the possibility of personal injury or equipment damage when troubleshooting these circuits. When an autotransformer is also used in the troubleshooting procedure, connect the isolation transformer to the ac-power source, then connect the autotransformer to the isolation transformer. Finally, plug the instrument power cord into the autotransformer outlet.



\* NUMBER INDICATES SCHEMATIC DIAGRAM



### GENERAL NOTES

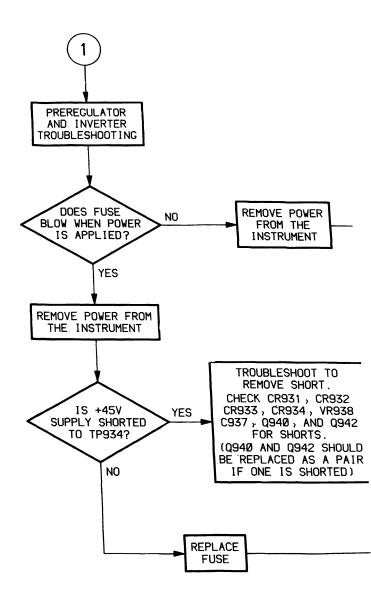
- A. Use schematic diagrams, the overall block diagram, circuit board illustrations, and circuit descriptions when analyzing instrument malfunctions and locating test points. The schematic diagrams include typical waveforms and voltages that are intended as an aid in troubleshooting.
- B. Always set the POWER switch to OFF and unplug the line cord before swapping, removing, or replacing components, and before connecting or disconnecting instrument leads and cables.
- C. When analyzing circuit malfunctions, consider connectors and cables as possible causes of failure.

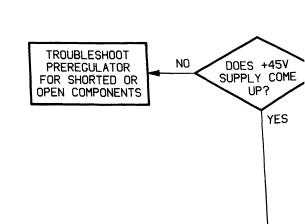
#### SPECIFIC NOTES

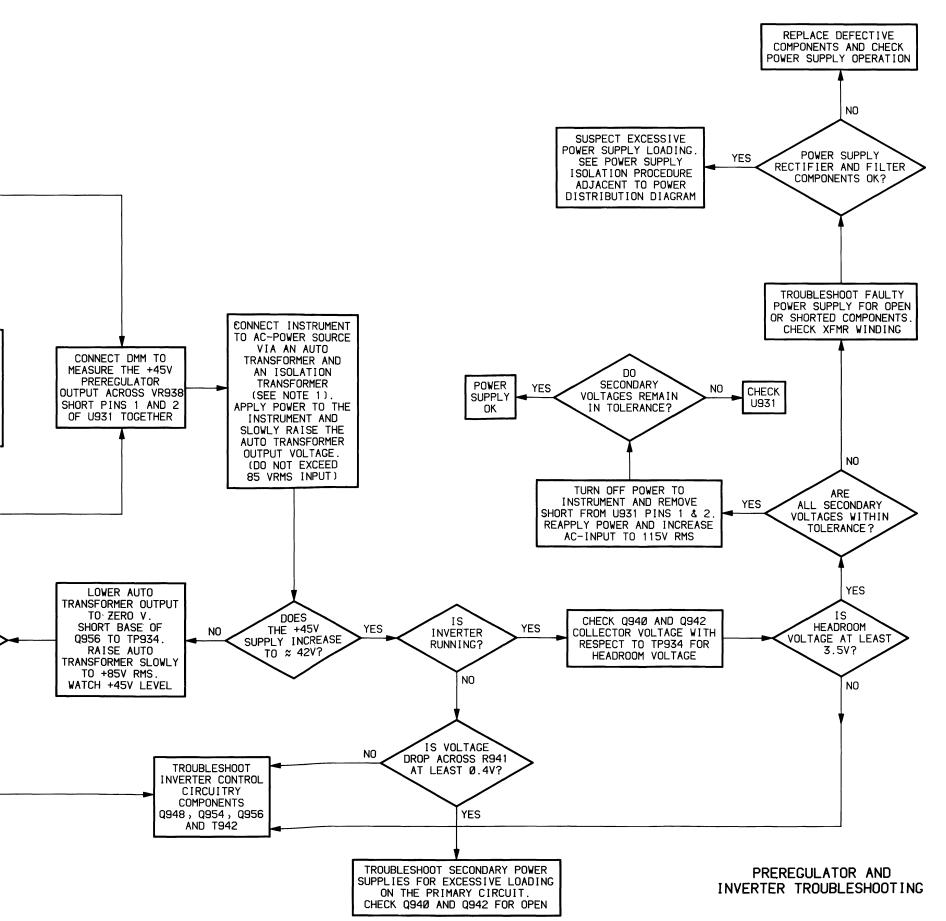
## WARNING

1.

The Preregulator and Inverter circuits have a floating common reference with respect to chassis ground. Ac-source potential is present on the common reference points. Connect the instrument to the ac-power source through an isolation transformer to prevent the possibility of personal injury or equipment damage when troubleshooting these circuits. When an autotransformer is also used in the troubleshooting procedure, connect the isolation transformer to the ac-power source, then connect the autotransformer to the isolation transformer. Finally, plug the instrument power cord into the autotransformer outlet.







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.

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

@

10-1

	SHAKEPROOF DIVISION
79807	WROUGHT WASHER MFG. CO.
80009	TEKTRONIX, INC.
82389	SWITCHCRAFT, INC.
83385	CENTRAL SCREW CO.
89663	REESE, J. RAMSEY, INC.
93907	TEXTRON INC. CAMCAR DIV
95987	WECKESSER CO., INC.

ST. CHARLES ROAD
2100 S. O BAY ST.
P O BOX 500
5555 N. ELSTON AVE.
2530 CRESCENT DR.
71 MURRAY STREET
600 18TH AVE
4444 WEST IRVING PARK RD.

ELGIN, IL 60120
MILWAUKEE, WI 53207
BEAVERTON, OR 97077
CHICAGO, IL 60630
BROADVIEW, IL 60153
NEW YORK, NY 10007
ROCKFORD, IL 61101
CHICAGO, IL 60641

	366-1701-01	B010405	1	KNOB:GY, 0.127 ID X0.392 OD X 0.4
-16			1	
				(ATTACHING PARTS)
-17	210-0583-00		1	NUT, PLAIN, HEX: 0.25-32 X 0.312 INCH, BRS
	210-0940-00		1	
	210-0021-00	XB010405	1	WASHER, LOCK: INTL, 0.476 ID X 0.60 "OD STL
				**
-19			2	
			1	
-21	210-0255-00		1	그들이 그리 얼마나 아이들이 다른 경우에 가르니다 게임하면 하는 사람이 하는 사람이 되는 것이 되는 것이다.
	384-1575-00		1	
-23	358-0550-00		1	BUSHING, SHAFT: 0.15 ID X 0.31NCH OD, PLSTC
-24	136-0387-01		1	THE PARTY OF THE P
-25	366-1031-03		1	
-26	366-1838-01		1	
-27	358-0640-00		1	그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그 그
-28	366-1405-08		1	그렇게 말았다면서 하는데 취하면 이렇게 하고 하는데 이번 사람이 하고 하는데 되는데 그렇다 하는데
-29	366-1840-00		1	
-30	366-1850-00		1	KNOB: CLEAR, 0.252 ID X 1.2 OD X 0.383
-31	331-0328-00		1	DIAL, CONTROL: 10 TURN FOR 0.25 DIA SHAFT
-32	210-0840-00		1	WASHER, FLAT: 0.39 ID X 0.562 INCH OD, STL
-33			1	RES., VAR, WW: (SEE R658 REPL)
-34	333-2679-00		1	PANEL, FRONT:
-35	366-2013-00		2	PUSH, BUTTON: DIRTY GRAY, 0.134 SQ X 0.480 H
-36	348-0660-00		4	CUSHION, CRT: POLYURETHANE
-37	386-4444-00		1	SUBPANEL, FRONT:
				(ATTACHING PARTS)
-38	213-0881-00		4	SCREW, TAPPING: 6-32 X 0.25 TYPE C
-39	213-0882-00		2	SCREW, TAPPING: 6-32 X 0.437 TYPE C
				*
-40	377-0512-00		7	INSERT, KNOB: 0.125 ID X 0.663 L, AL
-41	129-0836-00		2	SPACER, POST: 1.207 L, W/O.5-32 THD
	213-0228-00		2	
-42	384-1503-00		2	EXTENSION SHAFT: 5.4 L X 0.124DIA, PLASTIC
-43	384-1323-00		1	EXTENSION SHAFT: 6.4 L X 0.0810D SST
-44			1	CKT BOARD ASSY:ATTEN/SWEEP(SEE A12 REPL) (ATTACHING PARTS)
-45	211-0304-00		2	
				CKT BOARD ASSY INCLUDES:
-46				. TERMINAL, PIN: (SEE A12P1010, P2010, P6001,
-40				. P7000 REPL)
-47	136-0328-02			. SOCKET, PIN TERM: HORIZONTAL
-4/	130-0320-02		10	. SOUREI, FIN IERH HURIZONIAL

79807 OBD 78189 1222-01-00-0541C 80009 210-0255-00 80009 384-1575-00 80009 358-0550-00 71279 450-4252-01-0310 80009 366-1031-03 80009 366-1838-01 80009 358-0640-00 80009 366-1405-08 366-1840-00 80009 80009 366-1850-00 05129 461-S-70 89663 644R 80009 333-2679-00 80009 366-2013-00 80009 348-0660-00 386-4444-00 80009 01536 OBD 01536 OBD 80009 377-0512-00 80009 129-0836-00 80009 384-1503-00 80009 384-1323-00 01536 OBD 00779 86282-2

