466 SPECIFICATIONS

Introduction

The Tektronix 466 is a dual-channel portable oscilloscope. The 466 storage system provides storage for displays with a writing speed up to 3000 divisions/microsecond (in the Fast-Reduced Scan mode). Storage viewing time is greater than 15 seconds at full-stored display intensity--extending to more than 6 minutes using reduced intensity in the Save mode.

The dual-channel dc-to-100 MHz vertical system provides calibrated deflection factors from 5 millivolts to 5 volts/division. The sweep trigger circuits are capable of stable triggering over the full bandwidth capabilities of the vertical deflection system. The horizontal deflection system provides calibrated sweep rates from 0.5 seconds to 0.05 microsecond/division along with delayed sweep features for accurate relative-time measurements. A X10 magnifier extends the calibrated sweep rate to 5 nanoseconds/division. The instrument operates over a wide variation of line voltages and frequencies. Maximum power consumption is about 100 watts.

The following instrument specifications apply over an ambient temperature range of $-15^{o}C$ to $+55^{o}C$ unless otherwise specified. Warm-up time for specified accuracies is 20 minutes.

VERTICAL DEFLECTION SYSTEM

Deflection Factor

Calibrated range is from 5 millivolts to 5 volts/division in 10 steps in a 1-2-5 sequence. Accuracy is within 3% with the gain set at 5 mV/div. Uncalibrated VAR control provides deflection factors continuously variable between the calibrated settings, and extends all deflection factors at least 2.5:1; extends the deflection factor to at least 12.5 volts/division in the 5 volts/division position.

Frequency Response

Bandwidth in both Channel 1 and Channel 2 is dc to at least 100 megahertz and risetime is 3.5 nanoseconds or less over a temperature range of -15°C to +40°C. For temperatures from +40°C to +55°C the bandwidth is at least 85 MHz and the risetime 4.15 nanoseconds or less. Risetime is calculated from the formula: 0.35 divided by the bandwidth (in megahertz). The ac-coupled lower -3 dB point is 10 hertz or less (1 hertz or less when using a 10X probe). Vertical system bandwidth with the BW LIMIT pushbutton pulled is approximately 20 megahertz.

Frequency response is determined using a 5 division, vertically-centered reference signal from a 25 ohm source with the VAR VOLT/DIV control in the calibrated position.

Chopped Mode Repetition Rate

Approximately 250 kilohertz.

Input Resistance and Capacitance

One megohm within 2% paralleled by approximately 20 picofarads within 3%. Aberrations 2% or less using 1 MΩ, 20 pF normalizer.

Maximum Input Voltage

DC coupled: 250 V (dc + peak ac) or 500 V (peak-to-peak ac) at 1 kHz or less.

AC coupled: 500 V (dc + peak ac) or 500 V (peak-to-peak ac) at 1 kHz or less.

Cascaded Operation (CH 1 VERT SIGNAL OUT Connected to CH 2 OR Y)

Bandwidth is dc to at least 50 MHz with a sensitivity of at least 1 mV/division, when CH 1 OUT is connected to CH 2 Input using a 50 ohm, 42 inch cable terminated into 50 ohms at CH 2 Input.

TRIGGERING

Sensitivity

DC coupled: 0.3 division internal or 50 millivolts external from DC to 25 megahertz, increasing to 1.5 divisions internal or 150 millivolts external at 100 megahertz.

Sensitivity (cont.)

AC Coupled: 0.3 division internal or 50 millivolts external from 30 hertz to 25 megahertz, increasing to 1.5 divisions internal or 150 millivolts external at 100 megahertz.

LF REJ Coupled: 0.5 division internal or 100 millivolts external from 50 kilohertz to 25 megahertz, increasing to 1.5 divisions internal or 300 millivolts external at 100 megahertz. Attenuates all signals below about 50 kilohertz.

HF REJ Coupled: 0.5 division internal or 100 millivolts external from 30 hertz to 50 kilohertz. Blocks dc and attenuates all signals below about 30 hertz and above about 50 kilohertz.

EXT ÷ 10: Requirements are multiplied by 10.

Trigger Jitter

0.5 nanosecond or less at 5 nanoseconds/division with 100 megahertz applied (X10 MAG on).

External Trigger Input

Maximum input voltage is 250 V (dc + peak ac) or 250 V (peak to peak ac) (1 kilohertz or less). Input resistance is 1 megohm within 10%.

LEVEL Control Range

EXT: At least + and -2 volts, 4 volts peak to peak.

EXT ÷ 10: At least + and -20 volts, 40 volts peak to peak.

Trigger View

Deflection Factor: About 50 millivolts/division within 20%, in the EXT mode or about 500 millivolts/division within 20%, in the EXT ÷ 10 mode, ac or dc trigger coupling only.

Delay Difference: 3 nanoseconds or less with a 5 division, vertically centered, 5 nanosecond risetime or less signal from a 25 ohm source using equal length, 50 ohm cables from the vertical channel input and the external trigger input; terminated into 50 ohms at each input.

HORIZONTAL DEFLECTION SYSTEM

Calibrated Sweep Range

A Sweep: 0.5 second/division to 0.05 microsecond/division in 22 steps in a 1-2-5 sequence. X10 MAG extends maximum sweep rate to 5 nanoseconds/division.

Calibrated Sweep Accuracy

Unmagnified sweep accuracy is within 2% from +20°C to +30°C (+68°F to +86°F) and within 3% from -15°C to +20°C and +30°C to +55°C (+5°F to +68°F and +86°F to +131°F). For the same temperature ranges, magnified sweep accuracy is within 3% and within 4% respectively. Exclude the first and last 50 nanoseconds of the 5 nanosecond, 10 nanosecond, and 20 nanosecond magnified sweep rates. Accuracy specifications apply over full 10 divisions unless otherwise specified.

Sweep accuracy, over any 2 division portion of the sweep, is within 5%. Exclude the first and last magnified divisions of the 5 nanosecond and 10 nanosecond/division magnified sweep rates.

Mixed sweep accuracy is within 2% plus the measured A sweep error when viewing the A sweep portion only. The B sweep portion retains its normal accuracy. Exclude the first 0.5 division after display start and the first 0.2 division or 0.1 microsecond (whichever is greater) after the transition from A to B.

A Time/Division Variable Range

Provides continuously variable (uncalibrated) sweep rates between the calibrated settings of the A TIME/DIV switch. Extends all sweep rates at least 2.5:1. Extends the slowest A sweep rate to at least 1.25 seconds/division.

A Trigger Holdoff

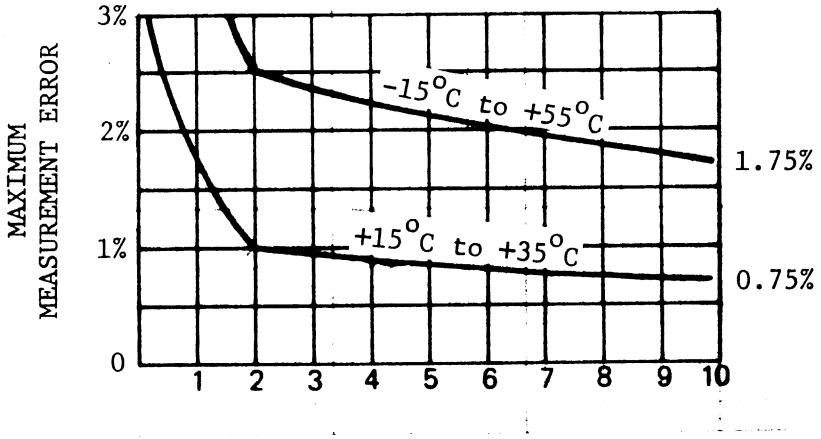
Increases A sweep holdoff time by at least a factor of 10.

Delay Time and Differential Time Measurement Accuracy

	+15°C to +35°C (+60°F to +95°F)	-15°C to +55°C (+5°F to +131°F)
Over One or More Major Dial Division	±1%	±2.5%
Over Less Than One Major Dial Division	+0.01 Major Dial Division	+0.03 Major Dial Division

TABLE 1-1

Differential Time Measurement Accuracy



Number of Major Dial Divisions of DELAY TIME POSITION control used to make measurement.

With the A TIME/DIV switch at .5 μs/div and .2 μs/div, the differential time measurement accuracy limit is valid only for DELAY-TIME POSITION dial settings between 1.50 and 8.50.

Delay Time Jitter

Within 0.002% (less than one part in 50,000) of the maximum available delay time, which is ten times the setting of the A TIME/DIV switch.

Calibrated Delay Time (A VAR set to calibrated position)

Continuous from .5 seconds to 0.2 microsecond.

X-Y OPERATION

Extreme counter-clockwise position of TIME/DIV switch. CH 2 or X-Y button of VERT MODE switch must be pushed.

Sensitivity

Same as vertical deflection system with X10 MAG turned off.

X Axis deflection accuracy within 4%.

X-Axis Bandwidth

DC to at least 4 megahertz using a 10 division reference signal.

Variable Range, Y-Axis Bandwidth, Input Resistance, and Maximum Usable Input Voltage

Same as vertical deflection system.

CALIBRATOR

Output

A square-wave signal of approximately 1 kilohertz.

Output voltage is 0.3 V, within 0.3% from +20°C to +30°C; or 1% from 0°C to +40°C; or 1.5% from -15°C to +55°C.

Output current is 30 milliamperes, within 2% from +20°C to +30°C; or within 2.5% from -15°C to +55°C.

Z AXIS INPUT

Sensitivity

A 5-volt peak to peak signal causes noticeable modulation at normal intensity. A positive-going signal decreases intensity.

Usable Frequency Range

From dc to 50 megahertz.

SIGNAL OUTPUTS

CH 1 VERT SIGNAL OUT

Output voltage is at least 50 millivolts/division onto a 1 megohm load (at least 25 millivolts/division into a 50 ohm load).

Bandwidth is from dc to at least 50 megahertz into a 50 ohm load.

Output dc level is approximately zero volts.

A and B +GATE Outputs

Output voltage is approximately 5.5 volts, positive-going.

POWER SOURCE

Line Voltage

110, 115, 120, 220, 230, or 240 VAC (all within 10%), depending on the settings of the Line Voltage Selector switch and the Regulating Range Selector assembly, with a line frequency of 48 to 440 hertz. Maximum power consumption is 100 watts at 115 Vac, 60 hertz.

CATHODE-RAY TUBE

Graticule Area

Eight by ten divisions. One division equals 0.9 centimeter.

Phosphor

P31 is the standard phosphor.

STORAGE

Stored Writing Speed

Measured with 50 V drive above signal extinction (+70 volts at Z-axis test point with visual extinction set at +20 V).

VAR PERS Full Scan Speed: 0.5 division/microsecond over the center 6 x 8 divisions (0.9 centimeters/division).

Stored Writing Speed (cont.)

FAST Full Scan Speed: 150 division/microsecond over the center 6 x 8 divisions (0.9 centimeter/division).

VAR PERS Reduced Scan Speed: 3 division/microsecond over the center 8 x 10 divisions (0.45 centimeter/division).

FAST Reduced Scan Speed: 3000 division/microsecond over the center 8 x 10 divisions (0.45 centimeter/division).

Storage View Time

FAST and VAR PERS View Times: At least 15 seconds. These times are at full stored display intensity. They are extended at least 25 times by using reduced intensity in the SAVE Display mode..

SUPPLEMENTAL INFORMATION

The supplemental information listed here represents limits that, when met, ensure optimum instrument operation. They are, however, not instrument specifications, but are intended to be used only as maintenance or operational aids.

VERTICAL DEFLECTION SYSTEM

Low-Frequency Linearity

There should be no more than 0.1 division of compression or

Low-Frequency Linearity (cont.)

expansion of a two-division signal at center screen when the signal is positioned to the upper and lower extremes of the crt graticule area.

Bandwidth Limiter Bandwidth

The -3 dB point should be between 15 and 25 megahertz.

Step Response Aberrations

$0^{\circ}C$ to $+40^{\circ}C$. There should be less than +3%, -3%, or a total of 3% peak to peak aberration on a positive-going step (excluding ADD Mode). Add 2% when checking a negative-going step. Position-effect should not cause total aberrations to be more than +5%, -5%, or a total of 5% peak to peak.

Add 5% to all aberration specifications for ADD Mode operation.

Step Response is determined using a 5 division, vertically-centered, dc-coupled reference signal at all deflection factors from a 25 ohm source with the VAR VOLT/DIV control in the calibrated position.

Common-Mode Rejection Ratio

At least 10:1 at 20 megahertz for common mode signals of 6 divisions or less with vertical gain adjusted for best CMRR at 50 kilohertz.

Step Attenuator Balance

Adjustable to 0.2 division or less of trace shift when switching between adjacent deflection factors.

Trace Shift as Variable is Rotated

Adjustable to 0.2 division or less.

INVERT Trace Shift

0.2 divisions or less when switching from normal to inverted.

Input Gate Current

0.5 nanoampere or less (0.1 division of deflection at 5 mV/div) from $-15^{\circ}C$ to $+30^{\circ}C$. Four nanoamperes or less (0.8 division of deflection at 5 mV/div) from $+30^{\circ}C$ to $+55^{\circ}C$.

Channel Isolation

At least 100:1 at 25 megahertz.

Position Control Range

At least 12 divisions up and 12 divisions down from graticule center.

TRIGGERING

External Trigger Input Capacitance

20 picofarads within 30%.

Trigger View

Risetime: 5 nanoseconds or less.

Centering of Triggering Point: Within 1.0 division of center screen.

HORIZONTAL DEFLECTION SYSTEM

A Sweep Length

10.5 to 11.5 divisions.

Magnifier Registration

There should be 0.2 division or less difference at graticule center when switching from MAG on to MAG off (at 1 millisecond/division).

Position Control Range

Should be able to position the start of the sweep to the right of graticule center, and the end of the sweep to the left of graticule center.

Phase Difference Between X and Y Axis Amplifiers

Typically 3^{o} or less from dc to 50 kilohertz.

CALIBRATOR

Repetition Rate

Repetition rate accuracy is typically within 25%.

Output Resistance

Approximately 9.4 ohms.

EXTERNAL Z AXIS INPUT

Maximum Input Voltage

Voltages applied to the EXT Z AXIS INPUT connector should be limited to less than 100 volts (dc + peak ac) or 100 volts (peak to peak ac) at 1 kilohertz or less.

OUTPUT SIGNALS

Output Resistance

Output resistance of the CH 1 VERT SIG OUT connector is approximately 50 ohms.

Output resistance of +A and +B GATE outputs is approximately 500 ohms.

Resolution

Typically at least 10 lines per division horizontally and vertically.

Geometry

0.1 division or less of tilt or bowing.

Raster Distortion

0.1 division or less.

Nominal Accelerating Potential

About 8,500 volts Normal Scan mode or about 10,500 volts in Reduced Scan mode.

Trace Rotation range is adequate to align trace with horizontal center line.

ENVIRONMENTAL

Storage Temperature

$-55^{o}C$ to $+75^{o}C$.

Altitude

Storage: To 50,000 feet.

Operating: To 15,000 feet. Maximum operating temperature decreased $1^{o}C$/1,000 feet above 5,000 feet.

Humidity

Operating and Storage: 5 cycles (120 hours) referenced to MIL-E-16400F.

Vibration (Operating)

15 minutes along each of 3 major axes at a total displacement of 0.025" P-P (4 g's at 55 hertz) with frequency varied from 10 hertz to 55 hertz to 10 hertz in one minutes sweeps. Hold for three minutes at 55 hertz. All major resonances must be above 55 hertz.

Shock (Operating and Non-Operating)

30 g's, 1/2 sine, 11 milliseconds duration, two shocks per axis each direction for a total of 12 shocks.

Weight

With Panel Cover, Accessories, and Accessory Pouch: 30 pounds (13.6 kg).

Without Panel Cover, Accessories, and Accessory Pouch: 26 pounds (11.8 kg).

Height

With Feet and Pouch: 7.5 inches (19.1 centimeters).

Without Pouch: 6.2 inches (15.7 centimeters).

Width

With Handle: 12.9 inches (32.8 centimeters).

Without Handle: 11.5 inches (29.2 centimeters).

Depth

Including Panel Cover: 21.7 inches (55.0 centimeters).

Handle Extended: 23.7 inches (60.0 centimeters).

Transportation

Meets the limits of National Safe Transit Committee test procedure 1A with a 30-inch drop.

Construction

Aluminum alloy chassis, panel, and cabinet with glass laminate etched wiring circuit board.

Finish

Anodized front panel and blue vinyl coated cabinet.

CIRCUIT DESCRIPTION

Introduction

This section of the manual contains a description of the circuitry used in the 466 Oscilloscope. The description begins with a discussion of the instrument, using the block diagram pullout page. Then, each circuit is described in detail using detailed block diagrams to show the interconnections between the stages in each major circuit and the relationship of the front panel controls to the individual stages.

Complete schematics of each circuit are given in the Diagrams Section. Refer to these diagrams throughout the following circuit description for electrical values and relationships.

Digital Logic

Digital logic techniques are used to perform many functions within this instrument. The function and operation of the logic circuits are described using logic symbology and terminology. All logic functions are described using the positive logic convention. Positive logic is a system of notation where the more positive of two levels (HI) is called the true or 1 state; the more negative level (LO) is called the false or 0 state. The HI-LO method of notation is used in this logic description. The specific voltages which constitute a HI or LO state vary between individual devices.

It should be noted that not all of the integrated circuit devices in this instrument are digital logic devices. The function of non-digital devices will be described individually using operating waveforms or other techniques to illustrate their function.