80009 366-1701-01

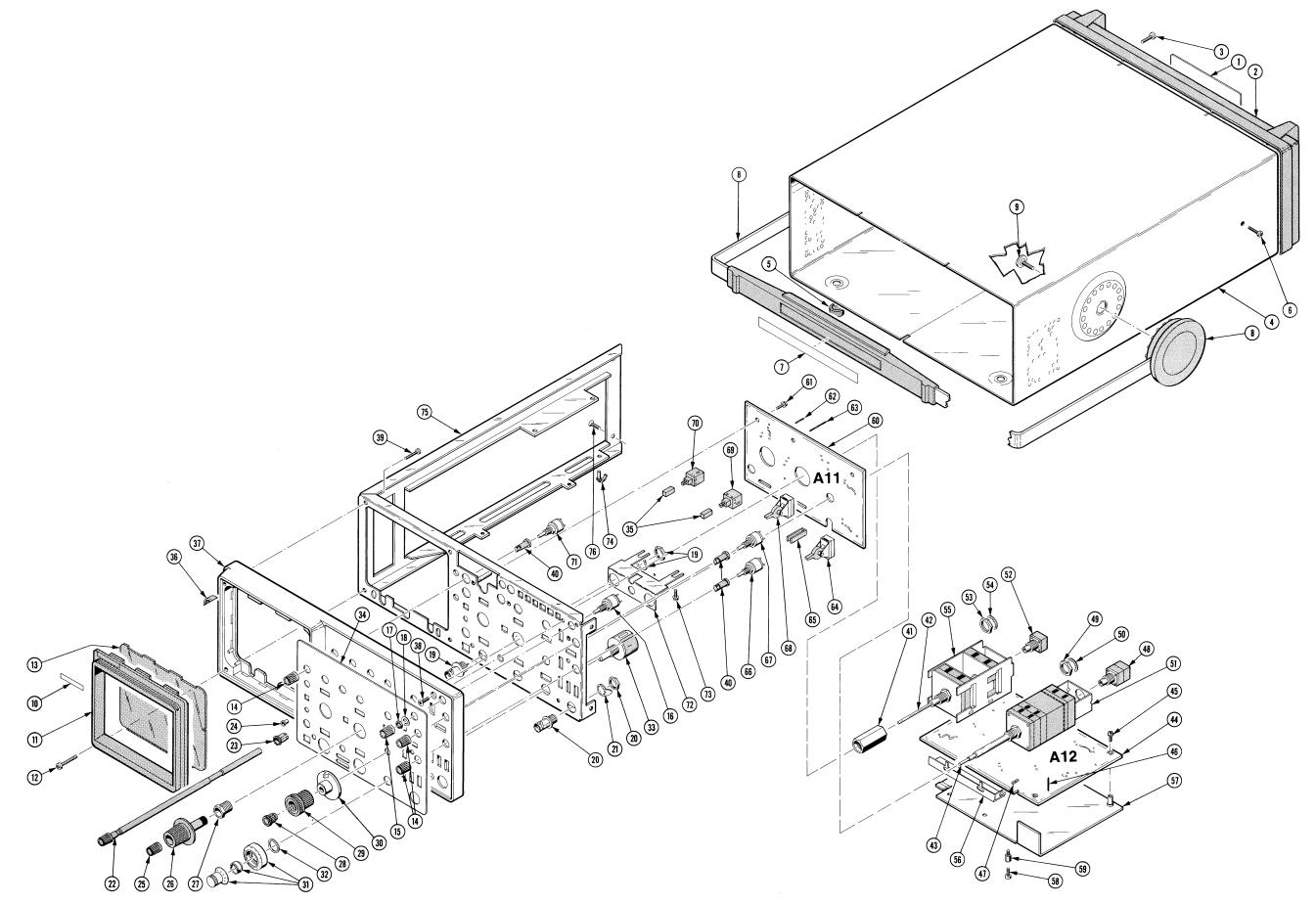
73743 2X20317-402

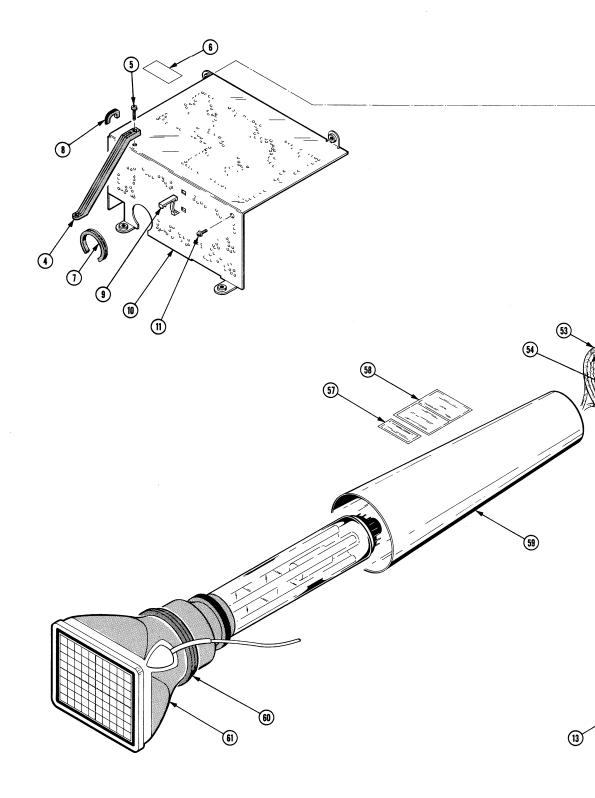
			CKT BOARD ASSY INCLUDES:
-62		4	. TERMINAL, PIN: (SEE AllJ1000 REPL)
-63		10	. TERMINAL, PIN: (SEE AllJ2001 REPL)
-64		9	. SWITCH, SLIDE: (SEE A11S101, S201, S305, S315,
1			\$317,\$401,\$440,\$611,\$650 REPL)
-65	361-1081-00	1	. SPACER, LED: PLASTIC
-66		1	. RES, VAR, NONWIR: (SEE AllR455 REPL)
-67		1	. RES, VAR, NONWIR: (SEE AllR557 REPL)
-68		2	. SWITCH, SLIDE: (SEE AllS464, S564 REPL)
-69		1	. SWITCH, PUSH: (SEE AllS264 REPL)
-70		1	. SWITCH, PUSH: (SEE Alls390 REPL)
-71		5	. RES, VAR, NONWIR: (SEE AllR190, R290, R395, R726,
		2	R807 REPL)
-72	407-2584-00	1	BRACKET, GROUND: FRONT PANEL, BRASS (ATTACHING PARTS)
-73	211-0304-00	2	SCREW, MACHINE: 4-40 X 0.312, PNH
7/	343-0089-00	1	CLAMP, LOOP: LARGE
-75	441-1535-00	. 1	
-15	411 2000		(ATTACHING PARTS)
-76	213-0881-00	2	
		1	TRANSISTOR:(SEE Q938 REPL) (ATTACHING PARTS)
	211-0318-00	1	SCREW, MACHINE: 4-40 X 0.75, FLH, 100 DEG
	210-0586-00	1	NUT, PL, ASSEM WA: 4-40 X 0.25, STL CD PL
	210 0300 00		*
	342-0582-00	1	INSULATOR, PLATE: TRANSISTOR, CERAMIC
	343-1025-00		RETAINER, XSTR:
		ĩ	
	344-0154-03	2	. CLIP, ELECTRICAL: FUSE, CKT BD MT

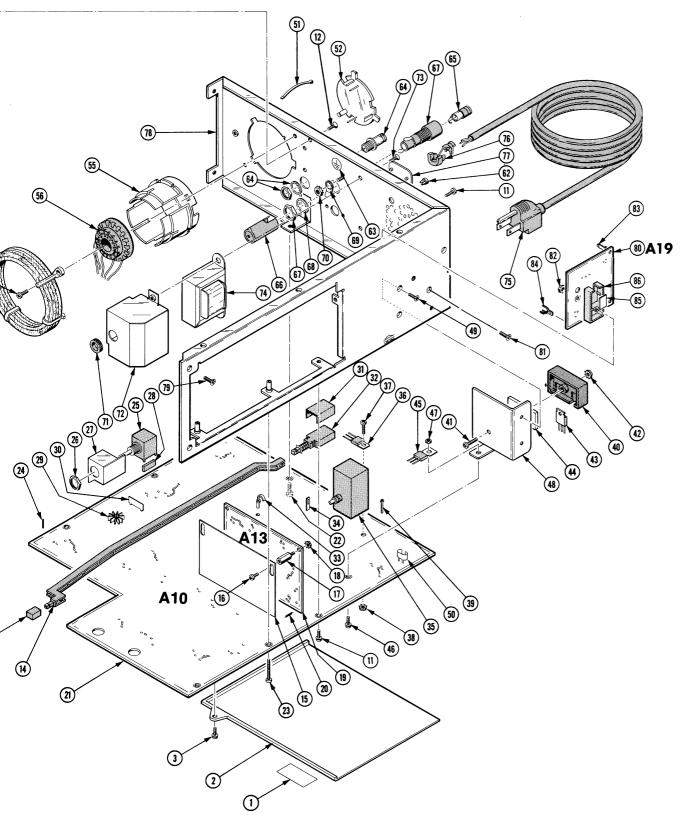
80009 407-2584-00 01536 OBD 80009 343-0089-00 80009 441-1535-00 01536 OBD 93907 OBD 83385 OBD 80009 342-0582-00 80009 343-1025-00 80009 344-0154-03

80009 361-1081-00

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-15	337-2915-00		1	SHIELD, ELEC: ALTERNATE SWEET
				(ATTACHING PARTS)
-16	211-0304-00		2	SCREW, MACHINE: 4-40 X 0.312, PNH
-17	129-0906-00		2	SPACER, POST: 0.685 L W/4-40 INT & EXT THD
				(ATTACHING PARTS)
-18	210-0586-00		2	NUT, PL, ASSEM WA: 4-40 X 0.25, STL CD PL
-10			1	
	131-0589-00			TERMINAL, PIN: 0.46 L X 0.025 SO
-21		1	1	CKT BOARD ASSY:MAIN(SEE A10 REPL)
-21			1	(ATTACHING PARTS)
-22	213-0882-00		3	SCREW, TAPPING: 6-32 X 0.437 TYPE C
	211-0302-00			SCREW, MACHINE: 4-40 X 0.75, PNH
-23	211-0302-00		2	*
			_	CKT BOARD ASSY INCLUDES:
-24				. TERMINAL, PIN: (SEE A10P1011, P2011, P6001,
				. P7001,P7055 REPL)
-25				. RES, VAR, NONWIR: (SEE Alor883 REPL)
				(ATTACHING PARTS)
-26	220-0495-00		1	. NUT, PLAIN, HEX.: 0.375-32 X 0.438 INCH BRS
	220 0173 00			*
-27	337-2945-00		1	. SHIELD, ELEC: POTENTIOMETER
-28	361-1047-00		1	. SPACER, VAR RES: 0.3 X 0.615 X0.55
-29		B010100 B019549	2	. HEAT SINK, XSTR: TO-18, AL BLACK ANODIZED
	214-3414-00	B019550	2	
-30	337-2922-00		1	. SHIELD, ELEC: HORIZONTAL AMPLIFIER
-31			1	
			1	. SWITCH, PUSH: (SEE AlOS901 REPL)
-33	343-0088-00		1	. CLAMP, LOOP: 0.062 INCH DIA
-34	131-1048-00		4	. TERM.QIK DISC:CKT BD MT, 0.11 X 0.02
-35			1	. SEMICOND DEVICE: (SEE A10U990 REPL)
-36			1	. THYRISTOR: (SEE A100925 REPL)
				(ATTACHING PARTS)
-37	211-0304-00		1	. SCREW, MACHINE: 4-40 X 0.312, PNH
-38	210-0406-00		1	. NUT, PLAIN, HEX.: 4-40 X 0.188 INCH, BRS
				*
-39			9	. TERM, TEST POINT: (SEE A10TP500, TP501, TP915,
			-	. TP920, TP934, TP940, TP951, TP952 REPL)
-40	343-0969-00		1	. RETAINER, XSTR: POLYPHENYLENESULFIDE
				(ATTACHING PARTS)
-41	211-0691-00		1	. SCREW, MACHINE: 6-32 X 0.625, PNH
-42	210-0457-00		1	. NUT, PL, ASSEM WA:6-32 X 0.312, STL CD PL

80009 343-0088-00 00779 61134-1 01536 OBD 73743 12161-50 80009 343-0969-00

01536 OBD 83385 OBD

00007 337-7313-00

80009 129-0906-00

22526 48283-029

01536 OBD

83385 OBD

01536 OBD 01536 OBD

73743 OBD

80009 337-2945-00 80009 361-1047-00 05820 201-AB 13103 2224B 80009 337-2922-00 80009 200-2735-00

-54	213-0882-00	2	SCREW, TAPPING: 6-32 X 0.437 TYPE C	01536	OBD
-55	426-1766-00	1	MOUNT, RESILIENT: CRT, REAR	80009	426-1766-00
	136-0202-04		SKT, PL-IN ELEK: ELECTRON TUBE, 14 CONT		136-0202-04
	334-1379-00		LABEL: CRT, ADHESIVE BACK		334-1379-00
	334-1951-00		MARKER, IDENT: CRT WARNING		334-1951-00
	337-2774-00		SHIELD, ELEC: CRT, STEEL		337-2774-00
	386-4443-00		SUPPORT, SHIELD: CRT, FRONT, PLASTIC		386-4443-00
-61			ELECTRON TUBE: (SEE V870 REPL)	00007	300 1113 00
	134-0158-00		BUTTON, PLUG: 0.187 DIA, NYLON	02768	207-080501-00
	334-3379-02		MARKER, IDENT: MARKED GROUNDSYMBOL	80009	
			CONN, RCPT, ELEC: (SEE J8001 REPL)	0000)	337 3377 32
-65			CAP., FUSEHOLDER: 3AG FUSES	\$3629	FEK 031 1666
	200-1388-03		COVER, FUSE, LEAD: POLYURETHANE		200-1388-03
	204-0833-00		BODY, FUSEHOLDER: 3AG & 5 X 20MM FUSES		031.1653(MDLFEU)
-68			WASHER, LOCK: INT, 0.521 ID X 0.625 INCH OD	24931	
-69	210-0202-00		TERMINAL, LUG: 0.146 ID, LOCKING, BRZ TINNED (ATTACHING PARTS)	7 :	2104-06-00-2520N
-70	210-0457-00	1	NUT, PL, ASSEM WA:6-32 X 0.312, STL CD PL	83385	OBD
-71	348-0738-00	1	GROMMET, PLASTIC: 0.312 ID, NYLON, BLACK	28520	SB-437-5
-72	337-2947-00	1		80009	
-73	211-0303-00	2	SCREW, MACHINE: 4-40 X 0.25, FLH 100 DEG	01536	OBD
-74		1	COIL, RF: (SEE L925 REPL)		
-75	161-0033-26 B010100 B014649	1	CABLE ASSY, PWR: 3, 18 AWG, 125V, 101.3 L	16428	KH-9230
	161-0104-00 B014650	1		16428	КН8352
	131-1084-03 XB014650	1	CONN, RCPT, ELEC: PWR, MALE, 250VAC, 6A	82389	EAC-301
	210-0586-00 XB014650	2		83385	OBD
	210-0803-00 XB014650	1	WASHER, FLAT: 0.15 ID X 0.032 THK, STL CD PL	12327	OBD
	211-0323-00 XB014650	2	SCREW, MACHINE: 4-40 X 0.312, FLH, 100 DEG	83385	OBD
	213-0882-00 XB014650	1	SCREW, TAPPING: 6-32 X 0.437 TYPE C	01536	OBD
	343-0002-00 XB014650	1	CLAMP, LOOP: 0.188 INCH DIA	95987	3-16-6B
	195-0389-00 XB014650	1	LEAD, ELECTRICAL: 18 AWG, 4.0 L, 5-4	80009	195-0389-00
	195-5498-00 XB014650	1	LEAD, ELECTRICAL: 18 AWG, 2.5 L, 8-9	80009	195-5498-00
	195-5499-00 XB014650	1	LEAD, ELECTRICAL: 18 AWG, 3.5 L, 8-0	80009	195-5499-00
-76	358-0161-00 B010100 B011399	1	BSHG, STRAIN RLF: FOR 0.50 INCH HOLE, PLASTIC	28520	1147 SR-5P-4
	358-0161-01 B011400	1	BSHG, STRAIN RLF: FOR 0.29 INCHDIA CABLE	28520	1154 SR-5L-1
	348-0746-00 XB011400	1	CUSHION, IDCTR: MOLDED POLYURETHANE	80009	348-0746-00
	211-0303-00 XB011400	1		01536	OBD
	210-0586-00 XB011400	1	NUT, PL, ASSEM WA: 4-40 X 0.25, STL CD PL	83385	- T 17 15
-77	200-2531-00	1	COVER, POWER: PLASTIC	80009	200-2531-00

REV MAY 1982 10-7

175-4232-00 1 CA ASSY, SP, ELEC: 2, 26 AWG, 4.0 L, RIBBON - (FROM All TO R647)

80009 175-4232-00

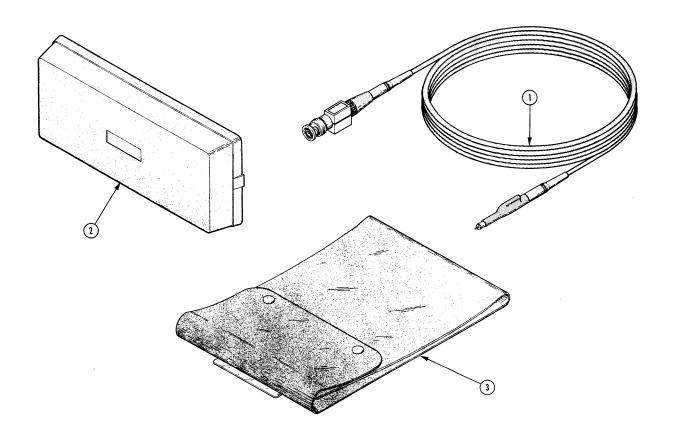


Fig. & Index	Tektronix		Model No.	0.	10045	Normal Description	Mfr	<b>M</b> ( <b>D</b> + <b>M</b> +
<b>N</b> o.	Part No.	Eff	Dscont	uty	1 2 3 4 5	Name & Description	Code	Mfr Part Number
					ACCESSO	RIES		
-1	010-6120-0	1		2	•	:P6120,1.5M L,10 X W/ACCESS	80009	010-6120-01
	013-0191-0	0		2	TIP PROBE:W/A		80009	013-0191-00
	070-3398-0			1	MANUAL, TECH: 0		80009	070-3398-00
	070-3826-0	0		1	MANUAL, TECH: S		80009	0,70-3826-00
	159-0021-0	0 B010	100 B021999	1	•	E:3AG,2A,250V,FAST-BLOW	71400	AGC 2
	159-0019-0	0 B022	000	1	FUSE, CARTRIDGE	E:3AG,1A,250V,SLOW BLOW	71400	MDL1
		,			OPTIONA	L ACCESSORIES		
	020-0672-0	0		1	ACCESSORY KIT	•	80009	020-0672-00
-2	200-2520-0	0		1	. COVER, SCOPE	FRONT, ABS	80009	200-2520-00
-3	016-0677-0	0		1	. POUCH, ACCES	SORY:	80009	016-0677-00
	386-4674-0	0		1	PLATE, MOUI	TING: ACCESSORY POUCH	80009	386-4674-00
	386-2370-0	0		2	PLATE, REII	F:ACCESSORY POUCH	80009	386-2370-00
	212-0068-0	0		4	SCREW, MACI	HINE:8-32 X 0.312 INCH, TRH STL	77250	OBD
	220-0736-0	0		4	NUT, PL, EXT	WSHR:8-32 X 0.344 HEX, NYLON	23050	OBD

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

ANGE INFORMATION

This material provides the additional information required to support those instruments which have been produced with the Preregulator circuit board. When servicing your instrument, use the appropriate text, schematic diagram, board charts, and dollies applicable to your particular instrument.

# TEXT CORRECTIONS

Page 3-25 First paragraph following the POWER SUPPLY heading REPLACE WITH:

The Power Supply circuitry converts the ac-source voltage

into the various voltages needed for instrument operation. It consists of the Power Input, Preregulator, and Inverter circuits (which drive the primary of the power transformer) and other Secondary circuits (which produce the necessary supply voltages for the instrument).

This instrument has either the Current Limit board (A19) or

This instrument has either the Current Limit board (A19) or the Preregulator board (A18) installed as part of the power supply. Refer to the appropriate circuit description for your particular instrument configuration.

Page 3-25 Power Input heading REPLACE WITH:

Current Limit Board Configuration

DELETE: Preregulator heading



affelliated by Tille Tiller thann't common-mode framatormer rant, differential-mode transformer T907, and capacitors C901, C903, C904, and C905. Capacitors C907, C908, and C910 form a high-frequency bypass network to prevent the diodes in CR904 from generating EMI.

The Preregulator provides a regulated dc-output voltage for use by the Inverter circuitry.

When the instrument is turned on, voltage developed across C909 will charge C913 through R911. When the voltage has risen to a level high enough that U920 can reliably drive 0933, U920 will receive its Vcc voltage through Q915. This level is set by zener diode VR917 in the emitter circuit of Q917 and by the voltage divider consisting of R912 and R913. The zener diode will keep 0917 off until the voltage at its base reaches approximately 6.9 V. Then 0917 will be biased into its active region and the resulting collector current will cause a voltage drop across R916. This voltage drop will bias on Q915, and the positive feedback through R914 will reinforce the turn on of Q917. Thus Q915 and Q917 will drive each other into saturation very quickly. Once Q915 is on, U920 will begin to function.