BLOCK DIAGRAM

General

The following discussion is provided to aid in understanding the overall concept of the 466 Oscilloscope before the individual circuits are discussed in detail. Refer to the Block Diagram in the Diagrams section.

Signals to be displayed on the CRT are applied to the CH 1 OR X and/or CH 2 OR Y connectors. The input signals are then amplified by the Preamp circuits. Each Preamp circuit includes separate vertical deflection factor, input coupling, balance, gain and variable attenuation controls. A trigger pickoff stage in each Vertical Preamp circuit supplies a sample of the channel signals to the Trigger Generator circuit. A sample of the Channel 1 signal is also supplied to the CH 1 VERT SIGNAL OUT BNC connector on the instrument rear panel.

In the X-Y mode of operation the Channel 1 signal is connected to the input of the Horizontal Amplifier circuit to provide the X-Axis deflection. The Channel 2 Vertical Preamp circuit contains an invert feature to invert the Channel 2 signal as displayed on the CRT.

The output of both Vertical Preamp circuits is connected to the Vertical Switching circuit. This circuit selects the channel(s) to be displayed. An output signal from this circuit is connected to the Z Axis Amplifier circuit to blank out the switching transients between channels when in the chopped mode. A trigger pickoff stage at the output of the Vertical Switching circuit provides a sample of the displayed signal(s) to the Trigger Generator circuit.

The Vertical Output Amplifier circuit provides the final amplification for the signal before it is connected to the crt vertical deflection plates. This circuit includes the BEAM FIND switch which compresses the vertical and horizontal deflection to within the viewing area to aid in locating an off-screen display.

The A and B Trigger Generator circuits produce an output pulse which initiates the sweep signal produced by the A or B Sweep Generator circuits. The input signal to the A or B Trigger Generator circuits can be individually selected from the Channel 1 signal, Channel 2 signal, the signal(s) displayed on the crt, a signal connected to the external trigger input connectors, or a sample of the line voltage applied to the instrument. Each trigger circuit contains level, slope, coupling, and source controls.

The A Sweep Generator circuit, when initiated by the A Trigger Generator circuit, produces a linear sawtooth output signal, the slope of which is controlled by the A TIME/DIV switch. The TRIG MODE switch controls the operating mode of the A Sweep Generator circuit. In the AUTO position, the absence of an adequate trigger signal causes the sweep to free run. In the NORM position, a horizontal sweep is presented only when correctly triggered by an adequate trigger signal. Pushing the SINGL SWP pushbutton allows one (and only one) sweep to be initiated.

The Z Axis Logic circuit produces an unblanking gate signal to unblank the crt so that the display can be presented. This

gate signal is coincident with the sawtooth produced by the A Sweep Generator circuit. A gate signal, which is also coincident with the sawtooth, is available at the A + GATE connector on the instrument rear panel. The Z Axis Logic circuit also produces an alternate sync pulse which is connected to the Vertical Switching circuit. The pulse switches the display between channels at the end of each sweep when the VERT MODE switch is in the ALT position.

The B Sweep Generator circuit is basically the same as the A Sweep Generator circuit. However, this circuit only produces a sawtooth output signal after a delay time determined by the A TIME/DIV switch and the DELAY TIME POSITION dial. If the B Triggering SOURCE switch is set to the STARTS AFTER DELAY position, the B Sweep Generator begins to produce the sweep immediately following the selected delay time. If this switch is in one of the remaining positions, the B Sweep Generator circuit does not produce a sweep until it receives a trigger pulse occurring after the selected delay time.

The output of either the A or B Sweep Generator is amplified by the Horizontal Amplifier circuit to produce horizontal deflection for the crt except in the fully counterclockwise (X-Y) position of the TIME/DIV switch. A 10X magnifier in the Horizontal Amplifier circuit increases the sweep rate 10 times in any A or B TIME/DIV switch position. Other horizontal deflection signals can be connected to the horizontal amplifier by using the X-Y mode of operation. When the TIME/DIV switch is set to X-Y, the X signal is connected to the Horizontal Amplifier circuit through the Channel 1 Vertical Preamp circuit.

The Z Axis Amplifier circuit determines the CRT intensity and blanking. The Z Axis Amplifier circuit sums the current inputs from the INTENSITY control. Vertical Switching circuit (chopped blanking), Z Axis Logic circuit (unblanking), and the external Z AXIS INPUT connector. The output level of the Z Axis Amplifier circuit controls the trace intensity through the CRT circuit. The CRT circuit provides the voltages and contains the controls necessary for operation of the cathode-ray tube. The storage circuit provides clock-controlled voltage signals for operating the crt storage functions.

The Power Supply circuit provides the low voltage power necessary for operation of this instrument. This voltage is distributed to all of the circuits in the instrument as shown by the Power Distribution Diagram. The Calibrator circuit produces a square-wave output with accurate voltage and current amplitudes which can be used to check the calibration of the instrument and the compensation of probes. The CALIBRATOR current loop provides an accurate current source for calibration of current measuring probe systems.

CHANNEL 1 PREAMP

General

Input signals for vertical deflection on the CRT can be connected to the CH 1 OR X input connector. In the X-Y mode

of operation the input signal connected to the CH 1 OR X connector provides the horizontal (X axis) deflection (TIME/DIV switch set to X-Y, VERT MODE switch set to CH 2 OR X-Y). The Channel 1 Preamp circuit provides control of input coupling, vertical deflection factor, gain, and DC balance. Fig. 3-1 shows a detailed block diagram of the Channel 1 Preamp circuit. A schematic of this circuit is shown on Diagram 1 at the rear of the manual.

Input Coupling

Signals applied to the input connector can be AC coupled, DC coupled, or internally disconnected from the input to the Vertical Input Amplifier circuits. When the Input Coupling switch S30A is set for DC coupling, the input signal is coupled directly to the Input Attenuator stage. When AC coupled, the input signal passes through capacitor C12. This capacitor prevents the DC component of the signal from passing to the amplifier. In the GND position, S30A opens the signal path and connects the input of the amplifier to ground. This provides a ground reference without the need to disconnect the applied signal from the input connector. Resistor R14, connected across the input coupling switch, allows C12 to be pre-charged in the ground position so that the trace remains on screen when switched to the AC position.

Input Attenuator

The effective overall deflection factor of each channel of the 466 is determined by the appropriate VOLTS/DIV switch. The

basic deflection factor of the Vertical Deflection System is 5mV/division of CRT deflection. To achieve the deflection factor values indicated on the front panel, precision attenuators are switched in to the circuit and the gain of the First Amplifier stage is changed.

For the VOLTS/DIV switch positions above 5 mV, attenuators are switched in to the circuit, singly or in pairs, to help produce the vertical deflection factors indicated on the front panel. These attenuators are frequency-compensated voltage dividers. In addition to providing constant attenuation at all frequencies within the bandwidth of the instrument, the Input Attenuators are designed to maintain the same input RC characteristics (1 MΩ times approximately 20 pF) for each setting of the VOLTS/DIV switch. Each attenuator contains an adjustable series capacitor to provide correct attenuation at high frequencies and an adjustable shunt capacitor to provide correct input capacitance.

Scale-Factor Switching Circuit

The vertical deflection factor for each channel is indicated by back-lighting the appropriate figures on the flange of the VOLTS/DIV knob. A shorting ring at the input connector is used to determine which of the two lights will be on, depending on the probe being used.

When no probe or a 1X probe is attached to the CH 1 OR X input connector, the shorting ring remains grounded. This allows Q52 base to be at +5 volts by way of R52, keeping Q52 and the 1X light DS52 on.

When a 10X probe with a scale factor switching connector is attached to the CH 1 OR X input connector, the shorting ring is then grounded. This grounds the base of Q52 through R20, which turns off Q52 and the 1X light DS52 and turns on Q54 and the 10X light DS54.

Source Follower Stage

The Channel 1 signal from the Input Attenuator is connected to the Source Follower stage through R42, R45 and C16. R39 provides the input resistance for this stage. R42 limits the current drive to the gate of Q72A. Diodes CR72 and CR73 protect the circuit by clamping the gate of Q72A at about -8.7 volts, if a high amplitude negative-going signal is applied to the CH 1 OR X input connector. Q72B is a relatively constant-current source for Q724.

First Amplifier Stage

A paraphase cascode amplifier stage composed of Q84 and Q86 converts the single-ended input signal into a push-pull output signal. C75 and C87 minimize Miller effect through Q84 and Q86.

Gain adjustment, R92 adjusts the overall gain of the Channel 1 vertical preamplifier by adjusting the signal current into the emitters of Q102 and Q104.

The VAR control R96, when rotated out of the detent position, also adjusts the signal currents into Q102 and Q104 to provide uncalibrated deflection factors between the calibrated settings of the VOLTS/DIV switch. Variable balance adjustment R84 adjusts for no baseline shift of a crt display when rotating the VAR control.

Second Amplifier Stage

Transistors Q112/Q114 and Q124/Q126 make up a Second Cascode Amplifier stage.

Q112 and Q114 convert the input signals into current signals which are in turn converted back to voltage signals by Q124 and Q126. R111 and R118 provide thermal compensation and C111 and C118 reduce Miller effect. C107/R107 and C108/R108 are variable high frequency compensation adjustments. CR114, CR117 and RT119 tend to offset changes associated with ambient temperature variations. As temperature increases, the value of RT119 decreases, resulting in a decrease in voltage across CR114 and CR117. CR114 and CR117 are voltage-variable capacitance semiconductors whose capacitance increases with a decrease in reverse voltage across them. CR114 and CR117 provide more high frequency peaking at higher temperatures.

Third Amplifier Stage

Q132 and Q134, in conjunction with Q304 and Q308 in the Vertical Switching Circuit, form a Third Cascode Amplifier stage. The push-pull signals picked off in the emitters of Q132 and Q134 are converted to a single-ended signal by Q136, Q138, Q144 and Q146. This signal is amplified by common-base amplifier stage Q148 and applied to the bases of emitter followers Q154 and Q156. Q156 provides the output signal to the CH 1 VERT SIGNAL OUT connector located on the instrument rear panel. The output signal at the emitter of Q154 is used as the trigger signal source in the CH 1 positions of the Trigger SOURCE switches and as the signal source for emitter follower Q158. Q158 provides the X-axis signal from the Channel 1 Preamplifier to the Horizontal Amplifier in the X-Y mode. CR156, CR157, CR158 and CR159 protect the emitter circuit of Q156 in the event large signal levels are accidentally connected to the CH 1 VERT SIGNAL OUT connector. R152 adjusts the DC level of the CH 1 trigger source signal.

CHANNEL 2 PREAMP

General

The Channel 2 Preamp circuit is basically the same as the Channel 1 Preamp. Only the specific differences between the two circuits are described here. Portions of this circuit not

described in the following description operate in the same manner as for the Channel 1 Preamp. Fig. 3-2 shows a detailed block diagram of the Channel 2 Preamp circuit. A schematic of this circuit is shown on diagram 2 at the rear of this manual.

Second Amplifier Stage

Basically, the Second Amplifier Stage in Channel 2 functions as described for the second Amplifier Stage in Channel 1. However, the Channel 2 Second Amplifier Stage also contains the INVERT switching function. This allows the Channel 2 signal to be inverted as displayed on the crt. The INVERT switch, when pushed, changes the biasing on Q220/Q222 and Q224/Q226 so that Q220 and Q222 (normally inactive) will carry the signal. Since their outputs are cross-coupled from side to side the output signal will be of the opposite polarity to that available in the normal position (pushbutton out) of the INVERT switch. The Channel 2 Invert Balance adjustment R212 adjusts the dc balance of the stage to eliminate baseline shift in the display when switching from a normal to an inverted display.

Third Cascode Amplifier

The trigger pickoff circuit only provides a signal to one emitter follower. This emitter follower (Q254) in turn provides the trigger signal to the Trigger Generator circuits in the CH 2 positions of the SOURCE switches.

VERTICAL SWITCHING CIRCUIT

General

The Vertical Switching Circuit determines whether the Channel 1 or Channel 2 or both signals are connected to the Vertical Output Amplifier Circuit. In the alternate and chopped modes of operation both channels are alternately displayed on a shared time basis. Figure 3-3 shows a detailed block diagram of the Vertical Switching Circuit. A schematic of this circuit is shown on diagram 3 at the rear of this manual.

Diode Gates

The Diode Gates, consisting of four diodes each, can be thought of as switches which allow either of the Vertical Preamp output signals to be coupled to the Vertical Output Amplifier. CR304, CR305, CR307 and CR308 control the Channel 1 output and CR314, CR315, CR317 and CR318 control the Channel 2 output. These diodes are in turn controlled by the Switching Multivibrator for dual trace displays, or by the VERT MODE switch for single trace displays.

Channel 1 Only Display. When the CH 1 pushbutton is pressed, -8 volts is applied to the junction of CR315-CR317 in the Channel 2 Diode Gate through R367 (see simplified diagram in Fig. 3-4). This forward biases CR315 and CR317 and reverse biases CR314 and CR318. CR314 and CR318 block the Channel 2 signal so it cannot pass to the Delay Line Driver stage. At the same time in the Channel 1 Diode Gate, CR305 and CR307 are connected to +5 volts through R371. CR305 and CR307 are held reverse-biased while CR304

and CR308 are forward biased. Therefore, the Channel 1 signal passes to the Delay Line Driver stage.

Channel 2 Display Only. When the CH 2 pushbutton is pressed, the above conditions are reversed. The junction of CR305-CR307 is connected to -8 volts through R376 and the junction of CR315-CR317 is connected to +5 volts through R361. The Channel 1 Diode Gate blocks the Channel 1 signal and the Channel 2 Diode Gate allows the Channel 2 signal to pass to the Delay Line Driver stage.

Switching Multivibrator

Alternate Trace Display. In this mode of operation, the Switching Multivibrator operates as a bistable multivibrator. When the ALT pushbutton is pressed, -8 volts is applied to the emitter of Alternate Trace Switching Amplifier stage Q352 by the VERT MODE switch. Q352 is forward biased to supply current to the "on" Switching-Multivibrator transistor through R352 and CR368 or CR378. For example, if Q374 is conducting, current is supplied to Q374 through R352 and CR378. The current flow through collector resistor R371 drops the CR305-CR307 cathode level negative so that the Channel 1 Diode Gate is blocked as for Channel 2 Only Operation. The signal passes through the Channel 2 Diode Gate to the Delay-Line Driver stage.

The alternate trace sync pulse is applied to the base of Q352 through C351 at the end of each sweep. This negative-going sync pulse momentarily interrupts the current through Q352 and both Q364 and Q374 are turned off. When Q352 turns on again after the alternate trace sync pulse, the charge on C368 determines whether Q364 or Q374 conducts. For example, when Q374 was conducting,

C368 was charged positive on the CR378 side to the emitter level of Q374 and negatively on the CR368 side toward the negative level at the junction of CR368 and CR378. This charge is stored while Q352 is off and holds the meitter of Q364 more negative than the emitter of Q374. During the time Q364 and Q374 are turned off, the voltages at their bases become approximately equal. Now, when Q352 comes back on, the transistor with the most negative emitter conducts first, the resulting negative movement at its collector holds the other transistor off. The conditions described previously are now reversed: now, the Channel 2 Diode Gate is reverse-biased and the Channel 1 signal passes through the Channel 1 Diode Gate.

Chopped Mode Operation. When the CHOP pushbutton is pressed, the Switching Multivibrator stage free-runs at about a 250 kHz rate. The emitters of Q364 and Q374 are connected to -8 volts through R368, R378, and the primary of transformer T354. At the time of turn-on, one of the transistors begins to conduct; for example, Q374. The negative level at the collector of Q374 forward-biases CR305 and CR307 and back-biases CR304 and CR308 preventing the Channel 1 signal from reaching the Delay-Line Driver stage. Meanwhile, the Channel 2 Diode Gate passes the Channel 2 signal to the Delay-Line Driver stage.

The frequency-determining components in the CHOP mode are C368, R368, R370, and R378. The switching action occurs as follows: when Q374 is on, C368 attempts to charge to -8 volts through R368. The emitter of Q364 slowly goes toward -8 volts as C368 charges. The base of Q364 is held at a point determined by the voltage divider R365 and R374 between -8 volts and the collector level of Q374.

When the emitter voltage of Q364 reaches a level slightly more negative than its base, Q364 conducts. Its collector level goes negative and pulls the base of Q374 negative through divider R364-R375 to cutoff Q374. This switches the Diode Gate stages to connect the opposite channel to the Delay-Line Driver stage. Again, C368 begins to charge towards -8 volts but this time through R378. The emitter of Q374 slowly goes negative as C368 charges until Q374 turns on. Q364 is shut off and the cycle begins again.

The Chop Blanking Amplifier stage, Q358, provides an output pulse to the Z Axis Amplifier circuit which blanks out the transition between the Channel 1 and the Channel 2 traces. When the Switching Multivibrator stage changes states, the voltage across T354 momentarily increases. A negative pulse is applied to the base of Q358 to turn it off. The width of the pulse at the base of Q358 is determined by R355 and C355. Q358 is quickly driven in to cutoff and the positive going output pulse, which is coincident with trace switching, is connected to the Z Axis Amplifier circuit through R359.

Added Mode Operation. When the ADD pushbutton is pressed, the following occurs:

1. +5 volts is applied to the cathodes of CR305 and CR307 through R371.

2. +5 volts is applied to the cathodes of CR315 and CR317 through R361.

3. -8 volts is applied to the junction of R321 and R322.

The first two actions enable both of the Channel Diode Gates so that the signal applied to the Delay Line Driver stage is the algebraic sum of the Channel 1 and Channel 2 signals. The -8 volts applied to R321 and R322 provides sufficient current to keep both diode gates turned on without altering dc levels associated with the Delay Line Driver stage.

Delay-Line Driver

The outputs from the Diode Gate stages are applied to the Delay-Line Driver stage composed of Q322 and Q324. Q322 and Q324 are connected as feedback amplifiers with R325 and R327 providing feedback from the collector to the base of their respective transistors. A sample of the signal in the collector circuit of Q322 is used for triggering in the NORM mode of trigger operation. The BW LIMIT switch S338A connects a pi filter composed of C338, C339, L338, and L339 between the output signal lines of the Delay-Line Driver stage to reduce the upper -3 dB bandwidth limit of the Vertical Amplifier system to approximately 20 MHz. R335 and R336 provide reverse termination for the delay line. The TRIG VIEW switch S338B connects the output of the Trigger View Amplifier to the input of the Delay Line in place of the Delay Driver Stage. This allows viewing the trigger signal present in the A Trigger Generator circuit.

Delay Line

Delay Line DL339 provides approximately 120 ns delay for the vertical signal to allow the Sweep Generator circuits time to initiate a sweep before the vertical signal reaches the vertical deflection plates of the crt. This allows the instrument to dis-

play the leading edge of the signal originating the trigger pulse when using internal triggering.

Reference Feedback Amplifier

Reference Feedback stage Q332 provides common mode voltage feedback from the Delay-Line Driver stage to allow the diode gates to be switched with a minimum amplitude switching signal. The emitter level of Q332 is connected to the junction of the Switching Multivibrator collector resistors, R371 and R361 through CR372 or CR362. The collector level of the "on" Switching Multivibrator transistor is negative and either CR362 or CR372 is forward biased. This clamps the cathode level of the forward biased shunt diodes in the applicable Diode Gate about 0.5 volt more negative than the emitter level of Q332. The level at the emitter of Q332 follows the average voltage level at the emitters of the Delay-Line Driver stage. The shunt diodes are clamped near their switching level and therefore, can be switched very fast with a minimum amplitude switching signal. This maintains about the same current through the Diode Gate shunt diodes so they can be switched with a minimum amplitude switching signal regardless of the deflection signal at the anodes of the shunt diodes.

Normal Trigger Pickoff Amplifier

The trigger signal for NORM trigger operation is obtained from the collector of Q322. Normal Trigger DC Adjustment R346 sets the DC level of the normal trigger output signal so the sweep is triggered at the 0 level of the displayed signal when the Triggering LEVEL control is set to 0. Q344 and Q346 are connected as a feedback amplifier with the signal applied to the non-inverting input

and the feedback connected between the output and the inverting input. Gain of the stage is approximately 1.3 as determined by R344 and R347.

VERTICAL OUTPUT AMPLIFIER

General

The Vertical Output Amplifier circuit provides the final stage of amplification needed for the vertical input signal to drive the crt vertical deflection plates.

Early instruments used an integrated circuit (IC) for the final stages of the Vertical Output Amplifier, while the later instruments use discrete components. The two circuits accomplish the same purpose but are described separately below for the sake of clarity.

Output Amplifier (with IC, U464)

Q412/Q416 and Q422/Q426 make up the first vertical output amplifier stage. Most of the components connected between the emitters of Q412 and Q422 provide high-frequency compensation for this stage. RT421 changes value with variations in ambient temperature to compensate for temperature-associated changes in amplifier gain. Gain Adjustment R415 adjusts the gain for the Vertical Output Amplifier.

Integrated Circuit, U464 is a multi-stage cascode amplifier cell. The input signal is applied push-pull between pins 1 and 5 with the inverted output signal taken from pins 9 and 12. Some of the components connected between pins 2 and 4 provide slower time constants to compensate for signal rolloff that occurs in the delay line, while the remaining components compensate

for thermal considerations in the stage. The Bias adjust (R478) sets the dc levels within the stage to optimize the operating performance of U464.

Output Amplifier (with discrete components)

Q422/Q426 and Q432/Q436 make up the first output amplifier stage which is a push-pull cascoded amplifier. Most of the components connected between the emitters of Q412 and Q422 provide high-frequency compensation for this stage. RT415 changes value with variations in ambient temperatures to compensate for temperature-associated changes in amplifier gain.

Q422, Q452, Q462, Q472, Q482, Q486, Q492 and Q496 make up two push-pull cascode amplifiers. The components connected between the emitters of Q442 and Q452 provide high-frequency compensation for the stage. RT458 and VR457 offset compensation changes associated with variations in ambient temperature. Gain adjustment, R468, adjusts the gain of the final vertical output stage.

Beam Finder

The BEAM FINDER, when pressed, limits the current, through R498, to Q486 and Q496. This reduces the gain of the final vertical output stage, which limits the display area without affecting the position of the display.

A AND B TRIGGER GENERATORS

General

The Trigger Generator circuits produce trigger pulses to start the Sweep Generator circuits. These trigger pulses are derived either from the internal trigger signal from the vertical deflection system, an external signal connected to the external trigger input connectors, or a sample of the line voltage applied to the instrument. Controls are provided in each circuit to select trigger level, slope, coupling, and source.

An A Trigger View Amplifier is provided that amplifies the A Trigger signal for display on the crt. This provides a method of making a quick and convenient check of the signal being used to trigger the A Sweep Generator and is intended primarily for checking the signal applied to the A External Trigger Input connector.

Since the A and B Trigger Generator circuits are virtually the same, only the A Trigger Generator circuit action and the differences between the A and B Trigger Generator circuits are explained. A schematic of these circuits is shown on diagram 5 at the back of this manual.

Trigger Source

The Trigger SOURCE switch S610 selects the source of the trigger signal. The sources available to the A Trigger Generator circuit are the signal(s) being displayed (NORM), Channel 1

(CH 1), Channel 2 (CH 2), LINE, and EXT. The EXT ÷ 10 (A trigger circuit only) position provides 10 times attenuation for the external trigger signal. The B Trigger SOURCE switch does not have a LINE or an EXT ÷ 10 position, but has a STARTS AFTER DELAY position.

In the LINE mode of triggering, a sample of the power line frequency is obtained from the secondary of power transformer T1501 in the Low Voltage Power Supply circuit. To prevent unwanted attenuation of the trigger signal by the LF REJ circuit, the Trigger COUPLING switches should not be in the LF REJ mode when using line voltage as a trigger source.

Trigger Coupling

The Trigger COUPLING switches offer a means of accepting or rejecting certain components of the trigger signal. In the AC, LF REJ, and HF REJ mode of trigger coupling, the DC component of the trigger signal is blocked by coupling capacitors C612 or C611. Frequency components below about 60 Hz are attenuated when using AC or HF REJ coupling and below about 15 kHz when using HF REJ coupling. The higher frequency components of the trigger signal are passed without attenuation. In the HF REJ mode of trigger coupling, the high frequency components of the trigger signal (above about 50 kHz) are attenuated, while the lower frequency components are passed without attenuation. The DC mode of trigger coupling passes unattenuated all signals from DC to 100 MHz and above.

Input Source Follower

Transistor Q622 is an FET source follower. It provides a high input impedance (set primarily by R616) for the trigger signal and also provides isolation between the Trigger Generator circuit and the trigger signal source. Diode CR617 provides input protection for Q622 if excessively high amplitude negative-going input signals are present. Q624 is a high-impedance, relatively constant, current source for Q622, and provides a measure of temperature compensation for Q622.

Paraphase Amplifier

U640 is a paraphase amplifier stage that converts the single-ended input from Source Follower Q622 into a push-pull output applied to the tunnel diode driver stage. Trigger Level Centering adjustment R635 sets the level at pins 14 and 15 of U640 so that the display is correctly triggered when the LEVEL control is centered. The LEVEL control varies the level at pins 14 and 15 of U640 to select the point on a trigger signal where triggering occurs.

The slope of the input signal that triggers the Sweep Generator circuit is determined by the setting of the SLOPE switch S630. When the SLOPE switch is set to the + position, the output signal present at pin 8 of U640 is in phase with the input signal and the output signal at pin 9 is inverted with respect to the input signal. When the SLOPE switch is set to the - position, the output signal at pin 8 is inverted with respect to the input signal and the output signal at pin 9 is in phase with the input signal.

Tunnel Diode Driver

Q650 and Q652 are common-emitter amplifier stages that provide the signal currents necessary to switch the triggering tunnel diodes. CR650 and CR652 are 4.7 mA tunnel diodes. Quiescently (i.e., after the sweep holdoff period has passed, but before triggering), CR650 and CR652 are biased into their low voltage states. Q650 cannot provide sufficient current to switch CR650 to its high voltage state. Q652, however, can provide sufficient current to bias CR652 into its high voltage state; when Q652 next conducts triggering signal current, the anode of CR652 steps positive to an approximately +0.5 volt level. Since only approximately 1 mA of current is required to maintain CR652 in its high voltage state, this makes approximately 3 mA of current additionally available with which to switch CR650 to its high voltage state. Thus, the next time Q650 conducts signal current, CR650 steps to its high voltage state, sending a positive pulse to the logic circuit to initiate sweep action. A Trigger Sensitivity adjustment R655 adjusts the tunnel diode bias to the proper level that will not allow CR650 to be switched to its high voltage state until CR652 has been switched to its high voltage state. At the end of the sweep time and during holdoff, a negative level is applied to the anode of CR652,

thereby resetting both CR650 and CR652 to their low voltage states. The reset level remains during holdoff time to ensure that a sweep gating signal will not be generated until the sweep circuit has returned to its quiescent state.

A Trigger View Amplifier

The amplifier consists of two emitter-coupled push-pull amplifier stages. The collector supply voltage is switched on and off by the TRIG VIEW pushbutton switch. With TRIG VIEW pushbutton not pushed, the emitter of Q672 and Q682 are returned to about -3 volts, due to the voltage divider between the +15 volts at R691 and the -8 volts at R675. This reverse-biases the base-emitter junctions of the transistor to prevent loading the A Trigger Generator circuit.

When the TRIG VIEW pushbutton is pushed the emitters of Q672 and Q682 are connected to +15 volts through R673 and R683 to allow signal amplification. R675 adjusts for display centering.

Normally, the output of the Vertical Switching Amplifier is applied to the input of the Delay Line. When the TRIG VIEW pushbutton is pressed, the signal from the Vertical Switching Amplifier is removed and the output from the A Trigger View Amplifier is applied in its place.

A AND B SWEEP GENERATORS

General

The A and B Sweep Generators produce sawtooth voltages which are amplified by the Horizontal Amplifier circuit to

provide horizontal deflection on the crt. These sawtooth voltages are produced on command (trigger pulses) from the Trigger Generator circuits. The Sweep Generator circuits also produce gate waveforms that are used by the Z Axis Logic circuit to unblank the crt during sweep time and by the Sweep Logic circuit to terminate sweep generation. Fig. 3-5 shows a detailed block diagram of the A Sweep Generator circuit. The B Sweep Generator circuit is very similar to the A Sweep Generator; therefore only the differences in operation associated with the B Sweep Generator will be discussed. A Schematic of both circuits is shown on diagram 6 at the rear of this manual.

Disconnect Amplifier

After holdoff but before the next sweep, Disconnect Amplifier Q1024 conducts current through R1024 and the timing resistor R_t. This prevents timing current from charging the timing capacitance C_t. The positive-going sweep start gate from Q908 turns off Q1024 and the timing current now begins to charge the timing capacitance.

Sawtooth Sweep Generator

Q1030 and Q1036 compose a Miller Integrator circuit. When the current flow through the Disconnect Amplifier is interrupted, the timing capacitance begins to charge through the timing resistor. The timing resistor and capacitance are selected by the A TIME/DIV switch to provide the various sweep rates listed on the instrument front panel. The output signal at the collector of Q1036 is a negative-going sawtooth waveform.

Output Buffer Amplifier

The Output Buffer Amplifier stage is a common-base amplifier with the signal current-driven into the emitter. It provides the output sawtooth current signal to the Horizontal Amplifier and provides a measure of isolation between the Sawtooth Generator and the Horizontal Amplifier. The HORIZ DISPLAY switch connects to this stage to control the A sawtooth output in the various horizontal modes of operation. In the A and A INTEN modes of operation, the A sweep signal passes through Q1038 to the Horizontal Amplifier. However, in the MIX and B DLY'D modes, -8 volts is connected to the emitter of Q1038 through CR1036 and R1036. This biases Q1038 off, preventing the A sawtooth signal from passing to the Horizontal Amplifier.

Sweep Start Amplifier

Just before the sweep starts to run down, the levels at the bases of Q1002A and B are approximately equal. When the sweep starts to run down, the base of Q1002B goes negative, which increases the forward bias on CR1004. This in turn decreases the forward bias on CR1001, which, very shortly after the start of the sweep, becomes reverse biased to interrupt the current through Q1002A. The circuit remains in this condition until after the sweep retrace is complete. When the circuit returns to quiescence, Q1002A again begins to conduct through R1024. This sets the current through Q1024, which establishes the starting point for the sweep. The Sweep Start adjustment sets the base level of Q1002A. This level is also connected to the base of Q1062A in the MIX mode of operation. This ensures that B Sweep starts at the same level as A Sweep.

B Sweep Generator Differences

There are three prime differences between the A and B Sweep Generators. The B Sweep Output Buffer Amplifier is prevented from passing the B Sweep signal to the Horizontal Amplifier in the A and A INTEN positions of the HORIZ DISPLAY switch. There is a transistor stage connected as a constant current source in the emitter circuit of Q1062A and B (corrects for current imbalances side-to-side in Q1062 during MIX mode operation). The Sweep Start Level connected to the base of Q1062A is not always a fixed dc level. During MIX mode operation the A Sweep Sawtooth signal is applied to the base of the amplifier. Now, the dc level at which the B Sweep Generator will start generating its sawtooth waveform is constantly being changed by the A Sweep sawtooth. The output waveform from the B Sweep Generator takes the form of a composite sawtooth waveform, with the first and last parts occurring at a rate determined by the A Sweep Generator and the middle part occurring at a rate determined by the B Sweep Generator.

SWEEP AND Z AXIS LOGIC CIRCUIT

General

The Sweep and Z Axis Logic Circuit derives the logic levels necessary to control the sequence of events associated with sweep generation and crt unblanking. The +A and +B GATE signals are also generated in this circuit. Positive logic terminologies and symbologies will be used in the following explanation of circuit operation. A schematic of this circuit is shown on diagram 8 at the rear of this manual.

A Sweep Gate

Q904 and Q906 compose the A Sweep Gate Circuit. They form an emitter coupled stage where only one transistor can be conducting at any time. The input signal to the stage is the positive-going trigger signal from the A Firing TD in the A Trigger Generator Circuit. The signal at the collector of Q904 is connected to the A Z Axis Gate Circuit to control CRT blanking and to generate the + A GATE signal. The signal at the collector of Q906 is connected to the emitter of the Sweep Disconnect Amplifier stage (Q1024) in the A Sweep Generator Circuit to initiate A Sweep generation.

B Sweep Gate

Q864 and Q866 compose the B Sweep Gate Circuit. They also form an emitter-coupled stage where only one transistor can be conducting at any time. The input signal to the stage is the positive-going trigger signal from the B Trigger Firing TD in the B Trigger Generator Circuit. The signal at the collector of Q866 is connected to the emitter of the Sweep Disconnect Amplifier stage (Q1084) in the B Sweep Generator Circuit to initiate B Sweep generation.

Sweep Control Integrated Circuit

U980 is the Sweep Control Integrated Circuit. Several functions are performed in this stage, depending on the mode of operation of the instrument sweep generators. The following is a brief explanation of the function associated with each pin of the IC.

Pin 1. This is the positive Auto Sense input. The signal connected here comes from the A Fire Trigger TD.

Pin 2. This is the negative Auto Sense input. A fixed DC level established by R981 and R982 is connected here.

Pin 3. This is the + auto gate terminal. In the AUTO mode of operation, if no trigger signals are applied to pin 1 of U980 during the ≈ 100 ms following the end of holdoff the gate level at pin 3 steps LO to turn Q906 on, which initiates a sweep.

Pin 4. Not used in this application.

Pin 5. Input terminal for negative voltage supply.

Pin 6. This is the auto gate timing terminal. R944 and C944 determine the amount of time between the end of holdoff and the generation of the auto gate.

Pin 7. This terminal lights the TRIG'D light when a triggered gate has occurred.

Pin 8. This is the holdoff timing terminal. The R/C connected to this terminal (selected by the TIME/DIV switch) determines the length of holdoff time.

Pin 9. Ground terminal.

Pin 10. This is the Holdoff output terminal. The gate level present here is LO during sweep holdoff time and HI otherwise.

Pin 11. This terminal lights the READY light when operating in the single sweep mode.

Pin 12. This is the single sweep mode terminal. When +5 volts is applied to this terminal the sweep operates in the single sweep mode; when the terminal is left open or grounded the sweep operates in the repetitive mode.

Pin 13. This pin is used for the FAST storage mode. When +5 volts is applied here the sweep operates in a mode similar to single sweep. However, the sweep is reset automatically when a signal from the storage circuit allows pin 18 to go LO.

Pins 14 & 15. Single sweep reset terminals. Pushing the PUSH TO RESET button prepares the single sweep circuitry to respond to the next one triggering event. Also causes the READY light to be lit.

Pin 16. This is the holdoff start input terminal. The HI sweep reset gate pulse from the sweep generators is applied here to initiate sweep holdoff.