Pulse-width modulator IC U920 controls the output voltage of the Preregulator by regulating the duty cycle of the pulse applied to the gate of Q933. It utilizes an oscillator whose frequency is determined by R920 and C920 (approximately 40 kHz) and whose output at pin 5 is a sawtooth voltage. An internal comparator compares this sawtooth voltage with the output voltage produced by the two error amplifiers. Whenever the sawtooth voltage is greater than the error-amplifier output voltage, Q933 is biased on to supply current to both C934 and the rest of the circuitry. The two error amplifiers are used to maintain a



With Q933 off, C933 charges to the output voltage of the Power Input circuit. When 0933 turns on, current through the FET will come from the winding connected to pins 1 and 2 of T933 and from C933. Current to C933 is supplied by the winding connected to pins 4 and 5 of T933. When U920 shuts off Q933, the collapsing magnetic field will raise the voltage at the anode of CR933. This diode then becomes forward biased and passes current supplied by the winding connected to pins 4 and 5 of T933 and from C933. For this part of the cycle, current to C933 will be supplied by the winding connected to pins 1 and 2 of T933. This process will continue for each period of the oscillator, and the duty cycle will be altered as necessary to maintain 43 V across C934. To shut off Q933 during each oscillator period, Q931 is used to discharge the gate-drain capacitance. Pin 10 of U920 goes LO, reverse biasing CR931 and turning on Q931 to effectively short together the gate and source, thus shutting off the FET.

Once the supply is running, power to U920 will be supplied from the winding connected to pins 6 and 7 of T933. Diode CR913 half-wave rectifies the voltage across pins 6 and 7 to keep filter capacitor C913 charged and to maintain Vcc voltage to U920 through Q915.

Instrument protection from excessive output voltage is supplied by silicon-controlled rectifier Q935. Should the Preregulator output voltage exceed 51 V, zener diode VR935 will conduct, causing Q935 to also conduct. The Preregulator output current will then be shunted through Q935, and the output voltage will very quickly go to zero. With the Vcc voltage of U920 not longer being supplied by the winding connected to pins 6 and 7 of T933, the Preregulator will shut down and Q935 will be reset.

the inverter part

ADD:

#### NOTE

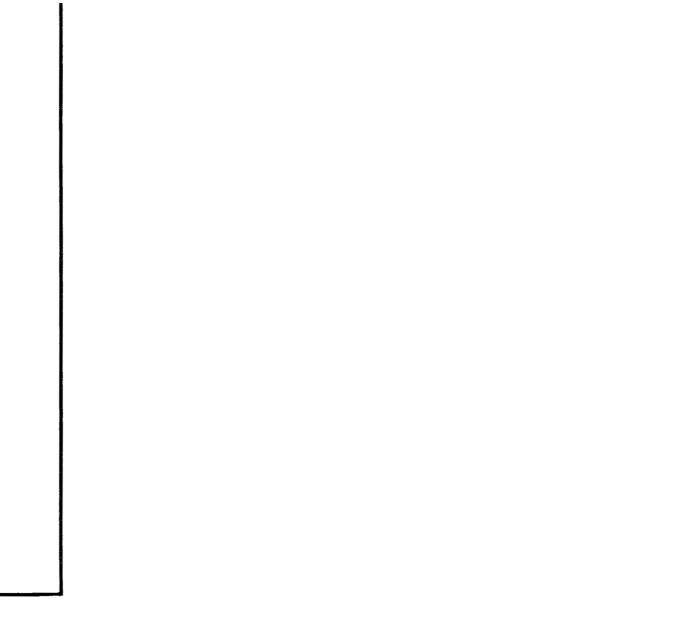
The following paragraph applies only to instruments having the Current Limit board.

Page 5-4 WARNING following part a

REPLACE WITH:

#### WARNING

To avoid electric shock and instrument damage when checking either the Head Room Voltage or the Preregulator Output Voltage, use a digital voltmeter that is isolated from ground, since the Inverter power-supply circuitry common is at line potential.



The following adjustment is only applicable to instruments having the Current Limit board (Al9).

d. ADJUST-Head Room Voltage Adjust (R952) for +4.3 V.

Page 6-13 Cathode-Ray Tube procedure, after step 3

ADD:

3a. For instruments with the Preregulator board (Al8), remove two nuts securing the shield at the back of the crt and remove the shield.

Page 6-13 Cathode Ray Tube procedure, after step 6

ADD:

6a. If applicable, reinstall the shield at the back of the crt; then secure it with two nuts (removed in step 3a).

Page 6-14 High-Voltage Shield procedure, after step 5

ADD:

5a. For instruments equipped with the Preregulator board (Al8), remove the screw from the front of the High-Voltage Shield at the upper-left hand corner.

installed. Use the appropriate board-removal procedure for your particular instrument.

After the Current Limit Circuit Board procedure Page 6-18

ADD:

Preregulator Circuit Board

To remove the Preregulator circuit board, perform the following steps:

- 1. Remove the High-Voltage shield (see the "High-Voltage Shield" removal procedure).
- 2. Remove two screws securing the Preregulator board mounting brackets (one at the rear-top of the frame and one on the right side near the back corner of the frame).
- 3. Remove the securing screw through the access hole of the clear plastic shield from the top of the Preregulator board at the front-right corner.
- 4. Disconnect four wire connectors from the Preregulator board and note their positions for reinstallation reference.

- 7. Reinstall the securing screw at the top of the Preregulator board (removed in step 3).
- 8. Reinstall the two bracket screws (removed in step 2).
- 9. Reinstall the High-Voltage shield (see the "High-Voltage Shield" reinstallation procedure).

A18C910	283-0335-00
A18C913	290-0770-00
A18C920	281-0852-00
A18C921	281-0775-00
A18C923	281-0772-00
A18C925	281-0820-00
A18C929	281-0809-00
A18C933	285-0932-00
A18C934	290-0831-00
A18C935	283-0208-00
A18CR904	152-0750-00
A18CR913	152-0061-00
A18CR931	152-0061-00
A18CR933	152-0661-00
A18E933	276-0640-00
A18L937	108-0422-00
A18L938	108-0422-00
A18P801	131-1048-00
A18P802	131-1048-00
A18P803	131-1048-00
A18P804	131-1048-00
A18Q915	151-0164-00
A18Q917	151-0432-00
A18Q931	151-0164-00
A18Q933	151-1152-00
A18Q935	151-0506-00

CAP.,FXD,CER DI:0.1UF,20%,600V CAP.,FXD,ELCTLT:100UF,+50-10%,25V CAP.,FXD,CER DI:1800PF,10%,100V CAP., FXD, CER DI:0.1UF, 20%, 50V CAP.,FXD,CER DI:4700PF,10%,100V CAP.,FXD,CER DI:680PF,10%,50V CAP.,FXD,CER DI:200PF,5%,100V CAP.,FXD,PLASTIC:1UF,10%,400V CAP.,FXD,ELCTLT:470UF,+50-10%,50V CAP.,FXD,CER DI:0.22UF,10%,200V SEMICOND DVC,DI:RECT BRIDGE,600V,3A,FAST REC SEMICOND DVC, DI:SW, SILICON, 175V, 0.1A SEMICOND DVC,DI:SW,SILICON,175V,0.1A SEMICOND DVC,DI:RECT,SILICON,600V,3A,FAST REC CORE,EM:0.187 X 0.188 COIL, RF: FIXED, 82 UH COIL, RF: FIXED, 82 UH TERM,QIK DISC:0.11 X 0.02 BL TRANSISTOR: SILICON, PNP TRANSISTOR: SILICON, NPN TRANSISTOR: SILICON, PNP TRANSISTOR: SILICON, MOSFE, N-CHANNEL SCR:SILICON

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HIONSES	313-0103-00
A18R931	315-0302-00
A18R933	308-0843-00
A18R934	308-0441-00
A18R935	315-0121-00
A18R936	315-0470-00
A18R937	301-0822-00
A18RT901	307-0350-00
A18RT902	307-0350-00
A18T901	120-1449-00
A18T907	120-1441-00
A18T933	120-1439-00
A18U920	156-1627-00
A18VR917	152-0166-00
A18VR935	152-0255-00
	the A10 circuit board assembly.
REMOVE:	
A10C912	281-0770-00
A10C915	290-0188-00
A10C917	290-0808-00

A10CR903 152-0040-00 A10CR904 152-0040-00 A10CR905 152-0040-00 A10CR906 152-0040-00 A10CR917 152-0141-00 A10CR931 152-0782-00 A10CR933 152-0782-00 RES.,FXD,CMPSN:3K OHM,5%,0.25W RES.,FXD,WW:0.2 OHM,5%,1W RES.,FXD,WW:3 OHM,5%,3W RES.,FXD,CMPSN:120 OHM,5%,0.25W RES.,FXD,CMPSN:47 OHM,5%,0.25W RES.,FXD,CPSN:8.2K OHM,5%,0.5W RES.,THERMAL:7.5 OHM,10%,3.9%/DEG C RES.,THERMAL:7.5 OHM,10%,3.9%/DEG C

TRANSFORMER:

TRANSFORMER:RF:POT CORE TRANSFORMER:RF:

MICROCKT,LINEAR:MOD CONTR CKT SEMICOND DVC DI:ZENER,0.4W,6.2V,5% SEMICOND DVC DI:ZENER,0.4W,51V,5%

CAP.,FXD,CER DI:0.001UF,20%,100V CAP.,FXD,ELCTLT:0.1UF,10%,35V CAP.,FXD,ELCTLT:2.7UF,10%,20V

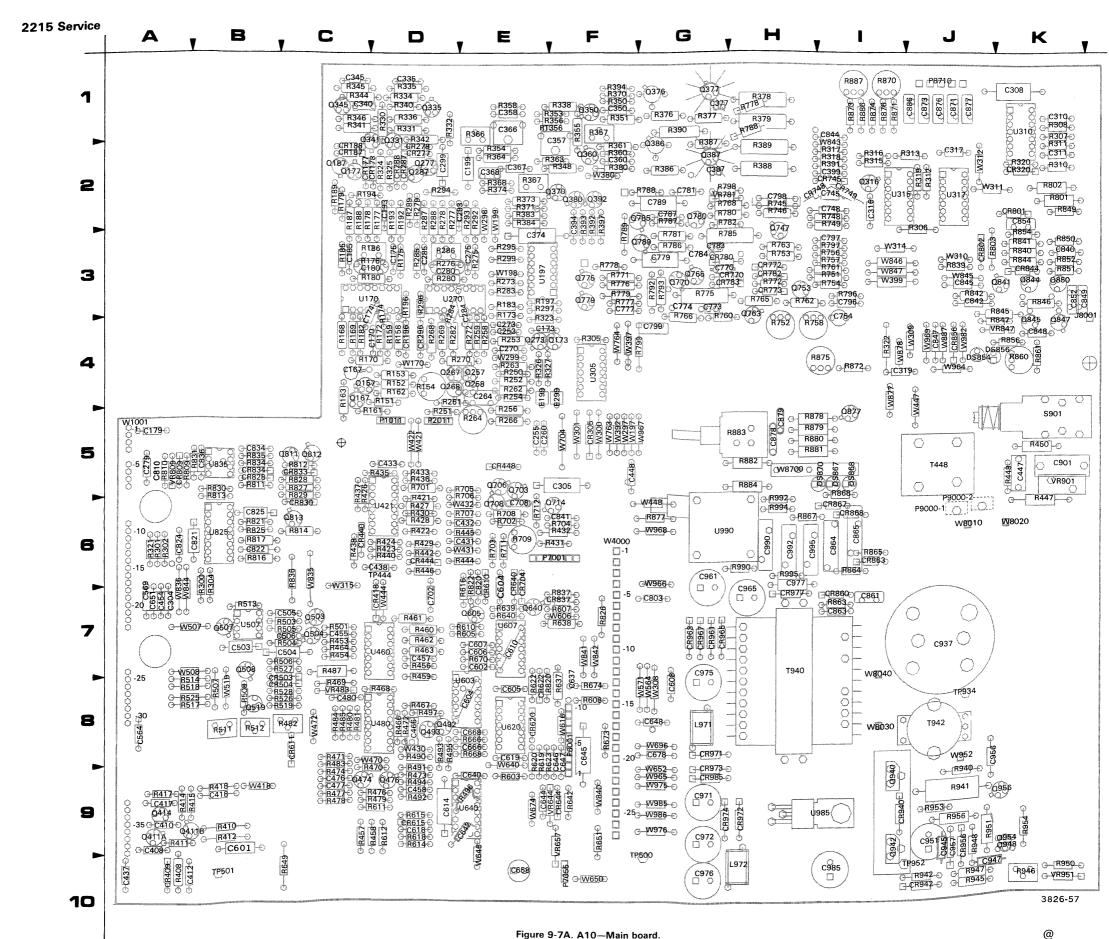
SEMICOND DEVICE:SILICON,600V,1A
SEMICOND DEVICE:SILICON,600V,1A
SEMICOND DEVICE:SILICON,600V,1A
SEMICOND DEVICE:SILICON,600V,1A
SEMICOND DEVICE:SILICON,30V,150MA
SEMICOND DEVICE:RECTIFIER,SILICON,600V
SEMICOND DEVICE:RECTIFIER,SILICON,600V

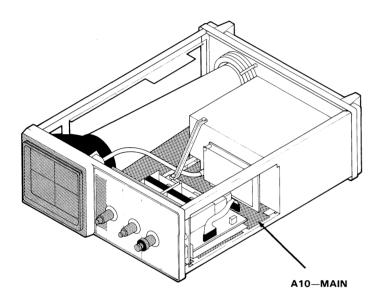
A10R926	301-0471-00
A10R952	311-1562-00
A10R953	315-0361-00
A10T925	120-1384-00
A10TP915	214-0579-02
A10TP920	214-0579-02
A10TP921	214-0579-02
A10U931	156-0885-00
A10VR913	152-0304-00
A10VR914	152-0149-00
A10VR915	152-0149-00
A10VR938	152-0788-00
ADD:	
A10R953	315-0203-00
A10W952	176-0122-01
REMOVE:	
F901	159-0021-00
L925	108-1096-00
ADD: F901	159-0019-00

RES.,FXD,CMPSN:470 OHM,5%,0.50W RES., VAR, NONWIR: 2K OHM, 20%, 0.50W RES.,FXD,CMPSN:360 OHM,5%,0.25W TRANSFORMER, RF: TOROID, 2 WINDS TERM, TEST POINT: BRS CD PL TERM, TEST POINT: BRS CD PL TERM, TEST POINT: BRS CD PL MICROCIRCUIT, LI: OPTOELECTRONIC ISOLATOR SEMICOND DEVICE: ZENER, 0.4W, 20V, 5% SEMICOND DEVICE: ZENER. 0.4W, 10V.5% SEMICOND DEVICE: ZENER, 0.4W, 10V, 5% SEMICOND DEVICE:TRANSIENT SUPPRESSOR RES.,FXD,CMPSN:20K OHM,5%,0.25W WIRE:22 AWG BARE, 12.0 V CHASSIS PARTS FUSE, CARTRIDGE: 3AG, 2A, 250V, FAST-BLOW COIL, RF: FIXED, 16MH, 25%

FUSE, CARTRIDGE: 3AG, 1A, 250V, FAST-BLOW

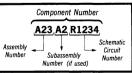
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### COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

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# A10—MAIN BOARD

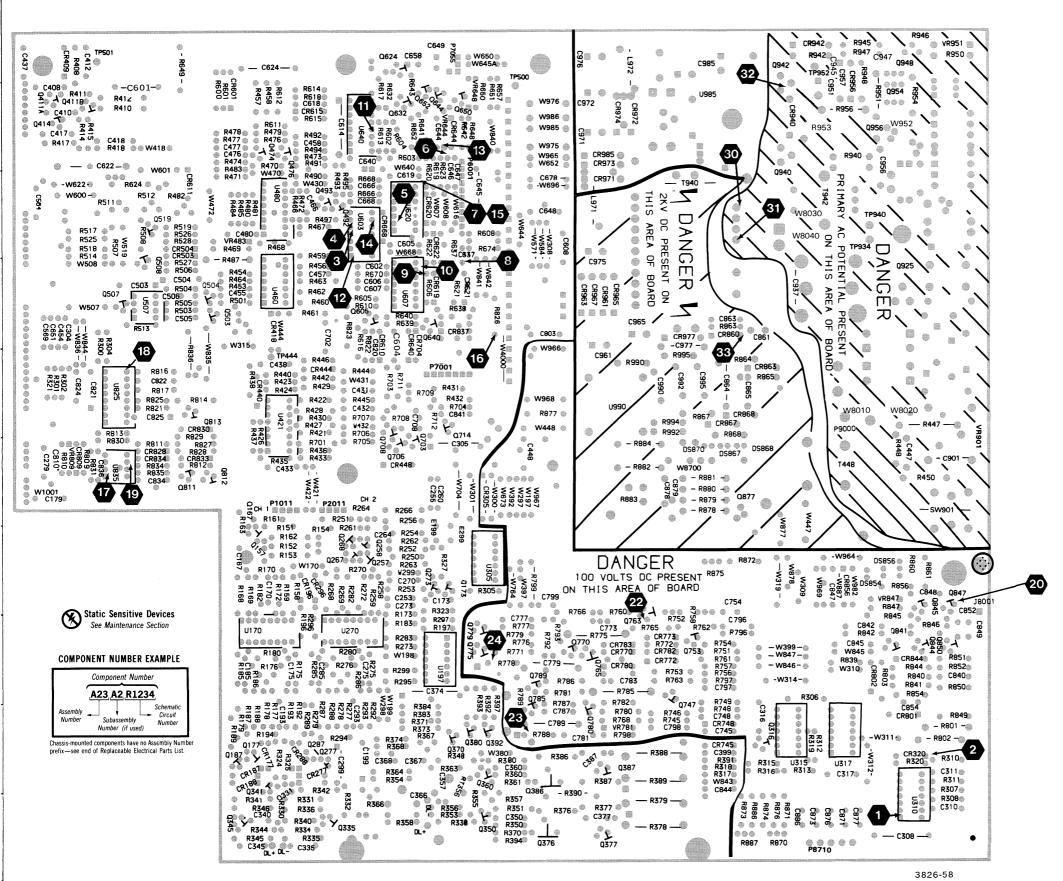
CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C167	2	C610	5	C985	9	P2011-1	2	Ω779	7	R287	2
C170	2	C614	4	C990	9	P2011-2	2	Q780	7	R288	2
C173 C174	2	C618	4	C992 C995	9	P2011-3	2	Q785	7	R289 R292	2 2
C174	2	C619 C637	5 5	C995 CR177	9	P2011-4 P6001-1	2 5	Q789 Q811	7 6	R292	2
C179	2	C640	4	CR178	3	P6001-1	10	Q812	6	R294	2
C180	2	C642	5	CR187	3	P6001-3	10	Q813	6	R295	2
C185	2	C644	5	CR188	3	P6001-4	5	Q841	6	R296	2
C193 C199	2 2	C645 C646	5 5	CR196 CR277	2	P6001-5	5	Q844	6	R297 R299	2 2
C253	2	C647	5	CR277	3	P6001-6 P6001-7	5 5	Q845 Q847	6	R299 R300	3
C255	2	C648	10	CR287	3	P6001-7	10	Q850	6	R301	3
C260	2	C651	10	CR288	3	P6001-9	7	Q877	9	R302	3
C264	2	C658	10	CR296	2	P6001-10	7	Q940	9	R304	3
C270	2	C666	5	CR305	3	P7001-1	9	Q942	9	R305	3
C273 C275	2 2	C668 C678	5 3	CR320 CR409	3 4	P7001-2 P7001-3	9	Q948 Q954	9	R306 R307	3
C279	2	C702	7	CR418	4	P7001-3	9	Q956	9	R308	3
C280	2	C708	7	CR440	4	P7001-5	7	R151	2	R310	3
C284	2	C745	7	CR444	4	P7001-6	7	R152	2	R311	3
C285	2	C748	7	CR448	4	P7001-7	6	R153	2	R312	3
C293 C299	2 2	C754 C770	7 7	CR503 CR504	4	P7055-1 P7055-2	10	R154	2 2	R313 R315	3 3
C299 C304	3	C773	7	CR504 CR610	4 5	P7055-2 P7055-3	10 10	R158 R159	2	R315	3
C305	3	C774	7	CR611	4	P8710-1	9	R161	2	R317	3
C308	3	C777	7	CR615	4	P8710-2	9	R162	2	R318	3
C310	3	C779	7	CR620	5	P8710-3	9	R163	2	R319	3
C311	3 3	C781 C783	7 7	CR622	5	P8710-4	9	R168	2	R320 R321	3
C316 C317	3	C784	7	CR640 CR644	5 5	P8710-5 P9000-1	9	R169 R170	2 2	R321	3
C319	3	C787	7	CR704	3	P9000-1	9	R172	2	R323	3
C335	3	C789	7	CR745	7	Q157	2	R173	2	R324	3
C340	3	C796	7	CR748	7	Q167	2	R174	2	R325	3
C345	3	C797	7	CR749	7	Q173	2	R175	2	R326	3
C350 C357	3 3	C798 C799	7	CR770 CR772	7 7	Q177 Q187	2 2	R176 R177	2 2	R327 R330	3 3
C358	3	C803	6	CR773	7	Q257	2	R177	2	R331	3
C360	3	C810	6	CR780	7	Q258	2	R179	2	R332	3
C366	3	C820	6	CR782	7	Q267	2	R180	2	R334	3
C367	3	C821	6	CR783	7	Q268	2	R182	2	R335	3
C368 C374	3	C822 C824	6	CR801 CR802	6 6	Q273 Q277	2 2	R183 R185	2 2	R336 R338	3
C377	3	C824 C825	6	CR809	6	Q287	2	R186	2	R340	3
C387	3	C834	6	CR828	6	Q316	3	R187	2	R341	3
C394	3	C836	6	CR830	6	Q331	3	R188	2	R342	3
C399	3	C840	6	CR833	6	Q335	3	R189	2	R344	3
C408 C410	4	C841	7	CR834	6	Q341 Q345	3 3	R192 R193	2 2	R345 R346	3
C410	4	C842 C844	6	CR837 CR844	6 6	Q350	3	R194	2	R348	3
C417	4	C845	7	CR856	6	Q360	3	R196	2	R350	3
C418	4	C847	6	CR860	9	Q370	3	R197	2	R351	3
C431	4	C848	6	CR863	9	Q376	3	R250	2	R353	3
C432	4	C849	6	CR867	9	Q377 Q380	3	R251	2 2	R354 R355	3
C433 C437	4	C852 C854	6	CR868 CR940	9	Q386	3	R252 R253	2 2	R355	3
C437	4	C861	9	CR940 CR942	9	Q387	3	R254	2	R357	3
C447	9	C863	9	CR956	9	Q392	3	R256	2	R358	3
C448	9	C864	9	CR961	9	Q411	4	R258	2	R360	3
C454	4	C865	9	CR963	9	Q414 Q474	4	R259	2	R361 R363	3 3
C455 C457	4	C871 C873	9	CR965 CR967	9	Q474 Q476	4	R261 R262	2 2	R364	3
C457	4	C873	9	CR967 CR971	9	Q492	4	R263	2	R366	3
C466	4	C877	9	CR972	9	Q493	4	R264	2	R367	3
C476	4	C878	9	CR973	9	Q503	4	R266	2	R368	3
C477	4	C879	9	CR974	9	Q504	4	R268	2	R370	3
C480 C503	4	C886 C901	9	CR977 CR985	9	Q507 Q508	4	R269 R270	2 2	R371 R373	3
C504	4	C901	9	DS854	6	Q519	4	R270	2	R374	3
C505	4	C945	9	DS856	6	Q605	4	R273	2	R376	3
C506	4	C947	9	DS867	9	Q640	5	R275	2	R377	3
C564	10	C951	9	DS868	9	Q703	7	R276	2	R378	3
C569 C602	10 5	C956	9	DS870	9	Q706	7	R277 R278	2 2	R379 R380	3
C602 C601	10	C957 C961	9	E199 E299	2 2	Q708 Q714	7	R278 R279	2 2	R380 R383	3
C603	6	C965	9	L971	9	Q747	7	R280	2	R384	3
C604	5	C971	9	L972	9	Q753	7	R282	2	R386	3
C605	6	C972	9	P1011-1	2	Q763	7	R283	2	R387	3
C606	5	C975	9	P1011-2	2	Q765	7	R284	2	R388	3
C607 C608	5 10	C976 C977	9	P1011-3 P1011-4	2 2	Q770 Q775	7	R285 R286	2 2	R389 R390	3
2300	.,			L		4.75	,				



CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBE
R391	3	R506	4	R785	7	R950	9	W508	4	W4000-2	10
R392	3	R507	4	R786	7	R951	9	W519	4	W4000-3	9
R393	3	R508	4	R787	7	R953	9	W564	10	W4000-4	10
R394	3	R511	4	R788	7	R954	9	W571	10	W4000-5	7
R397	3	R512	4	R789	7	R956	9	W606	10	W4000-6	10
R408	4		4	R792	7	R990	9	W616	5	W4000-7	3
		R513	i e			R992	9				
R410	4	R514	4	R793	7	1	9	W640	5	W4000-8	6
R411	4	R517	4	R796	7	R994		W646	5	W4000-9	6
R412	4	R518	4	R797	7	R995	9	W650	10	W4000-10	10
R414	4	R519	4	R798	7	RT356	3	W652	3	W4000-11	7
R415	4	R525	4	R799	7	S901	9	W674	5	W4000-12	3
R417	4	R526	4	R801	6	T448	9	W696	7	W4000-12	10
R418	4	R527	4	R802	6	T940	9	W704	3	W4000-13	10
R421	4	R528	4	R803	6	T942	9	W763	7	W4000-14	10
R422	4	R603	5	R809	6	TP444	4	W764	7	W4000-15	10
R423	4	R605	4	R810	6	TP500	9	W835	6	W4000-16	10
R424	4	R607	10	R811	6	TP501	9	W836	6	W4000-17	10
R426	4	R608	5	R812	6	TP934	9	W840	7.	W4000-18	6
R427	4	R610	4	R813	6	TP952	9	W841	7	W4000-19	10
R428	4	R611	4	R814	6	U170	2	W842	7	W4000-20	10
R429	4	R612	4	R816	6	U197	2	W843	6	W4000-20 W4000-21	10
-	4		4		6		3			W4000-21	10
R430		R614		R817		U197		W844	6	W4000-22 W4000-23	9
R431	4	R615	4	R820	6	U270	2	W845	7		
R432	4	R616	6	R821	6	U305	3	W846	7	W4000-24	9
R433	4	R618	4	R822	6	U310	3	W847	7	W4000-25	9
R435	4	R619	5	R825	6	U315	3	W877	9	W4000-26	9
R436	4	R620	5	R826	6	U317	3	W878	9	W4000-27	9
R437	4	R622	5	R827	6	U421	4	W887	9	W8010	9
R438	4	R623	5	R828	6	U460	4	W952	9	W8020	9
R440	4	R637	5	R829	6	U480	4	W964	9	W8030	9
R442	4	R638	5	R830	6	U507	4	W965	9	W8040	9
R444	4	R639	5	R831	6	U603	5	W966	9	W8700-1	9
R445	4	R640	5	R834	6	U607	5	W967	7	W8700-2	9
R446	4	R642	5	R835	6	U640A	4	W968	9	W8700-3	9
R447	9	R649	10	R836	6	U640B	5	W969	7	W8700-4	9
R448	9	R651	10	R837	6	U640	5	W975	9	W8700-5	9
R450	9	R666	5	R839	6	U825	6	W976	9	W8700-6	9
	4		5			U835	6	W982	9	W8700-7	9
R453	4	R668		R840	6	1		W985	9		9
R454		R670	5	R841	6	U985	9			W8700-8	9
R456	4	R673	10	R842	6	U990	9	W986	9		
R457	4	R674	10	R844	6	VR483	4	W1001-1	6	ŧ	
R458	4	R701	7	R845	6	VR644	5	W1001-2	2	ľ	
R459	4	R702	7	R846	6	VR657	10	W1001-3	2		
R460	4	R703	7	R847	6	VR781	7	W1001-4	3		
R461	4	R704	7	R849	6	VR809	6	W1001-5	9	Ī	
R462	4	R705	7	R850	6	VR847	6	W1001-6	3		
R463	4	R706	7	R851	6	VR901	9	W1001-7	2	ŀ	
R464	4	R707	7	R852	6	VR951	9	W1001-8	6		
R466	4	R708	7	R854	6	W170	2	W1001-9	2		
R467	4	R709	7	R856	6	W197	2	W1001-10	2		1
R468	4	R711	7	R860	9	W198	2	W1001-11	3	I	
R469	4	R712	7	R861	9	W199	2	W1001-12	3	I	1
R470	4	R745	7	R863	9	W297	2	W1001-12	2	I	
R470 R471	4	R745	7	R864	9	W297 W298	2	W1001-13 W1001-14	9	I	1
	4		7		_		_			I	1
R472	4	R748		R865	9	W299	2	W1001-15	3		1
R473		R749	7	R867	9	W300	3	W1001-16	3	I	
R474	4	R751	7	R868	9	W301	3	W1001-17	10	ł	
R476	4	R752	7	R870	9	W308	3	W1001-18	10	l	1
R477	4	R753	7	R871	9	W309	3	W1001-19	4	1	1
R478	4	R754	7	R872	9	W310	3	W1001-20	4	1	
R479	4	R756	7	R873	9	W311	3	W1001-21	4	1	1
R480	4	R757	7	R874	9	W312	3	W1001-22	4	l	1
R481	4	R758	7	R875	9	W314	3	W1001-23	4	1	1
R482	4	R760	7	R876	9	W315	3	W1001-24	4	l	
R483	4	R761	7	R877	9	W380	3	W1001-25	10	I	
R484	4	R762	7	R878	9	W392	3	W1001-26	10	l	
R485	4	R763	7	R879	9	W397	3	W1001-27	10	I	1
R487	4	R765	7	R880	9	W399	7	W1001-28	10	!	
R490	4	R766	7	R881	9	W418	4	W1001-29	10	I	1
R491	4	R768	7	R882	9	W421	4	W1001-20	10	I	1
R491 R492	4	R771	7	R883	9	W421 W422	4	W1001-30	4	I	
	4		7	R884	9		I	W1001-31 W1001-32	9	I	1
R493		R772				W430	4			l	1
R494	4	R775	7	R886	9	W431	4	W1001-33	3	l	1
R495	4	R776	7	R940	9	W432	4	W1001-34	3	l	1
R496	4	R777	7	R941	9	W444	4	W1001-35	3	I	
R497	4	R778	7	R942	9	W447	9	W1001-36	4	I	
	4	R779	7	R945	9	W448	9	W1001-37	4	l	
R501				R946	9	W470	4	W1001-38	4	ı	1
R503	4	R780	7	N340						1	1
	4 4	R780 R781	7	R947	9	W472	4	W1001-39	4		

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A18-PREREGULATOR BOARD & CIRCUIT VIEW FIG. 9-12,

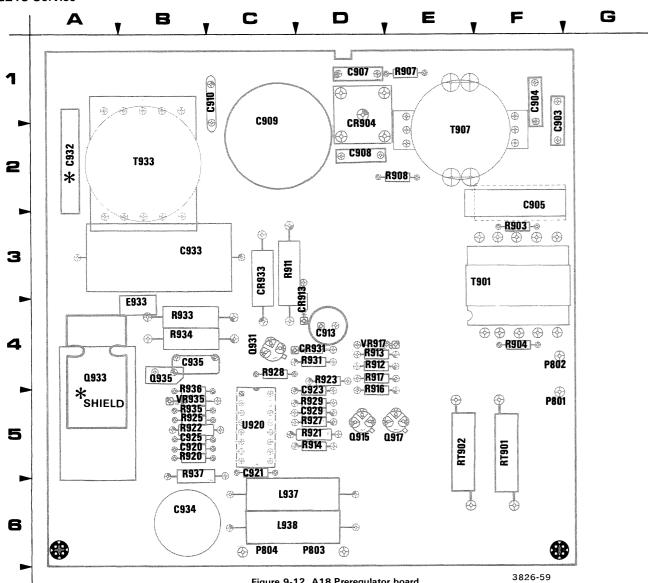
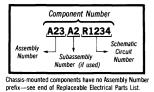


Figure 9-12. A18 Preregulator board.