Pin 17. This is the sweep disable output terminal. The gate level at this terminal is HI during holdoff and LO otherwise.

Pin 18. Sweep lockout input. +5 volts applied to this terminal disables all sweep action.

Pin 19. Auto mode terminal. Grounding this terminal enables auto sweep operation.

Pin 20. Input terminal to positive voltage supply.

A Sweep Holdoff Amplifier

Q954 is the A Sweep Holdoff Amplifier. The holdoff gate waveform is applied to the base of Q954 through R952 and C952 from pin 17 of U980. When Q954 is turned off (during holdoff time), its collector is LO and CR957 is forward biased, which resets both the Arm and Fire Trigger TD's in the A Trigger Generator. When Q954 is turned on (any time other than holdoff time), its collector level is HI and CR957 is reverse biased. This allows the trigger TD's in the A Trigger Generator to respond to the next adequate triggering signal.

B Sweep Holdoff Amplifier

Q844 is the B Sweep Holdoff Amplifier. Its circuit action is identical to that described for the A Sweep Holdoff Amplifier except that there are three gate signal sources that control the state of the stage. The three sources are the holdoff gate from pin 17 of U980 (through CR946), the collector of Q834 in the Delay Pickoff Comparator, and the collector of Q894 in the B Latch Multivibrator (through CR885). All three gate sources must

be in their LO state for B Sweep to be triggerable; any one of the sources in its HI state will disable the B Trigger Generator TD's.

Logic Multivibrator

Q926 and Q924 compose a multivibrator. At quiescence, Q924 is conducting and Q926 is turned off. When the sweep starts to run, the negative-going ramp is coupled through the base of Q1002B (A and B Sweep Generator Circuit) and CR1004 to the cathode of CR1011. CR1011 becomes forward biased and when the level at the anode of CR1011 falls to about +4 volts Q926 conducts and Q924 turns off. The multivibrator remains in this state until the sweep starts to retrace and the voltage level at the anode of CR1011 rises above about +4.5 volts. The resultant pulse at the collector of Q926 is applied to Sweep Control IC U980 to terminate the sweep. The pulse at the collector of Q924 is applied to the A Sweep Z Axis Gate to blank the CRT at the end of the sweep.

A Sweep Z-Axis Gate

Q912 and Q914 compose the A Sweep Z-Axis Gate. They form an emitter-coupled stage where only one transistor can be conducting at any given time. The controlling signal inputs come from the collector of Q904 in the A Sweep Gate, the blanking signal from Q924 in the A Sweep Generator, and Q906 in the B Latch Multivibrator (only in the MIX mode of operation). The blanking signal for use in the Z-Axis Amplifier is taken from the collector of Q914. The collector signal of Q912 is applied to the +A GATE Emitter Follower.

In all positions of the HORIZ DISPLAY switch except for B DLY'D, -8 volts is connected to the cathode of CR896. This pulls the anode CR895 down very close to -8 volts, causing it to be reverse biased, which in turn allows the gate signal at the collector Q914 to pass to the Z-Axis amplifier. In the B DLY'D position of the HORIZ DISPLAY switch, -8 volts is no longer connected to CR896. This allows CR895 to be forward biased, which blocks the A blanking signal from passing through Q914 to the Z-Axis Amplifier.

In all positions of the HORIZ DISPLAY switch except MIX, -8 volts is connected to the cathode CR887. This keeps CR888 reverse biased and prevents the collector signal of Q886 from affecting the A Z-Axis Gate. However, in the MIX position of the HORIZ DISPLAY switch, -8 volts is no longer connected to CR887. Now, when the B Sweep ends and sets the B Sweep Latch circuit, the collector signal of Q886 (through CR888) switches the A Sweep Z-Axis Gate causing the CRT display to be completely blanked. This prevents any further display of A Sweep in the MIX mode even though A Sweep may still be running.

B Sweep Z-Axis Gate

Q852 and Q854 compose the B Sweep Z-Axis Gate. They form an emitter-coupled stage where normally one transistor is on and the other is off. The controlling signal inputs come from the collector of Q864 in the B Sweep Gate and the blanking signal from Q874 in the B Sweep Generator. The blanking signal for use in the Z-Axis Amplifier is taken from the collector of Q852

(through CR894). The collector signal of Q854 is applied to the +B GATE Emitter Follower.

In the A position of the HORIZ DISPLAY switch, -8 volts is applied to the cathode of CR893, which causes CR892 to be back biased. The collector of Q852 pulled positive through R851 and CR851, which in turn back biases CR894, preventing the B Sweep Z-Axis Gate from affecting CRT unblanking. In the MIX and A INTEN positions of the HORIZ DISPLAY switch, -8 volts is removed from the cathode of CR893 and applied to the cathode of CR821. This forward biases CR892 and reverse biases CR851. CR894 is still reverse biased, but when B Sweep starts, the collector of Q852 steps negative enough to forward bias CR894 and add a slight amount of unblanking to the A Sweep unblanking already present. This provides a measure of intensification for the B Sweep portion of an A INTEN or MIX display. In the B DLY'D position of the HORIZ DISPLAY switch, -8 volts is applied to the cathodes of CR821 and CR893. This reverse biases both CR892 and CR852, which allows the full B Sweep unblanking signal to pass through CR894. Since the A Sweep Z-Axis Gate output diode CR896 is held reverse biased, the only unblanking signal present at the input to the Z-Axis Amplifier will be the B Sweep signal.

+A GATE And +B GATE Emitter Followers

Q916 and Q856 are emitter followers providing the +A GATE and +B GATE output signals available at the instrument rear

panel. The output signals are positive-going rectangular waveforms, approximately 5.5 volts in amplitude. The amplitude is set in the collectors of Q912 and Q854. For example, when Q912 is conducting the base of Q924 can go no more negative than approximately -0.7 volt (limited by CR914). When Q904 is not conducting the base of Q924 rises to the decoupled +5 volts power supply level through R914, CR916, CR917, CR857, and CR858 provide protection against accidental application of damaging voltage levels to the +A GATE and +B GATE output connectors.

B Sweep Latch

Q882 and Q884 compose the B Sweep Latch. Quiescently, (before either the A or B Sweeps have reached their maximum amplitudes) both transistors are off. Then, the sweep reset pulse from whichever sweep terminates first will be applied to the base Q882 (A Sweep reset through CR882; B Sweep reset through CR874). The positive-going reset pulse turns on Q882 and the negative-going movement at its collector turns on Q884. The collector of Q884 in turn pulls up on the base of Q882, holding Q882 on, which causes the circuit to stay in its on or latched state. The HI at the collector of Q884 is applied to the base of the B Sweep Holdoff Amplifier (through CR885) to disable the B Trigger Tunnel Diodes. In the B ENDS A position of the A TRIG HOLDOFF control the HI is also applied to the holdoff start input terminal of the Sweep Control IC through C947. Thus, when B Sweep ends A Sweep ends also.

The B Latch Multivibrator is reset to its quiescent state by the LO Holdoff level present at pin 10 of the Sweep Control IC during A Sweep holdoff.

HORIZONTAL AMPLIFIER

General

The Horizontal Amplifier circuit provides the output signals to the CRT horizontal deflection plates. The signal applied to the input of the Horizontal Amplifier is determined by the TIME/DIV switch. The signal can be a sawtooth waveform generated within the instrument, or some external signal applied to the CH 1 OR X input connector (X-Y mode of operation). The Horizontal Amplifier also contains the X10 magnifier, horizontal positioning, and some beam finder circuitry. Fig. 3-6 shows a detailed block diagram of the Horizontal Amplifier circuit. A schematic of this circuit is shown on diagram 9 at the rear of this manual.

X-Axis Amplifier

In all positions of the TIME/DIV switches except X-Y, the input signal to the base of Q1232 will be the sawtooth waveforms from the sweep generators. In the X-Y mode however, the sweeps are disabled and the signal applied to Q1232 comes from the Channel 1 Preamp via the X-Axis Amplifier stage. This stage includes Q1212, Q1222, and their associated circuitry.

Q1212 is connected as a feedback amplifier with R1216 as the feedback element. The input resistance is made up of R1212 and the gain-setting adjustment R1214. When not operating in the X-Y mode, the base of Q1212 rises toward the +15 volt supply but is clamped at approximately +4 volts by the divider action of R1218 through CR1218. This reverse biases the base-emitter junction of Q1214. The base of Q1222 also rises to approximately +4 volts. With the junction of R1205-R1222 at approximately 0 volts, Q1222 is also biased off.

When the TIME/DIV switches are set to the X-Y position (fully counterclockwise), -8 volts is applied to the junction of R1215 and R1217. Also, +5 volts is applied to the emitter circuit of Q1222 through CR1205. This biases the Z-Axis Amplifier circuit into conduction. At the same time, +5 volts is applied to the Channel 1 Scale-Factor Switching Amplifier circuit (through CR1202) and to R984 on diagram 8. This enables both scale-factor indicating circuits at the same time and disables sweep generation.

Input Paraphase Amplifier

Q1232 and Q1242 compose the Input Paraphase Amplifier. This is an emitter-coupled amplifier stage that converts the single-ended input signal to a push-pull output signal. The signal at the collector of Q1232 is opposite in phase to the input signal. The signal at the collector of Q1242 is in phase with the input signal. Thermistor resistor RT1243 reduces in value with increases in ambient temperature to

increase the gain of the stage. This compensates for changes in amplifier gain that occur as operating temperatures vary. R1227A and R1227B are the Horizontal POSITION and FINE controls, respectively. The FINE control has approximately one tenth the range of the POSITION control and provides fine adjustment of a magnified display.

Gain Setting Amplifier

Q1236 and Q1246 are an emitter coupled push-pull amplifier stage. The gain of the Horizontal Amplifier is controlled by adjusting the resistance connected between the emitters of this stage. The X1 Gain adjustment R1257 adjusts unmagnified horizontal gain and the X10 Gain adjustment R1253 adjusts magnified horizontal gain. Magnifier Registration adjustment R1255 balances quiescent DC current in Q1236 and Q1246 so that a center screen display does not change position when the X10 Magnifier is turned on.

When the BEAM FIND pushbutton is pressed, R1266 and R1267 are connected to +65 volts. This causes the Horizontal Amplifier to operate closer to the point where signal limiting occurs, thereby ensuring that an overscanned display will remain within the CRT viewing area.

Output Amplifier

The push-pull signal from the Gain Setting Amplifier is connected to the Output Amplifier through CR1262 and CR1265.

Each half of the Output Amplifier can be considered as a single-ended feedback amplifier, which amplifies the signal current at the input to produce a voltage output to drive the horizontal deflection plates of the crt. The amplifiers have a low input impedance and require very little voltage change at the input to produce the desired output change. The Output Amplifiers are limited from overdrive by CR1263, CR1264, CR1262, and CR1265. The input diodes CR1253 and CR1273 become back-biased when the signal level at either input becomes too positive and the diodes connected back to back between the two signal paths ensure that the signal amplitude side to side will be limited to a maximum of about 0.7 volt.

Transistors Q1272 and Q1282 are inverting amplifier stages whose collector signals drive the emitters of complementary amplifiers Q1274-Q1276 and Q1284-Q1286 respectively. C1281, C1274, and C1283 provide a signal path for fast AC signal currents from one side of the amplifier to the other. R1262-R1263 and R1264-R1265 are the feedback elements in the amplifier with C1262-C1263 and C1264-C1265 providing high-frequency compensation. The output signal from Q1274-Q1276 drives the right CRT deflection plate, while the signal from Q1284-Q1286 drives the left.

CALIBRATOR

General

The Calibrator circuit produces a square-wave output signal with accurate voltage and current amplitudes. This output is available as a voltage or current at the CALIBRATOR current loop on the instrument front panel.

Multivibrator

Q1362 and Q1372 along with their associated circuitry compose an astable multivibrator. The basic frequency of the multivibrator is approximately one kilohertz and is essentially determined by the RC combination of C1364, R1367 and R1365. Q1362 and Q1372 alternately conduct, producing a square-wave output signal, which is taken from the collector of Q1372.

Output Amplifier

The output signal from the Multivibrator overdrives Output Amplifier Q1376 to produce an accurate square wave at the output. When the base of Q1376 goes positive it is cut off and the collector level drops to ground. When the base goes negative, Q1376 is biased into saturation and its collector rises positive to about +5 volts. Amplitude adjustment R1375 adjusts the resistance between the collector of Q1376 and ground to determine the amount of current allowed to flow, which in turn determines the voltage developed across R1377.

LOW-VOLTAGE POWER SUPPLY

General

The Low-Voltage Power Supply provides the operating voltages for the circuitry in this instrument from six regulated supplies. Electronic regulation is used to provide stable, low-ripple output voltages. A schematic of this circuit is shown on diagram 11 at the rear of this manual.

Power Input

Power is applied to the primary of transformer T1701 through Line Fuse F1701, POWER switch S1701, Thermal Cutout S1702, Line Voltage Selector switch S1703, and the Regulating Range Selector Assembly. Line Voltage Selector switch S1703 connects the split primaries of T1701 in parallel for 115-volt nominal operation. Line Fuse F1701 should be changed to the correct value to provide the correct protection for each nominal line voltage (current rating of fuse for 230-volt operation is one-half the current rating of fuse for 115-volts).

The vacant windings between pins 10, 11, 12, 13 and 14 of T1701 are intended for use with the optional Inverter Circuit Board (Option 7). This allows the instrument to be operated from an external DC power source or an 1106 Power Supply.

Secondary Circuit

The -8 volt, +5 volt, -15 volt, +15 volt and +65 volt

supplies are series-regulated. U1724A and B and U1762A and B are high-gain amplifier cells with differential inputs. These amplifiers monitor voltage variations in the output voltages.

The +65 V supply uses zener diode VR1726 as its reference and is adjustable by a calibration control, R1736. All other supplies are referenced to the +65 volt supply. The +140 volt regulated supply is referenced to the +65 volt supply via 75 Volt zener diode VR1718. The +160 V supply is referenced to the +140 V supply via 20 V zener diode V1712.

C1743, C1744, and R1743 compose a wave-shaping circuit that provides a sample of the AC voltage present in the secondary of T1701 to the trigger circuitry for use in the LINE positions of the Trigger SOURCE switches.

FAN MOTOR CIRCUIT

General

The fan motor used in the 466 is a brushless DC fan motor using Hall Effect devices. The fan motor circuitry varies the rotational speed of the fan with variations in operating temperature. When the ambient temperature increases, the value of thermistor RT1696 reduces. This biases Q1698 on harder to conduct more current through the Hall devices. Higher currents through the Hall devices causes the potential difference across them (for instance, between pins 6 and 8 of the fan) to increase. This potential difference biases one of a pair of transistors

on and the other off. For instance, if pin 8 is more positive than pin 6 of the fan, Q1690A will be on and Q1690D will be off. The higher the potential difference between pin 8 and pin 6 the harder the on transistor will be conducting. The harder the transistor is conducting, the faster the fan rotates.

Z AXIS/CRT CIRCUIT

General

The CRT Circuit provides the voltage levels and control circuits necessary for operation of the cathode-ray tube. Fig. 3-7 shows a detailed block diagram of this circuit. The schematic of this circuit is on diagram 10 at the rear of the Manual.

High Voltage Oscillator

Q1486 and its associated circuitry compose the high-voltage oscillator that produces the drive for the high-voltage transformer, T1501. When the instrument is turned on, current through Q1484 provides forward bias for Q1486. Q1486 conducts and as its collector current increases, a voltage develops across the collector winding of T1501. This produces a corresponding voltage increase in the feedback winding of T1501, which is connected to the base of Q1486, reinforcing the drive on Q1486. Eventually the rate of collector current increase in Q1486 becomes less than that required to maintain the voltage across the transformer winding and the output

voltage drops. This turns off Q1486 by way of the feedback voltage to the base.

The voltage waveform at the collector of Q1486 is a sine-wave at the resonant frequency of T1501. Q1486 remains off during the negative half cycle while the field collapses in the primary of T1501. When the field is collapsed sufficiently, the base of Q1486 becomes forward biased into conduction again and the cycle repeats.

The amplitude of sustained oscillation depends on the average current delivered to the base of Q1486. The oscillator frequency is approximately 50 KHz. Fuse F1487 protects the +15 volt supply if the High Voltage Oscillator circuit becomes shorted. C1487 and L1487 provide decoupling from the +15 volt, unregulated supply.

High-Voltage Regulator

Feedback from the crt cathode supply is applied to the base of Q1472 through R1525D. Any change in the level at the base of Q1472 produces an error signal at the collector of Q1472, which is amplified by Q1476 and Q1484 and applied to the base of Q1486 through the feedback winding of T1501.

If the output voltage at the high voltage test point (TP1443) starts to go less negative, this positive-going change is applied to the base of Q1472. Q1472 conducts harder, which in turn causes Q1476 and Q1484 to conduct harder. This

results in greater bias current to the base of Q1486 through the feedback winding of T1501. Now, Q1486 is biased closer to its conduction level so that it comes into conduction sooner to produce a larger induced voltage in the secondary of T1501. This increased voltage appears as a more negative voltage at TP1443 to correct the original positive-going change. By sampling the output from the CRT cathode supply in this manner, the total output of the High-Voltage Supply is held relatively constant.

The Reduced Scan Horiz Cal is only effective when the REDUCED SCAN switch is pulled on. See description of Reduced Scan control circuit.

Over Current Protection

In some extreme cases, the crt could allow the current to increase high enough to damage the crt meshes. The Over-current Protection circuit will prevent this current from going beyond about 1 mA $\approx$ 90% of the total crt cathode current. As the current through pin 6 approaches a level representing a cathode current of approximately 1 mA, the voltage level at the base of Q1496 turns it on. Normally Q1496 and Q1492 are biased off. When Q1496 turns on Q1492 is biased into conduction, which starts to reduce the base drive applied to Q1484 and prevents the oscillator amplitude from increasing. This prevents the crt cathode current from increasing above approximately 1 mA.

High-Voltage Rectifiers and Output

The high-voltage transformer, T1501 has three output windings, one for the crt filament voltage, one that provides +600 V for the storage circuit and one that supplies the crt cathode and anode voltages. The filament winding is elevated to the level of cathode supply to prevent cathode-to-filament breakdown. A regulated DC voltage is used for the crt filament because the high-voltage transformer secondary varies considerably due to changing loads of the storage crt. The crt grid bias voltage is derived by a DC restorer circuit that uses a sample of the signal in the high-voltage winding in conjunction with DC levels supplied by the Z-Axis Amplifier and the negative cathode potential.

The positive accelerating potential is supplied by the High Voltage Mulitplier circuit. The regulated output voltage is approximately 7000 volts.

The negative cathode potential is supplied by half-wave rectifier CR1503. The voltage output depends on the Storage and Scan modes. See Table 3-1.

TABLE 3-1
CRT Cathode Voltages

	Non Store	Var Pers	Fast
Full Scan	-1470 V	-1460 V	-1445 V
Reduced Scan	≈ 3010 V	≈ 2990 V	≈ 2960 V

Z-Axis Amplifier

The Z-Axis Amplifier circuit controls the CRT intensity level from several inputs. The effect of these input signals is to either increase or decrease the trace intensity, or to completely blank portions of the display. The input transistor Q1424 is a current-driven, low input impedance amplifier. It provides termination for the input signals as well as isolation between the input signals and the following stages. The current signals from the various control sources are connected to the emitter of Q1424 and the algebraic sum of the signals determines the collector conduction level.

Q1428, Q1432, and Q1436 compose a feedback amplifier stage; R1434 and R1435 are the feedback elements. C1434 and C1435 provide high frequency compensation. Q1428 is an emitter follower providing drive to complementary amplifier Q1432-Q1436. CR1425, CR1432, and CR1439 provide protection in the event of high-voltage arcing.

In the .1 s, .2 s, .5 s, and X-Y positions of the TIME/DIV switch, +5 volts is connected to the anode of CR1401. This limits the effective range of the INTENSITY control to reduce the unblanking capabilities of the amplifier, thereby reducing the possibility of inadvertently burning the CRT phosphor. When the BEAM FIND pushbutton is pressed, two things occur: First, +15 volts is applied to the anode of CR1405 which lifts the emitter of Q1424 sufficiently positive to ensure there will be no con-

duction through Q1424. Secondly, R1425 becomes connected to -8 volts through R1427 which establishes a fixed predetermined unblanking level at the output of the amplifier. Thus, the INTENSITY control and all of the input unblanking signals have no control over the intensity level of the CRT display when the BEAM FIND pushbutton is pressed.

C414 is a high frequency by-pass to the crt cathode.

DC Restorer Circuit

C1443, C1444, CR1444, CR1445 and R1445 form a dc restorer circuit. All dc levels in this circuit are referenced to the negative potential of the crt cathode. The voltage difference across R1445 approximately equals the voltage swing present at the junction of CR1442 and CR1452. The control end of R1445 is more negative than the end connected to CR1445. The amplitude of the voltage swings at the junction of CR1442 and CR1452 is determined by the voltage levels established by the Z-Axis Amplifier circuit and the CRT Bias adjustment circuit. CR1452 sets the limit of the positive excursion and CR1442 sets the limit of the negative excursion.

CRT Control Circuits

Focus of the crt display is controlled by FOCUS control R1526. ASTIG adjustment R1575, which is used in conjunction with the FOCUS control to provide a well-defined display, varies the positive level on the astigmatism. Geometry adjustment

R1556 varies the positive level on the horizontal deflection plate shields to control the overall geometry of the display.

Two adjustments control the trace alignment by varying the magnetic field around the CRT. Y-Axis Full Scan adjustment R1563 controls the current through L1561, which affects the CRT beam after vertical deflection, but before horizontal deflection. Therefore, it affects only the vertical (Y) components of the display. TRACE ROTATION adjustment R1553 controls the current through L1551 and affects both vertical and horizontal rotation of the beam. R1554, Trace Rotation (Reduced Scan), R1564, Y-Axis (Reduced Scan) and R1573, Astig (Reduced Scan) become active only when in the REDUCED SCAN mode. See Reduced Scan control circuit description.

Reduced Scan Control Circuit

When the INTENSITY control is pulled for the REDUCED SCAN mode, several controls are switched in and the crt cathode supply voltage is approximately doubled.

The following calibration adjustments are active only in the REDUCED SCAN mode: R1464, Reduced Scan Horiz cal; R1527, Reduced Scan Vert Gain; R1554, Trace Rotation (Reduced Scan); R1564, Y-Axis (Reduced Scan) and R1573 Astig (Reduced Scan).

The voltage between pins 2 and 13 of the crt is kept constant when switching between NON STORE and store modes;

this keeps the crt grid-voltage cut-off constant. In the Full Scan Mode, pin 13 of the crt is at about +65 volts as set by CR1507 and R1507. Pin 2 of the crt is at about -1470 volts (in the NON STORE mode). When the REDUCED SCAN knob is pulled, +15 volts is applied to relay coil L1501, which closes S1501 and adds CR1506 to the rectifier circuit. This causes the voltage at pin 2 of the crt to go to approximately -3010 volts (in the NON STORE Mode).

R1464 is activated when +15 volts is applied to the cathode of CR1462. The voltage at the top of R1464 gradually goes to +15 volts as C1462 becomes charged.

In the Full Scan mode, there is about 3 volts across R1527, established by VR1532 and VR1527. In the REDUCED SCAN mode, +15 volts is removed from the cathode of VR1532 and the lower side of R1527 is allowed to go to about -158 volts, making the Reduced Scan Vert Gain control active.

R1554 and R1564 are activated in the REDUCED SCAN mode when +15 volts is connected to them. At the same time +15 volts is removed from R1553 and R1563.

R1573 is added to the ASTIG circuit in the REDUCED SCAN mode when S1403B switches +160 V to the top of R1573.

To keep the calibration correct when changing from NON STORE to VAR PERS or FAST storage modes, it is necessary to

change the crt cathode voltage. This is accomplished by taking current out of the summing node at the base of Q1472 through R1502 from the junction of R1542 and R1543.

In the NON STORE mode J8-5 and J8-6 are both grounded and very little current is flowing in R1502. In the VAR PERS mode J8-6 is ungrounded by S1921 and current is drawn through R1543, R1547, and R1502 to make the cathode voltage less negative.

In the FAST mode -15 V is connected, by J1921, to both J8-5 and J8-6. This allows current to be drawn through R1545, R1542, R1543 and R1502 to make the cathode voltage even less negative. See Table 3-1.

C1462 and C1465 are in the circuit to prevent bright flashes on the crt when changing between Full Scan and REDUCED SCAN.

The voltage/temperature characteristics of CR1466 and CR1462 help to keep the high voltage constant with temperature changes.

Storage Circuits

The Cathode Ray tube used in the 464/466 is an image transfer storage tube. In the FAST mode, the display is stored on the front mesh, and then transferred to the viewing screen. In the (VAR PERS) mode the stored information is

is displayed on the viewing screen and the viewing screen is pulsed with erase pulses. The storage circuitry is located on two boards (Storage Timing and Storage Output).

Erase and Timing Circuits

Fig. 3-8 shows a detailed block diagram of the Erase and Timing circuits. When the ERASE button is pressed, programable unijunction transistors Q1836 and Q1838 are turned on. Q1838 will turn on first due to the charging of C1835 and the voltage divider in the gate circuit. When Q1838 is turned on the timing register (U1874A, U1874B and U1878) is cleared. The timing register is ready to start counting. When Q1836 is turned on by the charging of C1834, a pulse is generated to start the clock generator Q1864. After six clock pulses have been counted by the timing register the last flip flop of U1878 triggers U1874A, to flip on the next clock pulse, which turns on Q1872, stopping the clock generator. In the VAR PERS storage mode the timing register works the same way as in the FAST mode, except that on the fourth clock pulse the clock generator is turned off. When pin 6 of U1878 goes LO the timing register is cleared through U1866D and U1866C. Five pulses are generated by the timing register A, $\overline{A}$, B, E and $\overline{E}$. See Fig. 3-9 for the output waveforms of the timing register.

When Q1836 is turned on, U1846B (monstable multi-vibrator) is turned on for 100 milliseconds. This produces a pulse at the G output. When an "A" SWP END occurs the timing register

receives a clear pulse which generates another 100 millisecond pulse (transfer pulse) is only produced in the FAST mode. In the VAR PERS mode, the last flip flop does not change states. The G pulse provides the 600 volt, 100 millisecond fade positive pulse to the Front Mesh. The K pulse is generated by the G pulse and the zero output of U1874B. After the "A" SWP END pulse, the timing register is cleared and a K pulse is generated by the G pulse. The K pulse is used for a transfer pulse on the front mesh. The A and $\overline{A}$ pulses are generated by U1874B (the first stage of the timing register). The A output line is HI for six clock pulses and then goes LO after a clear pulse is generated. The $\overline{A}$ pulse is the opposite of the A pulse. The I output produces pump pulses. QA is a 100 Hz oscillator which triggers U1846A. The output of U1846A is a 100 Hz two micro-seconds wide pulse. When pin 10 of U1878 goes HI the pump pulses are gated to the I output. The K pulse turns off the gate U1816D to stop the pump pulses. The 100 Hz oscillator also triggers U1844 a monstable multivibrator. The output of U1844 produces the VAR PERS pulses at the J output. No variable persistence pulses are generated for the first two clock pulses. When pin 14 of U1878 goes HI, variable persistence pulses are gated through U1876A.

In the FAST mode, the J output is the opposite of the B output ($\overline{B}$). See Fig. 3-8 for details. The width of the variable persistence pulses is controlled by the VIEW TIME control. The VIEW TIME controls the amount of current charging C1812, which controls the time that U1844 is on. In the FAST

mode, the VIEW TIME controls the time between erase cycles. The automatic erase generator is made up of Q1832 and Q1834, with C1831 as a timing capacitor. The charging current for C1831 comes from the VIEW TIME control. After C1831 is charged, Q1832 and Q1834 will flip causing Q1836 to turn on, starting a new erase cycle.

The M output is produced by Q1852. The signal from Q1852 runs at a 5 KHz rate with the 100 Hz pump pulse oscillator providing a sync coupling through C1842. The M output signal is a 5 KHz sawtooth, used to provide a uniformly stored display.

In the FAST mode, when more than one display is stored, flip flop U1872 is set by the single sweep switch. This disables U1876B so that the fade positive pulse and pre-pulses are not generated, but the transfer pulse is generated by the "A" SWP END pulse clearing the timing register through the $\overline{E}$ output.

The L signal is used in the SAVE mode to pulse the flood gun cathode, this reduces the flood gun cathode current. The 100 Hz output is connected to Q2072 and Q2074. The SAVE INTENS controls the duty cycle of the pulses from the L output to the flood gun cathode.

Storage Output Circuits

The storage output amplifier circuits (Fig 3-10) provides

selected voltage levels for the crt storage elements to maintain proper operation in all modes of operation (Non Store, Fast Var Persistence). See the timing diagrams for each mode of operation.

Flood Gun Anode and CE1 Amplifiers

The basic circuit is a two transistor operational amplifier. The output voltage is controlled by the input current. The FGA and CE1 amplifiers operate the same, with the input currents and outputs being different. See Figs. 3-11 through 3-14 for waveforms and voltage levels produced. The $\overline{A}$ pulse turns off diode CR2054 and CR2044. When these diodes are off, current from R2053 and R2043 is added to the amplifier input through diodes CR2055 and CR2045. When the B pulse occurs CR2053 and CR243 are turned on, which turns off CR2055 and CR2045, removing the current through R2053 and R2043 from the input. In the Multi-Fast mode[1], diodes CR2052 and CR2042 are held on by the H input level. This maintains a 20 V level on the FGA element and a 30 V level on the CE1 element. In the non store mode, the voltage divider R2054 and R2052 provide the input current which sets the output voltage of the FGA amplifier. Resistors R2044 and R2042 set the input current, which sets the output voltage of the CE1 amplifier.

CE2 and CE3 Circuits

The basic circuit is a two transistor operational amplifier.

[1]The storage circuit is put into the Multi-fast mode by pressing the SINGL SWP pushbutton, while in the FAST mode.

The output voltage is controlled by the input current. The $\overline{A}$ pulse turns off CR2032 and turns on CR2034, which adds the current through R2031 to the input. In the variable persistence mode, the +5 volt to CR2033 turns it on and turns off CR2034, removing the current from R2031 to the input. When the K and the $\overline{A}$ pulses are HI, both diodes CR2035 and CR2032 are turned on, turning off diodes CR2034 and CR2036. This removes the current from R2032 and R2031 from the input of the amplifier. The Zener diode VR2038 maintains a 20 volt difference between the CE2 output and the CE3 output.

Collector Circuit

The basic circuit is a three transistor operational amplifier. The output voltage is controlled by the input current. In the Non Store mode, the input current is provided by the voltage diodesR2022 and R2012. In the Variable Persistence mode the +5 volts connected to CR2013 by S1921C turns CR2013 on and turns CR2012 off, which removes the current through R2013 from the input. When the $\overline{A}$ and the K pulses are both HI, CR2014 and CR2016 are turned on, turning CR2015 and CR2012 off, thus removing the current through R2015 and R2013 from the input.

Fast Mesh Circuit

The basic circuit is a four transistor operational amplifier. The output voltage is controlled by the input current. In the Non Store mode, the input current is provided by R1984 and R1988. In the storage modes, the $\overline{A}$ pulse turns off CR1986

and turns on CR1984 thus adding the current through R1985 to the input. In the Variable Persistence mode, switch S1921C connects the +5 volts to CR1985, turning it on and turning CR1984 off, which reduces the current to the amplifier. In the Fast mode, I pulses turn on CR1982, which turns off diode CR1983, removing the current through the Fast Prep adjustment from the amplifier. When the K pulse is HI, CR1988 is turned off and CR1987 is turned on and the current through R1987 and R1989 is applied to the input circuit to provide a transfer level on the Fast Mesh.

Front Mesh Circuit

The basic circuit is a four transistor operational amplifier (Q1938, Q1942, Q1944 and Q1948) and a fast high voltage switch (Q1952, Q1956, Q1962, Q1964, Q1966 and Q1968). In the Non-Store mode, the amplifiers input current is through R1925, Diodes CR1938, CR1935, and CR1927 are turned off. When $\overline{A}$ goes LO, CR1932 is turned on and CR1933 is turned off, removing the input current through CR1933. When the J pulse goes LO, CR1924 turns on and CR1925 is turned off. This removes the current through the STORAGE LEVEL control from the input. Diode CR1926 is turned off by the J pulse, which connects the current through the Front Prep adjustment to the input. When the E pulse occurs, CR1928 and CR1936 turn on, removing the current from the Front Prep and the Front Op adjustments to the input circuit. When $\overline{E}$ goes LO, CR1937 is turned off, which allows the current through the Front Hold Adjustment to be added to the input circuit. The G pulse output is connected directly to Q1952, the input of the high voltage switch. When the G pulse goes HI, Q1952

conducts, turning Q1956 off, which turns off Q1962 and Q1964 and turns on Q1966 and Q1968, applying a 600 J pulse to the Front Mesh. Diode CR1941 is turned off, disconnecting the operational amplifier from having any control over the Front Mesh during a G pulse. See the waveforms and voltage levels for the Front Mesh.

MAINTENANCE

Introduction

This section of the manual contains maintenance information for use in preventative or corrective maintenance and troubleshooting the 466.

Cabinet Removal

WARNING

Dangerous potentials exist at several points throughout this instrument. When the instrument is operated with the cover removed, do not touch exposed connections or components. Some transistors may have elevated cases. Disconnect power before cleaning the instrument or replacing parts.

The instrument wrap-around cabinet can be removed in the following manner:

1. Unwrap the power cord from the pouch.
2. Remove the six screws indicated in Fig. 4-1 and remove the rear ring assembly from the instrument.
3. With front cover in place, set instrument on its face.
4. Slide the wrap-around cabinet off the rear.

To replace the instrument in its wrap-around cabinet, reverse the removal procedure. The portable wrap-around cabinet should be installed with the carrying handle pivot points and positioned toward the bottom of the instrument.

PREVENTIVE MAINTENANCE

General

Preventive maintenance consists primarily of cleaning and visual inspection. When performed on a regular basis, preventive maintenance can prevent instrument breakdown and will improve the reliability of this instrument. The severity of the environment to which the instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is just prior to recalibration of the instrument.

Cleaning

General. The instrument should be 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 and prevents efficient heat dissipation. It also provides an electrical conduction path which can result in instrument failure.

The cabinet provides protection against dust in the interior of the instrument. Operation without the cabinet in place necessitates more frequent cleaning. The front cover provides a measure of dust protection for the front panel and the crt face. The front cover should be installed when storing or transporting the instrument.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain benzene, toluene, xylene, acetone or similar solvents. Recommended cleaning agents are isopropyl alchol or Kelite (1 part Kelite, 20 parts water).