Static Sensitive Devices
See Maintenance Section

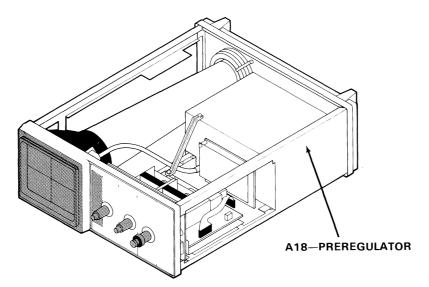
#### COMPONENT NUMBER EXAMPLE



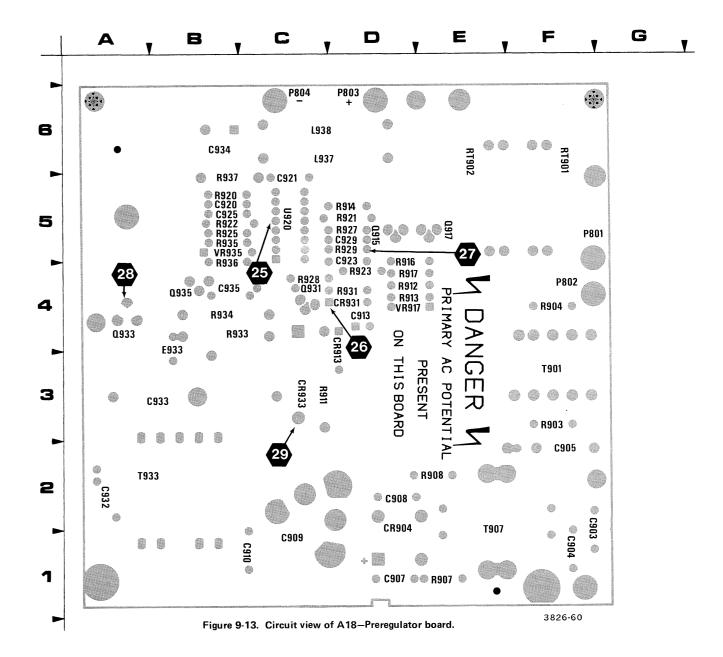
\* THIS INSTRUMENT UTILIZES EITHER C932 OR A SHIELD MOUNTED IN THE Q933 HOLDER, BUT NOT BOTH.

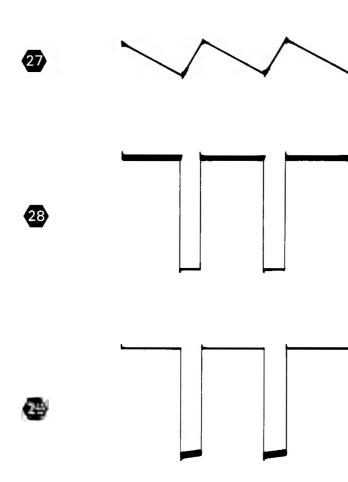
### A18—PREREGULATOR BOARD

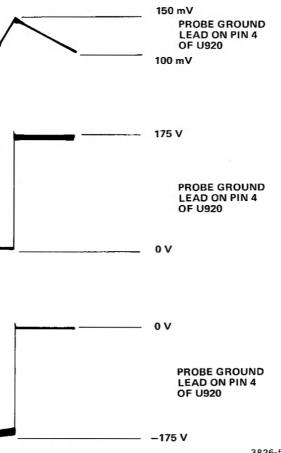
	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
I	C903	9	L937	9	R921	9
I	C903	9	L938	9	R922	9
İ	C904 C905	9	P801	9	R923	9
Į	C905	9	P802	9	R925	9
I	C908	9	P803	9	R927	9
l	C909	9	P804	9	R928	9
1	C910	9	Q915	9	R929	9
ı	C913	9	Ω917	9	R931	9
ı	C920	9	Q931	9	R933	9
	C921	9	0933	9	R934	9
ı	C923	9	Q935	9	R935	9
1	C925	9	R903	9	R936	9
	C929	9	R904	9	R937	9
ı	C929	9	R907	9	RT901	9
١	C932	9	R908	9	RT902	9
ı	C934	9	R911	9	T901	9
Ì	C935	9	R912	9	T907	9
ı	CR904	9	R913	9	T933	9
ı	CR913	9	R914	9	U920	9
	CR931	9	R916	9	VR917	9
	CR933	9	R917	9	VR935	9
	E933	9	R920	9	1	
	2000		120			1



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0337	OI	73	17001-2	O.L.	OE	noo/	414	-11	VV905	41
C945	4E	10J	P7001-3	8L	6E	R940	7F	9J	W966	3J
C947	4F	10J	P7001-4	8L	6F	R941	7G	9J	W968	31
C951	7F	10J	P8710-1	4N	1J	R942	7F	10J	W975	5J
C956	7F	9.J	P8710-2	3N	1J	R945	6D	10J	W976	6J
C957	7F	10J	P8710-3	5N	1J	R946	7D	10K	W982	6J
C961	3J	6G	P8710-4	2N	1J	R947	7D	10J	W985	6J
C965	3H	7H	P8710-5	2L	1J	R948	7E	9J	W986	6J
C971	51	9G	P9000-1	1A	6J	R950	6E	10K	W1001-5	8D
C972	61	9G	P9000-2	2A	6J	R951	7E	9J	W1001-14	8D
C975	51	8G				R953	8E	9J	W1001-32	8D
C976	61	10G	Q877	3L	51	R954	7F	9K	W4000-3	6L
C977	2L	7H	Q940	7G	91	R956	6F	9.J	W4000-23	6L
C985	6J	101	Q942	8G	91	R990	21	6H	W4000-24	7L
C990	21	6H	Q948	7E	10K	R992	21	6H	W4000-25	7L
C992	2J	6H	Q954	7E	10K	R994	2J	6H	W4000-26	6L
C995	2J	6Н	Q956	7F	9К	R995	2J	6Н	W4000-27 ₩8010	6L 1B
CR860	3J	71	R447	2B	6K	S901	1A	5K	W8020	2B
CR863	4K	61	R448	3B	5K	777	.,,,,		W8030	8H
CR867	2J	61	R450	2A	5K	T448	3B	5J	W8040	6G
CR868	2K	61	R860	3J	4K	T925	3C	7K	W8700-1	5L
CR940	7G	91	R861	4J	4K	T940	2H	7H	W8700-2	7L
CR942	8G	10J	R863	4J	71	T942	7F	8J	W8700-3	8L
CR956	7F	9.J	R864	3J	61			-	W8700-4	8L
CR961	31	7G	R865	3K	61	TP500	8D	10G	W8700-5	7L
CR963	31	7G	R867	2J	6Н	TP501	8D	10B	W8700-6	7L
CR965	3H	7G	R868	2J	61	TP934	6G	8K	W8700-7	7L
CR967	4H	7G	R870	2N	11	TP952	7G	8J	W8700-8	5L
CR971	5H	8G	R871	2N	111	, , ,	. •	~		

Partial A10 also shown on diagrams 2, 3, 4, 5, 6, 7 and 10.