Switch Contacts. Most of the switching in the 466 is accomplished with circuit-board mounted, cam-actuated contacts. Care must be exercised to preserve the high-frequency characteristics of these switches. Seldom is switch maintenance necessary, but if it is required, observe the following precautions.

Cleaning the switch contacts should only be done using isopropyl alcohol or a solution of one part Kelite to 20 parts water. In the absence of these three cleaners it is safe to use petroleum ether, white kerosene, or a solution of 1% Joy detergent and 99% water. Do not use acetone, MEK, MIBK, benzol, toluoul, carbon tetrachloride, trichlene, methyl alcohol, methylene chloride, sulfuric acid, or Freon TC-TE-TF-22-TA-12.

Most spray circuit coolants and contact cleaners contain Freon 12 as a propellant. Because many Freons adversely affect the contacts, check the contents before using a spray cleaner or coolant. An acceptable contact cleaner-restorer is No Noise (Electronic Chemical). The only recommended circuit coolants are dry ice or isopropyl alcohol. There are three recommended switch lubricants. They are Silicone Versilube (General Electric Co.), Rykon R (Standard Oil, and WD-40 (Rocket Chemical Co.).

Exterior. Loose dust accumulated on the outside of the 466 can be removed with a soft cloth or small paint brush. The paint brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

CRT. Clean the blue and clear plastic light filters and the crt face with a soft, lint-free cloth dampened with denatured alcohol or a mild detergent and water solution. The optional crt mesh filter can be cleaned in the following manner.

1. Hold the filter in a vertical position and brush lightly with a soft brush to remove light coatings of dust and lint.
2. Greasy residues or dried-on dirt can be removed with a solution of warm water and a neutral pH liquid detergent. Use the brush to lightly scrub the filter.
3. Rinse the filter thoroughly in clean water and allow to air dry.
4. If any lint or dirt remains, use clean low-pressure air to remove. Do not use tweezers or other hard cleaning tools on the filter; the special finish may be damaged.
5. When not in use, store the mesh filter in a lint-free dust-proof container such as a plastic bag.

Interior. Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air. Remove any dirt that remains with a soft paint brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning circuit boards.

Visual Inspection

The instrument should be inspected occasionally for such defects as broken connections, broken or damaged ceramic strips, improperly seated semiconductors, damaged or improperly installed circuit boards, and heat-damaged parts.

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

Lubrication

The fan motor and most of the potentiometers used in the 466 are permanently sealed and generally do not require periodic lubrication. The switches, both cam- and lever-type, are installed with proper lubrication applied where necessary and will only rarely require any additional lubrication. It is recommended that a regular periodic lubrication program not be performed on any of the components used in the 466.

Semiconductor Checks

Periodic checks of the transistors and other semiconductors are not recommended. The best check of semiconductor performance is actual operation in the instrument.

Recalibration

To assure accurate measurements, check instrument calibration after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. Complete calibration instructions are given in the Calibration section.

The calibration procedure can also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles may be revealed or corrected by recalibration.

CORRECTIVE MAINTENANCE

General

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

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical part replacements for the 466 can be obtained through your local TEKTRONIX Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

NOTE

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 components are used in the 466. These components are manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufactured for Tektronix, Inc. in accordance with our specifications. These special components are indicated in the Electrical Parts List by an asterisk preceding the part number. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local TEKTRONIX Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., it is imperative that all of the following information be included in the order to ensure receiving the proper parts.

1. Instrument type (include mod of option numbers).
2. Instrument serial number.
3. A description of the part (if electrical, include the circuit number).
4. TEKTRONIX Part number.

Recalibration After Repair

After any electrical component has been replaced, the calibration of that particular circuit should be checked, as well as the calibration of other closely related circuits. Since the power supply affects all circuits, calibration of the entire instrument should be checked if work has been done in the power supply or if the transformer has been replaced.

Instrument Repackaging

If the 466 is to be shipped for long distances by commercial means of transportation, it is recommended that the instrument be repackaged in the original manner

for maximum protection. The original shipping carton can be saved and used for this purpose. The Repackaging illustration in the Mechanical Parts Illustrations shows how to repackage the 466 and gives the part numbers for the repackaging components. New shipping cartons can be obtained from Tektronix, Inc. Contact your local TEKTRONIX Field Office or representative.

Soldering Techniques

WARNING

Always disconnect the instrument from the power source before soldering.

Ordinary 60/40 solder and a 35- to 40-watt pencil-type soldering iron can be used to accomplish the majority of the soldering. If a higher wattage-rating soldering iron is used on the etched circuit boards, excessive heat can cause the etched circuit wiring to separate from the board base material.

CAUTION

The Vertical Preamplifier Attenuator circuit boards are made of material easily damaged by excessive heat. When soldering to these boards, do not use a soldering iron with a rating of more than approximately 15 watts. Avoid prolonged applications of heat to circuit-board connections. Use only isopropyl alcohol when cleaning this circuit board.

When soldering to the ceramic strips in the instrument a slightly larger soldering iron can be used. It is recommended that a solder containing about 3% silver be used when soldering to these strips to avoid destroying the bond to the ceramic material. This bond can be broken by repeated use of ordinary tin-lead solder or

by the application of too much heat; however, occasional use of ordinary solder will not break the bond if excessive heat is not applied.

If it becomes necessary to solder in the general area of any of the high-frequency contacts in the instrument, clean the contacts immediately after soldering. Refer to the section entitled Switch Contacts under **PREVENTIVE MAINTENANCE** for recommended cleaners and procedures.

Component Replacement

WARNING

Always disconnect the instrument from the power source before replacing components.

Semiconductor Replacement. Semiconductors should not be replaced unless actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement of semiconductors may affect the calibration of this instrument. When semiconductors are replaced, check the operation of the part of the instrument which may be affected.

Replacement semiconductors should be of the original type of a direct replacement. Lead configuration of the semiconductors used in this instrument are shown in the pullout pages. Some plastic case transistors have lead configurations which do not agree with those shown there. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. All transistor sockets in this instrument are wired for the standard basing as used for metal-cased transistors.

Transistors which have heat radiators or are mounted on the chassis use silicone grease to increase heat tranfer. Replace the silicone grease when replacing these transistors.

WARNING

Handle silicone grease with care. Avoid getting silicone grease in the eyes. Wash hands thoroughly after use.

An extracting tool should be used to remove the 14, 16 & 20 pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix Inc. Order Tektronix Part No. 003-0619-00. If an extracting tool is not available when removing one of these integrated circuits pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, since this may damage the pins.

Circuit Board Replacement. Occasionally it may be necessary to gain access to the reverse side of a circuit board or to remove one circuit board to gain access to another. The following procedures outline the necessary steps to facilitate instrument disassembly. Most of the connections to the circuit boards in the instrument are made with pin connectors. However, some connections are soldered to the board. Observe the soldering precautions given under Soldering Techniques in this section.

Vertical Preamp Board Replacement

1. Disconnect and remove the following control extension shafts: (held to switch or potentiometer shafts with .050" Allen set screws).

a. Two vertical POSITION shafts.

b. Two VAR VOLTS/DIV shafts.

c. TRIG VIEW pushbutton shaft.

2. Disconnect the INVERT pushbutton extension shaft from the INVERT switch shaft. Insert a scribe or similar tool between the end of the white plastic switch shaft and the inside end of the black plastic extension shaft and pry gently.

3. Remove the CH 1 and CH 2 attenuator shields (each is held with five screws and washers).

4. Unsolder the two resistors that connect the Vertical Preamp board to the Attenuator boards.

5. Unplug P350 from the Vertical Mode Switching board.

6. Unplug nine coaxial cable connections from the board. Note cable color code and location to facilitate reinstallation.

7. Unplug the delay-line leads (one lead soldered) from the rear end of the board.

8. Unsolder the red-brown wire from the rear end of the board. Note location for reinstallation.

9. Unsolder the bare wire ground connection between the Preamp board and the Interface board, near the Geometry control.

10. Remove the five screws holding the board and remove the board from the instrument.

11. To replace the Vertical Preamp board, reverse the order of removal steps.

Vertical Mode Switch and Attenuator Replacement.

1. Remove the Vertical Preamp board according to the preceding procedure.

2. Remove the two VOLTS/DIV knobs.

3. Remove AC-DC-GND lever switch knobs (pull straight off).

4. Remove the two UNCAL and REDUCED SCAN light lenses. Pry them away from the front panel with a fingernail and pull straight out.

5. Unplug P53 and P63 from the Vertical Mode Switch board that connects to the VOLTS/DIV sensitivity lights on the front panel.

6. Unplug all remaining connectors from the Vertical Mode Switch board. Note wire color codes to facilitate correct reinstallation.

7. Remove the securing screw and hex securing post from the rear of the Vertical Mode Switch board.

8. Remove the four nuts that secure the attenuator assemblies to the front casting.

9. Remove the Vertical Mode Switch board from the instrument.

10. To reinstall the Vertical Mode Switch board, reverse the order of removal steps. To align the **VERT MODE** switch pushbuttons, hold the assembly in place with a slight forward pressure and use a small tool to reach through the front panel to align the buttons. Install the remaining parts in the reverse order they were removed. Do not tighten the circuit board securing screws until the securing nuts at the front of the attenuator chassis are tight and the circuit board is aligned properly.

Trigger Generator and Sweep Logic Board Replacement.

1. Remove the **READY** and **TRIG** light lenses from the front panel. Pry them away from the front panel with a fingernail and pull straight out.

2. Disconnect eight coaxial cables (five on the front and three on the back. Unsolder the red-brown wire from the top of the board. Make note of cable color-codes and locations to ensure proper installation during reassembly.

3. Unsolder the two wires (white-red and white-yellow) from the bottom of the circuit board, that come from the Timing board and DELAY TIME POSITION control. Make note of wire color-codes and locations to ensure proper installation during reassembly.

4. Remove the **A TRIGGER** and **B TRIGGER SLOPE/LEVEL** knobs and the **A TRIG HOLDOFF** knob.

5. Remove the nuts and washers from the **SLOPE/LEVEL** potentiometers.

6. Remove the POWER switch actuator rod from the plastic holder on the switch. Pry the rod out of the holder with a small flat-bladed screwdriver.

7. If the circuit board is being completely replaced remove the POWER switch bracket from the circuit board. It is held with two nuts and two flat washers.

8. Remove three mounting screws from the circuit board (two at rear, and one at center-top; pozidrive screwdriver required).

9. Unplug the Trigger Generator & Sweep Logic circuit board from the Interface Board by forcing the Trigger board away at the two white interboard connectors at the bottom edge of the Trigger board. Use screwdriver to pry loose.

10. Move the Trigger board to the rear until the Trigger switches clear the front casting and then remove the assembly from the instrument. Exercise caution to avoid damaging the connector pins on the Interface Board.

To reinstall the Trigger Generator & Sweep Logic circuit board, reverse the order of the removal steps. If the indexing of the Trigger switches was disturbed, a series of trial-and-error installation-removal-adjustment steps will be necessary to return them to correct alignment.

Sweep Timing Circuit Board Replacement

1. Remove the Trigger Generator & Sweep Logic circuit boards as outlined above to facilitate the Timing Board removal.

2. Unsolder four wires from the Timing circuit board. Make note of wire color-codes to ensure proper installation during reassembly.

3. Remove the knobs from the VAR TIME/DIV control and the A AND B TIME/DIV switches (1/16" Allen wrench required). Be careful not to lose the plastic bushing behind the knobs.

4. Remove the X10 MAG and the UNCAL light lenses. Pry them away from the instrument front panel with a fingernail and pull straight out.

5. Remove the (2) board mounting screws and the hex rod from the Sweep Timing circuit board (3/16" wrench or nutdriver required).

6. Use a flat blade screwdriver and pry the Timing Board away from the Interface Board. Gently pull away the corner of the Interface Board near the B External Trigger Input connector and simultaneously lift up on the Timing Board near the rear to fully disengage connector pins from the Interface Board.

To reinstall the Timing Board reverse the order of the removal steps.

Storage Board Replacement

1. Remove the **INVERT, BEAM FIND,** and **X10 MAG (IN)** extension shafts. Remove by prying with a scribe or similar tool between the end of the white plastic switch shaft and the inside end of the extension shaft.

2. Remove the **INTEN, ASTIG, FOCUS, TRACE ROTATION,** and **SCALE ILLUM** extension shafts. (Use .050" Allen wrench to remove shafts from shaft coupling).

3. Remove the **STORAGE LEVEL/INTEN, VIEW TIME/ERASE** and **POSITION/FINE** knobs. Use .050" and 1/16" Allen wrenches. The **ERASE** knob is removed by pulling straight off.

4. Remove the **SAVE, NON STORE, VAR PERS** and **FAST** pushbuttons by pulling them straight off.

5. Unplug P1951 from the Storage board.

6. Unsolder the white-gray wire from the +600V point on the Storage Board.

7. Remove the four board mounting screws.

8. Carefully move the board straight forward to disconnect the interconnecting pins from the Main Interface Board.

9. To install the Storage board, reverse the order of removal steps.

Low-Voltage Power Transformer Replacement

1. Remove the fuse block cover from the rear of the instrument.

2. Remove the calibrator loop. Unsolder the white-red and white-brown wires. Remove the nuts, flat washers and insulating washers.

3. Remove the ground post.

4. Remove the blue cover plate from the rear of the instrument.

5. Remove the screw holding the top outside transformer mounting bar.

6. Remove the transformer mounting bolts to free the transformer.

7. Unsolder the transformer leads from the Interface Board and the solder lug on the rear subpanel. Note the wire color codes to facilitate correct reinstallation.

8. Remove the transformer leads from the fuse block. It will be necessary to use a special pin removing tool available under TEKTRONIX Part Number 003-0707-00. It is necessary to use this tool to remove the transformer leads from the fuse block. The leads can be reinstalled by simply pushing them into place. Note wire color codes and locations to facilitate correct reinstallation.

9. Option 7 only. Unsolder the five wires from transformer terminals. Note wire color codes and locations to facilitate re-installation.

10. Remove the POWER switch mounting bracket from the Trigger Board.

11. Remove the thermal cutout switch mounted to the main chassis. It is held with two self tapping screws.

12. Remove the transformer assembly from the instrument.

13. Remove the thermal cutout and POWER switch assembly from the old transformer and install on the new transformer. Note wire color codes and locations to facilitate correct installation.

14. Install the new transformer assembly in the instrument by reversing the order of the removal steps.

HV Multiplier and HV Transformer Replacement

1. Remove the high-voltage shield on the right side behind the Vertical Preamp board. It is held with two screws on the outside of the shield and one screw under the rear of the Vertical Preamp board.

2. Remove the plastic cover from the HV Multiplier.

3. Discharge the crt anode lead to the chassis and unsolder it from the HV Multiplier board.

4. Unsolder the HV Transformer center lead and remove the HV Multiplier board.

5. To remove the HV Transformer:

   a. Remove the top HV shield (held with four screws).

   b. Unsolder the two high-voltage diodes from the HV Transformer lead that projects through Interface board.

   c. Unsolder the remaining HV Transformer leads from the Interface board, while removing HV Transformer. (Use a solder removing tool). Note the wire locations to facilitate reinstallation.

6. To install the HV Multiplier or HV Transformer reverse the the order removal steps.

CRT Replacement

WARNING

Handle the crt carefully. Rough handling or scratching can increase the implosion hazard.

Removal:

1. Remove the gray plastic bezel and filter from the front of the crt (held with four screws).

2. Remove plastic rear cover from the rear of the instrument. (Held with two flat head screws.) Do not unsolder wires.

3. Remove the bell-shaped cover to expose the crt socket. (Held with two screws.) It will be necessary to remove one screw, loosen one screw and swivel the plate under the fan impeller to gain access to one of the mounting screws.

4. Unplug the crt socket.

5. Set the instrument on its left side.

6. Unplug the vertical deflection plate leads from the left side of the crt neck.

7. Unplug the horizontal deflection plate leads from the bottom side of the crt neck.

8. Unplug the storage plug P1951 from the Storage Board.

9. Disconnect the crt anode connector and discharge the connector pin to the instrument chassis.

10. Holding one hand on the crt face push, forward (slowly) on the crt base with the other hand. Guide the anode connector and the storage plug through crt shield openings while slowly pulling the crt out of the instrument. The plastic corner pads may fall loose when the crt is removed; save them for reinstallation. Also the white plastic centering bracket should remain inside the crt shield.

Set the crt on a soft material to prevent scratching.

Installation

1. Make sure the plastic centering bracket is in place inside the shield and that the black plastic corner pads are in place at the front corners of the crt opening.

2. Insert a wire or string through the hole in the upper right rear corner of the crt shield, to facilitate installation of the anode lead. Be sure to dress the wire or string across the upper right opening of the plastic centering bracket.

3. Connect the wire or string to crt anode lead connector and add tape to hold it firmly.

4. Insert the neck of the crt part way into the crt shield and into the plastic centering bracket. Orient the crt with the anode lead towards the top of the instrument.

5. While holding the front of the crt with one hand carefully insert the storage plug through the grommet hole in the bottom of the crt shield. Be sure to pull wires through while inserting crt.

6. Draw the anode lead through the hole in the shield.

7. While still holding the crt with one hand make sure the plastic centering bracket is in place on the crt neck.

8. Slowly push the crt the rest of the way into the crt shield. If the crt does not go in all the way, it will be necessary to pull it out part way and move the plastic centering bracket farther up on the crt neck.

9. Install the bezel filter on the front of the crt.

10. Make the following crt connections:

a. Crt anode lead

b. Crt base socket

c. Storage plug (P1951). Be sure to match arrows.

d. Horizontal deflection plate leads to neck pins. (White-green wire to right pin and white-red wire to left pin)

e. Vertical deflection plate leads to neck pins. (White-blue to upper pin and white-brown to lower pin).

11. Install bell-shaped crt socket cover (two screws).

12. Secure plate under fan impeller.

13. Install plastic rear cover (two flat head screws).

14. Check the calibration of the complete instrument.

IMPORTANT - PLEASE READ BEFORE USING THIS PROCEDURE

PURPOSE

The purpose of the performance check is for incoming inspection to determine the acceptability of newly purchased or recently recalibrated instruments. This procedure does not check every facet of the instrument's calibration; rather, it is concerned primarily with those portions of the instrument essential to measurement accuracy and correct operation.

The purpose of the calibration procedure is to provide a calibration sequence for adjustments-not to provide a trouble-shooting guide. Run a functional check of all modes prior to calibration and correct all defects found.

LIMITS AND TOLERANCES

All limits and tolerances given in this procedure are calibration guides and should not be interpreted as instrument specifications unless they are also found in the Specifications section of this manual.

Tolerances given are for the oscilloscope under test and do not include test equipment error.

STEP TITLES

Where possible, instrument performance is checked before an adjustment is made. Steps containing adjustments and checks are titled Check/Adjust steps. Those with only checks are titled Check steps.

LINE VOLTAGE SELECTION

This procedure is for 115 V ac line, medium range. If a different range is to be used, set the Regulating Range Selector and Line Voltage Selector for the available line voltage.

INTERNAL ADJUSTMENTS

Do not preset internal controls or move the +65 Volt Supply adjustment as this typically will require complete recalibration.

DISPLAY

The most accurate display adjustments are made with a stable, well-focused, low-intensity display. Unless otherwise noted, adjust the Intensity, Astigmatism, Focus and Trigger Level controls as needed.

EXTERNALLY AVAILABLE INTERNAL ADJUSTMENTS

The following calibration adjustments can be made without cabinet removal (review the appropriate portion of the calibration procedure before making adjustments):

Adjustment	Location	Calibration
CH 1 Var Bal (R84)	Left-hand side panel	Vertical
CH 1 Gain (R92)	Left-hand side panel	Vertical
CH 2 Var Bal (R184)	Left-hand side panel	Vertical
CH 2 Gain (R192)	Left-hand side panel	Vertical
Fine Fast Transfer Level (R1989)	Bottom panel	Storage

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 5-1, or equivalent, is required for complete calibration of the 466. Specifications given for the equipment are the minimum necessary for accurate calibration. Therefore, the equipment used must meet or exceed the listed specifications. Detailed operating instructions for the test equipment are not given in this procedure. Refer to the appropriate instruction manual if more information is needed.

If only a Performance Check is to be performed, not all of the listed test equipment is required. Items used only for

calibration are indicated by footnote 1. The remaining pieces of equipment are common to both procedures.

Special Calibration Fixtures

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

Calibration Equipment Alternatives

All of the listed test equipment is required to completely check and calibrate this instrument. However, complete checking or calibration may not always be necessary or desirable. The user may be satisfied with checking only selected characteristics, thereby reducing the amount of test equipment actually required.

The Performance Check and Calibration procedures are based on the first item of equipment given as an example. When other equipment is substituted, control settings or calibration setup might need to be altered. If the exact item of equipment given as an example in the Test Equipment list is not available, first check the specifications column carefully to see if any other equipment might suffice. Then check the Usage column to see what this item is used for. If used for a check or adjustment that is of little or no importance to your measurement requirements, the item and corresponding step(s) can be deleted.

The following procedures are written to completely check and adjust the 566 to the Performance Requirements listed in the Specifications section and in the Operators manual. If the applications for which you will use the 466 do not require the full available performance from the 466, the procedures and the required equipment list can be shortened accordingly. For example, the basic measurement capabilities of this instrument can be verified by just checking vertical deflection accuracy and basic horizontal timing and Calibrator signal.

TABLE 5-1
Test Equipment Required

Description	Minimum Specifications	Usage	Examples
1. Variable Autotransformer [1]	Capable of supplying 1.2 amperes over a range of 103.5 to 126.5 volts	Power supply regulation check	General Radio W8MT3VM Variac Autotransformer
2. Digital Voltmeter [1]	Range, 0 to 140 volts; dc voltage accuracy, within 0.15%; display, 4-1/2 digits.	Low-voltage power supply checks and adjustment; CRT grid bias check; Vertical and horizontal centering adjustments; Calibrator output voltage adjustment.	a. Tektronix DM501 Digital Multimeter[2] b. Any digital voltmeter that meets minimum specifications.
3. DC Voltmeter [1]	Range, 0 to 1500 volts; calibrabrated to 1% accuracy at -1470 volts.	High-voltage power supply check.	a. Triplett Model 630-NA. b. Simpson Model 262.
4. Test Oscilloscope with 10X probe and 1X probe.	Bandwidth, DC to 100 megahertz; minimum deflection factor, 5mV/division; accuracy within 3%; dual trace.	Power Supply ripple; CRT Z-Axis compensation; Vertical gain adjustment; A Trigger Holdoff check; High-speed timing adjustment; Storage checks and adjustment A and B + GATE output signals check.	a. Tektronix 465 Oscilloscope with 2 P6065 (10X) probes. b. Tektronix 475 Oscilloscope with 2 P6075 (10X) probes. c. 2 P6062A(10X or 1X) probes are supplied as standard accessories for the 466.

[1] Used for calibration procedure only.

[2] Requires a TM series power module.

TABLE 5-1 (cont.)

Description	Minimum Specifications	Usage	Examples
5. Amplitude Calibrator	Amplitude accuracy, within 0.25%; signal amplitude, 2 millivolts to 20 volts; output signal, 1 kilohertz square wave.	Vertical checks and adjustments; Trigger View gain check; Storage checks and adjustments X Gain adjustment; External Z-Axis check.	a. Tektronix PG506 Calibration Generator.[2] b. Tektronix 067-0502-01 calibration fixture.
6. Sine-Wave Generator	Frequency, 350 kilohertz to above 100 megahertz; output amplitude, variable from 0.5 to 4 volts peak-to-peak; output impedance, 50 ohms; reference frequency, 50 to 350 kilohertz; amplitude accuracy, constant within 3% of reference frequency as output frequency changes.	Vertical centering, bandwidth and isolation checks; Trigger checks and adjustments; Storage check and adjustments; X-Y phase difference adjustment; X-Y bandwidth check.	a. Tektronix SG503 Leveled Sine-Wave Generator.[2] b. Tektronix Type 191 Constant-Amplitude Signal Generator.
7. Time-Mark Generator	Marker outputs, 2 nanoseconds to 0.5 second; marker accuracy, within 0.1%; trigger output, 1 millisecond to 0.1 microsecond, time coincident with markers.	CRT Y-Axis and geometry adjustments; Auto trigger check; Horizontal timing checks and adjustments. Storage checks and adjustments.	a. Tektronix TG501 Time-Mark Generator.[2] b. Tektronix 2901 Time-Mark Generator.
8. Low-Frequency Generator	Frequency, 10 hertz to 50 kilohertz; output amplitude, variable from 10 millivolts to 4 volts peak-to-peak	Low-frequency trigger checks.	a. Tektronix SG502 Oscillator.[2] b. General Radio 1310A Oscillator

TABLE 5-1 (cont.)

Description	Minimum Specifications	Usage	Examples
9. Square-Wave Generator	Repetition rate, 1 to 100 kilohertz; risetime, 1 nanosecond or less from fast-rise output; output amplitude, 100 volt pulse supplying at least 10 millamperes from high-amplitude output; aberrations, within 2% from fast-rise output.	Vertical compensation.	a. Tektronix Type 106 Square-Wave Generator
10. 50-Ohm Signal Pickoff	Frequency response, 50 kilohertz to 100 megahertz; impedance 50 ohms for signal input, signal output and trigger output.	Trigger checks and adjustments.	Tektronix CT-3 signal pickoff. Part Number 017-0061-00.
11. Cable (2 Required)	Impedance, 50 ohms; Length, 42 inches; Connectors, BNC.	Signal interconnection.	Tektronix Part Number 012-0057-01.
12. Cable (2 Required)	Impedance, 50 ohms; Length 18 inches; Connectors, BNC.	Signal interconnection.	Tektronix Part Number 012-0076-00.
13. Adapter	Connectors, GR874 to BNC female.	Vertical compensation. Trigger adjustments.	Tektronix Part Number 017-0063-00.
14. Adapter	Connectors, GR874 to BNC male.	Trigger adjustment signal interconnection.	Tektronix Part Number 017-0064-00.

TABLE 5-1 (cont.)

Description	Minimum Specifications	Usage	Examples
15. Adapter	Connectors, BNC female to BNC female.	Signal interconnection.	Tektronix Part Number 103-0028-00.
16. Dual-Input Coupler	Connectors, BNC female to 2 BNC male.	Vertical checks, trigger checks and adjustments, X-Y Phase check.	Tektronix Part Number 067-0525-00.
17. T Connector	Connectors, BNC.	Signal interconnection.	Tektronix Part Number 103-0030-00.
18. 10X Attenuator (2 Required)	Ratio, 10X; impedance, 50 ohms; connectors, BNC.	Vertical compensation. Vertical bandwidth check. Trigger adjustments.	Tektronix Part Number 011-0059-01.
19. 5X Attenuator	Ratio, 5X; impedance, 50 ohms; connectors, BNC.	Vertical system compensation adjustments. Trigger adjustments.	Tektronix Part Number 011-0060-01.
20. 2X Attenuator	Ratio, 2X; impedance, 50 ohms; connectors, BNC.	Vertical system compensation.	Tektronix Part Number 011-0069-01.
21. Termination (2 Required)	Impedance, 50 ohms; connectors, BNC.	Signal termination.	Tektronix Part Number 011-0049-01.
22. Input RC Normalizer	RC time constant, 1 megohm times 20 picofarads; connectors, BNC.	Vertical input attenuator compensation.	Tektronix Input RC Normalizer calibration fixture. Part Number 067-0538-00.

TABLE 5-1 (cont.)

Description	Minimum Specifications	Usage	Examples
23. Screwdriver	Length, three-inch shaft; bit size, 3/32 inch.	Adjust variable resistors.	Xcelite R-3323.
24. Low-Capacitance Screwdriver	Length, 1-inch shaft; bit size, 3/32 inch.	Adjust all variable capacitors.	J.F.D. Electronics Corp. Adjustment Tool Number 5284.
25. Light Shield	Folding viewing hood.	Horizontal, delay-time jitter.	Tektronix Part Number 016-0592-00. (Standard Accessory for the 466.)
26. Shorting Strap		Calibration adjustment.	

3. The dual-input couplers (Item in the equipment required list) are needed for common-mode and X-Y checks. They also permit faster trigger calibration and checking. A direct substitute can easily be made by connecting 2 short, 50 ohm, BNC cables and a BNC female-to-female adapter to a BNC T-connector.

Parts List	Tektronix part number
2 - 50 Ω BNC cables, 8 inches long	012-0118-00
1 - BNC female-to-female adapter	103-0028-00
1 - BNC T-connector	103-0030-00

CABINET REMOVAL

WARNING

High voltages exist at several points throughout this instrument. Disconnect power before cleaning the instrument or replacing parts. When the instrument is operated with the cover removed, do not touch exposed connections or components. Some transistors may have elevated cases.

The instrument wrap-around cabinet can be removed in the following manner:

1. Install dust cover and set instrument face on a flat surface.

2. Unwrap the power cord from the instrument feet.

3. Remove the six screws indicated in Fig. 5-1 and remove the instrument feet and rear cabinet assembly from the instrument.

4. Slide the wrap-around cabinet up and over the back to remove the oscilloscope. To replace the instrument in its wrap-around cabinet, reverse the removal procedure.

A. POWER SUPPLIES AND CALIBRATOR

Equipment Required

1. Digital Multimeter
2. DC Voltmeter
3. Test Oscilloscope
4. Autotransformer
5. Three-Inch Screwdriver

See ADJUSTMENT LOCATIONS 1 pull-out page for adjustments and test points (TP).

466 CONTROL SETTINGS:

Power	
Regulating Range Selector	Medium
Line Voltage Selector	115 V
POWER	ON
CRT	
INTEN	Midrange
REDUCED SCAN (PULL)	Push INTEN in
FOCUS	Midrange
SCALE ILLUM	As desired
Vertical (CH 1 and CH 2)	
VERT MODE	CH 1
POSITION	Midrange
VOLTS/DIV	5 mV
VAR VOLTS/DIV	Calibrated detent

AC-GND-DC	DC
INVERT	Normal (button out)
20 MHz BW (PULL)	Full bandwidth (Push in, then release. Shows no yellow)

Storage

NON STORE	On (button in)
STORAGE LEVEL	NORM
INTEN (SAVE)	Midrange
SAVE	Off (button out)
VIEW TIME	NORM

Trigger (A and B)

COUPLING	AC
LEVEL	Midrange
SLOPE	+
A TRIGGER SOURCE	NORM
B (DLY'D) TRIGGER SOURCE	STARTS AFTER DELAY
TRIG MODE	AUTO
A TRIG HOLD OFF	NORM

Sweep (A and B)

HORIZ DISPLAY	A
A TIME/DIV	1 ms
B TIME/DIV	1 ms
VAR TIME/DIV	Calibrated detent
DELAY TIME POSITION	Full counterclockwise
X10 MAG	Off (button out)
POSITION (Horiz.)	Midrange
FINE	Midrange

1. Check/Adjust Power Supply DC Levels and Ripple

NOTE

Review the important information at the beginning of the Calibration Section before starting calibration.

a. Connect digital multimeter between test point given in Table 1 and ground on interface board.

CHECK - - - - - - - - - - TABLE 5-A-1

Power Supply	Test Point	Tolerance	Reading
+65 Volt	+65 V	± 0.5%	+64.67 to +65.33
+15 Volt	+15 V	± 1.5%	+14.77 to +15.23
+ 5 Volt	+ 5 V	± 1.5%	+ 4.92 to + 5.08
– 8 Volt	– 8 V	± 1.5%	– 7.88 to – 8.12
–15 Volt	–15 V	± 1.5%	–14.77 to –15.23
+140 Volt	+140 V	± 5. %	+133 to +147

NOTE

If the adjustment in step 1b is made, the oscilloscope will require complete recalibration.

b. Connect digital multimeter between +65 Volt testpoint and ground on interface board.

ADJUST–+65 Volt Supply (R1736) for +65.00 volts.

CHECK - - - - - - - - - - TABLE 5-A-2

Power Supply	Test Point	Tolerance After Adjustment	Reading
+65 Volt	+65 V	± 0.1%	+64.93 to +65.07
+15 Volt	+15 V	± 0.7%	+14.89 to +15.11
+ 5 Volt	+ 5 V	± 0.7%	+ 4.96 to + 5.04
– 8 Volt	– 8 V	± 0.7%	– 7.94 to – 8.06
–15 Volt	–15 V	± 0.7%	–14.89 to –15.11
+140 Volt	+140 V	± 5 %	+133 to +147

c. Connect test oscilloscope to +65 Volt test point and ground on interface board. Check ripple amplitude while varying autotransformer between 103.5 to 126.5 V ac.

CHECK - - - - - - - - - - TABLE 5-A-3

Power Supply	Test Point	Typical Ripple (Peak-to-peak)
+65 Volt	+65 V	4 mV
+15 Volt	+15 V	2 mV
+ 5 Volt	+ 5 V	2 mV
− 8 Volt	− 8 V	2 mV
−15 Volt	−15 V	2 mV
+140 Volt	+140 V	100 mV

d. Return line voltage to 115 volts.

2. Check High Voltage

a. Verify NON STORE button is pushed in and INTEN-REDUCED SCAN (PULL) button is pushed in.

b. Connect dc voltmeter between TP1501 and ground on interface board.

CHECK--CRT cathode voltage is -1470V, within 2% (-1440V to -1500V)

c. Disconnect dc voltmeter.

3. Check/Adjust Calibrator Accuracy

a. Connect shorting strap from TP1367 to TP1372.

b. Connect digital multimeter between ground and CALIBRATOR current loop.

CHECK--Calibrator dc level is 300 mV, within 0.3% from $+20^{\circ}$ C to $+30^{\circ}$ C (299.1 to 300.9 mV) or 1.0% from 0° C to $+40^{\circ}$ C (297 to 303 mV) or 1.5% from -15° C to $+55^{\circ}$ C (295.5 to 304.5 mV)

ADJUST--Amplitude (R1375) for 300 mV

c. Remove shorting strap.

d. Disconnect digital multimeter.

e. Set test oscilloscope:

Volts/Div	10 mV
Time/Div	0.2 ms

f. Connect 10X probe to CALIBRATOR current loop.

CHECK--Calibrator frequency is 1kHz within 25%-0.8 ms (4 div) to 1.33 ms (6.65 div) per cycle.

g. Remove X10 probe.

B. DISPLAY AND Z-AXIS

Equipment Required

1. Digital Multimeter
2. Time-Mark Generator
3. Test Oscilloscope
4. 10X Probe
5. 50-Ohm BNC Cable
6. 50-Ohm BNC Termination
7. Three-inch Screwdriver
8. Low-Capacitance Screwdriver

See ADJUSTMENT LOCATIONS 1 pull-out page for adjustments and test points (TP).