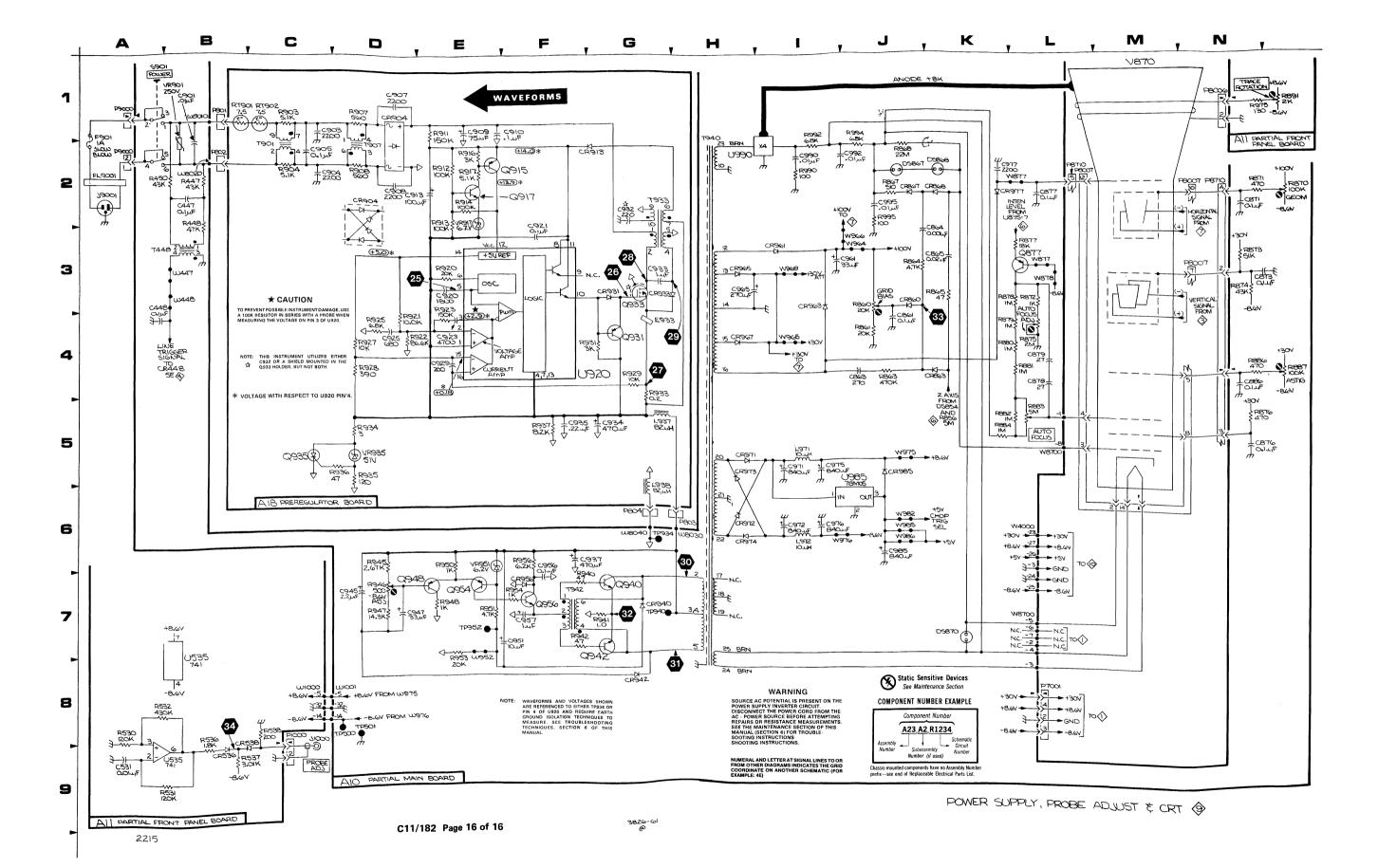




# POWER SUPPLY, PROBE ADJUST & CRT (9) (CONT)



					IOBE AL	3031 6		<u> </u>	CONT		
ASSEMBL	Y A11										
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C531	9A	1D	P1000-2 P8006-1	9C 1N	1B 2A	R532 R536	8A 9B	1D 1D	U535	9B	1D
CR536	9B	1D	P8006-2	1N	2A 2A	R537	9B	1D	W1000-5	8C	4A
CR538	9C	1D	F6000-2	114	<sup>2A</sup>	R538	8C	1B	W1000-14	8C	4B
C11330	30	ן יט	R530	8A	1D	R891	1N	2A	W1000-14 W1000-32	8C	4E
P1000-1	9C	1B	R531	9B	1D	R975	1N	2A	W1000-32		,-
Partial A11 also shown on diagrams 1, 2, 3, 4, 5, 6, 7 and 8.											
ASSEMBL	Y A18										
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C903	1C	1F	CR913	2G	3D	R903	1C	3F	R933	5G	4B
C904	2C	1F	CR931	3G	4D	R904	2C	4F	R934	5D	4B
C905	2C	2F	CR933	3G	3C	R907	1D	1E	R935	5D	5B
C907	1D	1D	0000	"	""	R908	2D	2E	R936	5D	5B
C908	2D	2D	E933	4G	4B	R911	1E	3C	R937	5F	5B
C909	1E	1C	2000	.0	.5	R912	2E	4D	1		
C910	1E	1C	L937	5G	6C	R913	2E	4D	RT901	1B	5F
C913	2E	4D	L938	6G	6C	R914	2E	5D	RT902	1C	5E
C920	3E	5B				R916	2E	4D			
C921	3F	5C	P801	1B	5F	R917	2E	4D	T901	2C	3F
C923	4E	5D	P802	2B	4F	R920	3E	5B	T907	2D	2E
C925	4D	5B	P803	6G	6D	R921	4D	5D	T933	2G	2B
C929	4E	5D	P804	6G	6C	R922	4D	5 <b>B</b>	j	]	
C932	3G	2A				R923	4E	4D	U920	4F	5C
C933	3G	3B	Q915	2E	5D	R925	4D	5B			
C934	5G	6B	Q917	2E	5E	R927	4D	5D	VR917	3E	4D
C935	5F	4B	Q931	4G	4C	R928	4D	4C	VR935	5D	5B
CR904	1D	1D	Q933 Q935	3G 5C	4A 4B	R929 R931	4G 4G	5 <b>D</b> 4D			
CHASSIS MOUNTED PARTS											
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
						=					
F901	1A	CHASSIS	L925	1C	CHASSIS	P8007-4	5L	CHASSIS	P8007-12	2L	CHASSIS
FL9001	2A	CHASSIS	5	}		P8007-5	4N	CHASSIS	P8007-14	6M	CHASSIS
	_		P8007-1	6M	CHASSIS	P8007-7	3N	CHASSIS	l		
J1000	9C	CHASSIS	P8007-2	6M	CHASSIS	P8007-8	5N	CHASSIS	V8 <b>7</b> 0	1M	CHASSIS
J9001	2A	CHASSIS	P8007-3	5L	CHASSIS	P8007-10	2N	CHASSIS			





```
285-1184-00
                          B018550
                                    CAP, FXD, MTLZD: 0.01UF, 20%. 4000V
  A10C992
             285-1184-00
                          B018550
                                    CAP, FXD, MTLZD: 0.01UF, 20%, 4000V
  A10U305
             156-0728-02
                          B019250
                                    MICROCIRCUIT, DI: QUAD 2-INP STATE W/OC
  A10U310
             156-0721-02
                          B012543
                                    MICROCIRCUIT, DI: QUAD 2-INP NAND SCHMITT
  A10U315
                                    MICROCIRCUIT.DI: QUAD 2-INP NAND GATE
             156-0384-02
                          B019250
  A10U317
                                    MICROCIRCUIT, DI: DUAL D FLIP-FLOP
             156-0388-03
                          B019250
  A10U607
             156-0382-00
                          B018550
                                    MICROCIRCUIT.DI: QUAD 2-INP NAND GATE
  A10U640
             156-1195-01
                          B020950
                                    MICROCIRCUIT.DI: DUAL RETRIG/RESET
  A13U665
                          B019250
             156-0382-02
                                    MICROCIRCUIT.DI: QUAD 2-INP NAND GATE
 A13U670
             156-0382-02
                          BC19250
                                    MICROCIRCUIT, DI: QUAD 2-INP NAND GATE
                                    MICROCIRCUIT.DI: HEX INVERTER
  A13U690
             156-0385-02
                          B019250
                                    MICROCIRCUIT.DI: QUAD 2-INP AND GATE
  A13U693
             156-0480-02
                          B012543
REMOVE:
                          B018550
                                    CAP, FXD, CER DI: 0.001UF, +80-20%, 100V
 A10C602
             281-0862-00
                                    CAP, FXD, CER DI: 0.001UF, +80-20%, 100V
 A10C606
             281-0862-00
                          B018550
                          B018550
                                    CAP.FXD.CER DI: 0.001UF.+80-20%,100V
             281-0862-00
 A10C607
ADD:
             281-0862-00
                                    CAP.FXD CER DI: 0.001UF.+80-20%, 100V
                          B016700
 A10C372
                                    CAP, FXD, CER DI: 0.001UF, +80-20%, 100V
             281-0862-00
                          B020500
 A10C606
                          B022000
                                    CAP.FXD.PPR DI: 0.1UF.20%,250VAC
             285-1250-00
 A18C905
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Page 1

of 2

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B018550

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CAP, FXD, MTLZD: 0.01UF, 20%, 4000V

201-0171-00

285-1184-00

A10C990

A10C995

000-2775-00D

27	ı
37 37	l
39	
44 32 25 25	
25	l
25 40	l
51	ı
	l
25	l
25 25 25 32	l
	ı
40	
40	l
40	
	۱
49	
62	
54	
	١
	l
	l
	l

CHANGE:

C990 & C995 from 0.02UF to 0.01UF

C992 from 0.02UF to 0.01UF

```
ADD:
A10C619
             281-0808-00
                             B025695
                                         CAP, FXD, CER DI: 7PF, 20%, 100V
A10C674
             281-0808-00
                             B025695
                                         CAP, FXD, CER DI: 7PF, 20%, 100V
A10Q502
             151-0199-00
                             B025695
                                         TRANSISTOR: PNP,SI
A10Q505
             151-0424-00
                             B025695
                                         TRANSISTOR: NPN,SI
A10R500
             315-0203-00
                             B025695
                                         RES, FXD, CMPSN: 20K OHM, 5%, 0.25W
A10R502
             315-0203-00
                             B025695
                                         RES, FXD, CMPSN: 20K OHM, 5%, 0.25W
A12Q626
             151-0424-00
                             B025695
                                         TRANSISTOR: NPN.SI
A12Q676
             151-0424-00
                             B025695
                                         TRANSISTOR: NPN,SI
             307-0107-00
                             B025200
A12R113
                                         REX, FXD, CMPSN: 5.6 OHM, 5%, 0.25W
```

B025695

SEMICOND DVC, DI: SI, 30V

A10R619 315-0472-00 B025695 RES,FXD,CMPSN: 4.7K OHM,5%,0.25 A10R623 315-0331-00 B025695 RES,FXD,CMPSN: 330 OHM,5%,0.25 A10R673 315-0331-00 B025695 RES,FXD,CMPSN: 330 OHM,5%,0.25 A10R674 315-0472-00 B025695 RES,FXD,CMPSN: 4.7K OHM,5%,0.25	CHANGE TO:			
A13Q664 151-0424-00 B025695 TRANSISTOR: NPN,SI	A10C647	281-0852-00	B025695	CAP,FXD,CER DI: 1800PF,10%,100V
	A10R619	315-0472-00	B025695	RES,FXD,CMPSN: 4.7K OHM,5%,0.25W
	A10R623	315-0331-00	B025695	RES,FXD,CMPSN: 330 OHM,5%,0.25W
	A10R673	315-0331-00	B025695	RES,FXD,CMPSN: 330 OHM,5%,0.25W
	A10R674	315-0472-00	B025695	RES,FXD,CMPSN: 4.7K OHM,5%,0.25W
	A12R627	315-0201-00	B021950	RES,FXD,CMPSN: 200 OHM,5%,0.25W

# DIAGRAM CHANGES

DIAGRAM (1) CH 1 & CH 2 ATTENUATORS

152-0141-02

REPLACE--C140 (Location 2N) with R113, a  $5.6\Omega$  resistor.

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A12CR680

DIAGRAM (5) SWEEP GENERATOR & LOGIC

CHANGE--C645 (Location 4B) to a 2.2  $\mu F$  capacitor.

--C647 (Location 4B) to an 1800 pF capacitor.

REMOVE--CR626, CR630; ADD--C619, Q626; CHANGE--R619, R623 (see partial schematic).

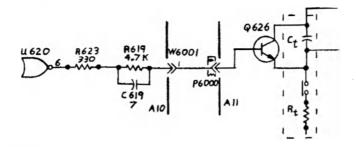


DIAGRAM (8) TIMING SWITCH

CHANGE--R627 (Location 7C) to a 200 $\Omega$  resistor.

DIAGRAM (10) ALTERNATE B SWEEP

REMOVE--CR676, CR680; ADD--C674, Q676; CHANGE--R673, R674 (see partial schematic).