466 CONTROL SETTINGS (* indicates changes from the previous step)

POWER	ON
CRT	
* INTEN	* Full counterclockwise
REDUCED SCAN (PULL)	Push INTEN in
FOCUS	Midrange
SCALE ILLUM	As desired
Vertical (CH 1 and CH 2)	
VERT MODE	CH 1
POSITION	Midrange
VOLTS/DIV	5 mV
VAR VOLTS/DIV	Calibrated detent
* AC-GND-DC	* GND
INVERT	Normal (button out)
20 MHz BW)PULL)	Full bandwidth (push in, then release. Shows no yellow)
Storage	
NON STORE	On (button in)
STORAGE LEVEL	NORM
INTEN (SAVE)	Midrange

SAVE	Off (button out)
VIEW TIME	NORM

Trigger (A and B)

COUPLING	AC
LEVEL	Midrange
SLOPE	+
A TRIGGER SOURCE	NORM
B (DLY'D) TRIGGER SOURCE	STARTS AFTER DELAY
TRIG MODE	AUTO
A TRIG HOLD OFF	NORM

Sweep (A and B)

* A TIME/DIV	* X-Y
* B TIME/DIV	* X-Y
VAR TIME/DIV	Calibrated detent
DELAY TIME POSITION	Full counterclockwise
HORIZ DISPLAY	A
X10 MAG	Off (button out)
POSITION (Horiz.)	Midrange
FINE	Midrange

1. Adjust Crt Grid Bias

   a. Connect digital multimeter between TP1443 and ground.

   b. Set INTEN control for +20 V and SCALE ILLUM to off (full counterclockwise).

   CHECK--Crt display for well-defined, low-intensity dot, using FOCUS and ASTIG controls as needed.

   ADJUST--Crt Grid Bias (R1454 for dimmest, visible dot.

   c. Disconnect digital multimeter.

2. Adjust Trace Alignment

   a. Set: A TIME/DIV 1 ms
   INTEN Midrange

b. Position trace to center horizontal graticule line.

CHECK--Trace is parallel with center horizontal line.

ADJUST--TRACE ROTATION (front-panel adjustment) to make trace parallel to center horizontal line.

3. Adjust Display Controls, Y-Axis Alignment and Geometry

a. Set:

CH 1 AC-GND-DC	DC
CH 1 VOLTS/DIV	0.1 V

b. Connect 50 µs time marks from time-mark generator to CH 1 Input connector via 50-Ohm cable and 50-Ohm termination.

c. Adjust VAR TIME/DIV control for 10 time marks/major div.

CHECK--Center time-mark tilt is 0.1 div or less, when compared to center vertical graticule line.

ADJUST--Y-Axis Alignment (R 1563) to align center time mark with center vertical graticule line.

INTERACTION--Y-Axis Alignment and TRACE ROTATION adjustments. Readjust until there is minimum interaction.

CHECK--Vertical curvature of time marks across graticule area is 0.1 div or less.

ADJUST--Geometry (R 1556) for minimum curvature of time marks.

d. Remove time marks from CH 1 Input.

CHECK--Trace curvature is 0.1 div or less, when positioned from graticule top to bottom.

INTERACTION--Geometry (R 1556 and Y-Axis Alignment (R 1563) adjustments. Adjust both for optimum response.

4. Adjust Z-Axis Compensation

a. Connect test oscilloscope 10X probe to TP1443 and ac couple the test oscilloscope input.

b. Set oscilloscope under test A TIME/DIV switch to .05 μs and INTEN control for 15 volt display on test oscilloscope.

CHECK--Display for best square corner on unblanking gate.

ADJUST--Z-Axis Compensation (C1435), using low capacitance screwdriver, for best square corner on unblanking gate.

c. Disconnect test equipment.

C. VERTICAL

Equipment Required

1. Calibration Generator
2. Test Oscilloscope (only if gain requires complete recalibration)
3. Square-Wave Generator
4. Leveled Sine-Wave Generator
5. 2 X10 Probes (only if gain requires complete recalibration)
6. X10 Probe with Scale-Factor Switching (or an 11 kΩ resistor, see Step 1a)
7. 50-Ohm BNC Cable
8. Dual-Input Coupler
9. GR-to-BNC Female Adapter
10. X10 BNC Attenuator (2 required)
11. 50-Ohm BNC Termination (2 required)
12. 20 pF BNC Normalizer
13. Low-Capacitance Screwdriver
14. Screwdriver

See ADJUSTMENT LOCATIONS 2 pull-out page for adjustments and test points (TP).

—Early instruments had an output stage (and output circuit board) using an integrated circuit (IC). Later instruments contain individual transistors in the output stage. The pull-out page ADJUSTMENT LOCATIONS 2 permits easy identification of the board in your instrument. The calibration procedure indicates the earlier output stage adjustments by double boxes.

466 CONTROL SETTINGS (* indicates changes from the previous step)

POWER	ON
CRT	
INTEN	As desired
REDUCED SCAN (PULL)	Off (push INTEN in)
FOCUS	For optimum definition
SCALE ILLUM	As desired
Vertical (CH 1 and CH 2)	
VERT MODE	CH 1
POSITION	Midrange
* VOLTS/DIV	* 5 mV
VAR VOLTS/DIV	Calibrated detent
AC-GND-DC	DC
INVERT	Normal (button out)
20 MHz BW (PULL)	Full bandwidth (push in, then release. Shows no yellow)

Storage

NON STORE	On (button in)
STORAGE LEVEL	NORM
INTEN (SAVE)	Midrange
SAVE	Off (button out)
VIEW TIME	NORM

Trigger (A and B)

COUPLING	AC
LEVEL	Midrange
SLOPE	+
A TRIGGER SOURCE	NORM
B (DLY'D) TRIGGER SOURCE	STARTS AFTER DELAY
TRIG MODE	AUTO
A TRIG HOLD OFF	NORM

Sweep (A and B)

HORIZ DISPLAY	A
A TIME/DIV	1 ms
B TIME/DIV	1 ms
VAR TIME/DIV	Calibrated detent
DELAY TIME POSITION	Full counterclockwise
X10 MAG	Off (button out)
POSITION (Horiz)	Midrange
FINE	Midrange

1. CHECK PROBE INDICATOR LAMPS

a. Connect a X10 probe with a scale-factor switching connector to CH 1 input (if no scale-factor switching probe is available, an 11 kΩ resistor may be used. Connect the resistor between ground and the metal coding ring on the input connector).

CHECK—5 mV lamp is extinguished and 50 mV lamp is on.

b. Set VERT MODE switch to CH 2 and move probe to CH 2 input.

CHECK—5 mV lamp is extinguished and 50 mV lamp is on.

c. Remove X10 probe.

2. CHECK INPUT COUPLING SWITCHES

a. Connect 20 mV standard amplitude signal from calibration generator to CH 2 input via 50 Ω cable.

b. Position bottom of display to center horizontal graticule line and set CH 2 AC-GND-DC switch to GND.

CHECK—No vertical deflection; trace is at center horizontal graticule line.

c. Set CH 2 Input coupling to AC.

CHECK—Display is centered about center horizontal graticule line.

d. Set VERT MODE switch to CH 1 and move test signal to CH 1.

e. Position bottom of display to center horizontal graticule line.

f. Set CH 1 AC-GND-DC switch to GND.

CHECK—No vertical deflection; trace is at center horizontal graticule line.

g. Set CH 1 AC-GND-DC switch to AC.

CHECK—Display is centered about center horizontal graticule line.

h. Disconnect square-wave signal.

3. CHECK ALTERNATE MODE

a. Set:

VERT MODE	ALT
A TRIGGER LEVEL	Fully clockwise

b. Position two traces about 2 divisions apart.

CHECK—Sweeps alternate for all A TIME/DIV settings except X-Y.

4. CHECK CHOP MODE

a. Set:

A TIME/DIV	1 μs
VERT MODE	CHOP
AC-GND-DC (both)	GND

b. Position two traces about 4 divisions apart and set A TRIGGER LEVEL control for a stable display.

CHECK—Vertical Switching transients are completely blanked between horizontal chopped segments.

CHECK—Duration of each cycle is about 4 divisions.

c. Set:

VERT MODE	CH 1
AC-GND-DC (both)	DC
CH 1 VOLTS/DIV	.2 V

5. ADJUST OUTPUT AMPLIFIER BIAS (IC OUTPUT BOARD ONLY)

NOTE

The adjustment in step 5b affects Position Effect, Aberrations and Risetime. This adjustment may be slightly misadjusted for optimum vertical performance. Severe misadjustment will result in loss of gain and increased aberrations.

RECALIBRATION—Do not adjust at this time—instead, move to Step 6 and complete the checks or adjustments in Steps 6 through 26.

Calibration (after repair or replacement of vertical components)—Do Step 5 .

If calibration requirements are met, there is no need to make this adjustment. If position effect, aberrations and risetime requirements are not met, then make this adjustment.

After the adjustment, do Steps 6 through 26. If calibration requirements are still not met, the setting of bias adjustment may be compromised to meet position effect, aberrations and risetime.

a. Connect 100 MHz signal from leveled sine-wave generator to CH 1 input via 50 Ω cable and 50 Ω termination.

ADJUST—Bias Adj (R478) for maximum signal.

b. Disconnect test equipment.

6. CHECK BEAM FINDER

a. Push in BEAM FIND button and hold.

CHECK—Trace remains entirely on screen, regardless of the setting of vertical or horizontal POSITION controls.

b. Release BEAM FIND button.

7. CHECK/ADJUST CH 1 VAR VOLTS/DIV BALANCE AND VAR INDICATOR

a. Position trace to center horizontal graticule line.

CHECK—CH 1 UNCAL lamp is on when VAR control is out of detent.

CHECK—Trace shift of 0.2 div or less when rotating VAR control through its range.

ADJUST—CH 1 Var Bal (R84) for minimum trace shift while rotating CH 1 VAR control through its range.

b. Return CH 1 VAR control to detent position.

8. CHECK/ADJUST CH 1 POSITION CENTERING

a. Connect about 50 kHz signal from leveled sine-wave generator to CH 1 input via 50 Ω cable and 50 Ω termination.

b. Set:

CH 1 VOLTS/DIV	.2 V
CH 1 AC-GND-DC	AC
A TIME/DIV	1 ms

c. Adjust either generator or CH 1 VAR control for 2.4 div display,—then change CH 1 VOLTS/DIV switch to 20 mV without moving the VAR control.

CHECK—Top of display positions down to center horizontal graticule line or below, bottom of display positions up to center horizontal graticule line or above.

ADJUST—CH 1 Pos Ctr (R166) so display positions same distance above and below graticule center line.

d. Disconnect generator and return CH 1 VAR control to detent position.

9. CHECK/ADJUST CH 2 VAR VOLTS/DIV BALANCE AND VAR INDICATOR

a. Set VERT MODE switch to CH 2 and position trace to center horizontal graticule line.

CHECK—CH 2 UNCAL lamp is on when VAR control is out of detent.

CHECK—Trace shift of 0.2 div or less when rotating VAR control through its range.

ADJUST—CH 2 Var Bal (R184) for minimum trace shift while rotating CH 2 VAR control through its range.

b. Return CH 2 VAR control to detent position.

10. CHECK/ADJUST CH 2 INVERT BALANCE

a. Set CH 2 AC-GND-DC to GND.

b. Position trace to center horizontal graticule line and push INVERT button.

CHECK—Trace shift is 2 div or less when switching from normal to inverted.

ADJUST—Inver Bal (R212) for minimum trace shift.

INTERACTION—Invert Bal (R212) and Var Bal (R184). Readjust as needed for no visible interaction.

11. CHECK/ADJUST CH 2 POSITION CENTERING

a. Connect about 50 kHz signal from leveled sine-wave generator to CH 2 input via 50 Ω cable and 50 Ω termination.

b. Set:

CH 2 VOLTS/DIV	.2 V
CH 2 AC-GND-DC	AC

c. Adjust either generator or CH 2 VAR control for 2.4 div display—then change CH 2 VOLTS/DIV switch to 20 mV without moving VAR control.

CHECK—Top of display positions down to center horizontal graticule line or below, bottom of display positions up to center horizontal graticule-line or above.

ADJUST—CH 2 Pos Ctr (R266) so display positions same distance above and below graticule line.

d. Disconnect generator and return CH 2 VAR control to detent position.

12. CHECK CH 2 AND CH 1 GATE CURRENT

a. Set:

AC-GND-DC (both)	GND
VOLTS/DIV (both)	5 mV

b. Position trace to graticule center and change AC-GND-DC switch to DC.

CHECK—Trace shift is 0.1 div or less, when switching between GND and DC.

c. Change VERT MODE to CH 1, position trace to graticule center and change AC-GND-DC switch to DC.

CHECK—Trace shift is 0.1 div or less, when switching between GND and DC.

d. Set both AC-GND-DC switches to DC.

13. CHECK/ADJUST GAIN

RECALIBRATION NEED. *It is not always necessary to do a complete gain recalibration to meet instrument gain specifications. Use following sequence to determine needed adjustments.*

I. CHECK Steps 19a, b and e. Note CH 1 5 mV/DIV accuracy.

II. CHECK Steps 19g and h. Note CH 2 5 mV/DIV accuracy.

A. If both channels are within 3%, continue with steps i through k and remainder of procedure.

B. If error exceeds 3% and both channels have an error of the same polarity (for example—CH 1 is +4% and CH 2 is +2%) adjust the smaller error to zero using Output Gain Adj R468 [(R415)] then adjust either CH 1 Gain Adj (R92) or CH 2 Gain Adj (R192) to remove the remaining error (for example—CH 1 error is 4% and CH 2 is +2%. Adjust Output Gain Adj to change the error to CH 2 0% and CH 1 to +2%. Then adjust CH 1 Gain Adj to reduce CH 1 error to 0%).

C. If error exceeds 3% and the channels have an error of opposite polarity (for example—CH 1 is +4% and CH 2 is −2%) adjust the larger error to match the lesser error, using either CH 1 Gain Adj (R92) or CH 2 Gain Adj (R192) then adjust Output Gain Adj R468 [(415)] to remove the remaining error (for example—CH 1 error is +4% and CH 2 is −2%. Adjust CH 1 Gain Adj to change the error to CH 1 −2%. Then adjust Output Gain Adj to reduce CH 1 and CH 2 errors to 0%).

III. If any gain adjustment has insufficient adjustment range, a complete gain recalibration is needed. Start with Step 13a and continue. This establishes a typical CH 1 output used as a reference for setting output gain.

a. Set:

VERT MODE	CH 1
CH 1 VOLTS/DIV	5 mV
CH 1 AC-GND-DC	DC

b. Connect 20 mV standard amplitude signal from calibration generator to CH 1 input via 50 Ω cable.

c. Set:

test oscilloscope	
Vertical mode	Add
Channel 2	Invert
Volts/Div (both)	10 mV

d. Connect two X10 probes from test oscilloscope to TP322 and TP324 on preamp board.

CHECK—Signal between TP322 and TP324 is 400 mV peak-to-peak.

ADJUST—CH 1 Gain Adj (R92) for 400 mV peak-to-peak. (NOTE: This is a nominal value for this adjustment. It may be reset to obtain correct CH 1 input-to-display gain).

e. Remove X10 probes from TP322 and TP324.

f. Observe crt display.

CHECK—Display is 4 div within 3% (3.88 to 4.12 div).

ADJUST—Output Gain Adj R468 [(R415)] for 4 div display.

g. Set:

VERT MODE	CH 2
CH 2 VOLTS/DIV	5 mV
CH 2 AC-GND-DC	DC

h. Connect 20 mV standard amplitude signal from calibration generator to CH 2 input via 50 Ω cable and 50 Ω termination.

CHECK—Display is 4 div within 3% (3.88 to 4.12 div).

ADJUST—CH 2 Gain Adj (R192) for 4 div display.

i. Change VOLTS/DIV and calibration generator settings as shown in Table 5-C-1.

CHECK—Display is either 3.88 to 4.12 div or 4.85 to 5.15 div.

TABLE 5-C-1

Vertical Deflection Accuracy

VOLTS/DIV SETTING	CALIB GEN INPUT SIGNAL	DEFLECTION IN DIV FOR 3% ACCURACY		READING IN DIV
		DIVISIONS	ACCURACY	
10 m	50 mV	5	±0.15	4.85 to 5.15
20 m	0.1 V	5	±0.15	4.85 to 5.15
50 m	0.2 V	4	±0.12	3.88 to 4.12
.1	0.5 V	5	±0.15	4.85 to 5.15
.2	1 V	5	±0.15	4.85 to 5.15
.5	2 V	4	±0.12	3.88 to 4.12
1	5 V	5	±0.15	4.85 to 5.15
2	10 V	5	±0.15	4.85 to 5.15
5	20 V	4	±0.12	3.88 to 4.12

j. Set:

VERT MODE	CH 1
CH 1 VOLTS/DIV	5 mV
CH 1 AC-GND-DC	DC

k. Connect 20 mV standard amplitude signal from calibration generator to CH 1 input via 50 Ω cable and 50 Ω termination.

CHECK—Display is either 3.88 to 4.12 div or 4.85 to 5.15 div. Check all VOLT/DIV settings. See Table 5-C-1.

14. CHECK CH 1 AND CH 2 VAR VOLTS/DIV RANGE

a. Set both VOLTS/DIV switches to 10 mV and calibration generator for 50 mV signal.

b. Rotate CH 1 VAR control fully counterclockwise.

CHECK—Display reduces to 2 div or less.

c. Move signal to CH 2 Input connector and set VERT MODE switch to CH 2.

d. Rotate CH 2 VAR control fully counterclockwise.

CHECK—Display reduces to 2 div or less.

e. Return both VAR controls to detent position.

15. CHECK ADD MODE

a. Set:

VOLT/DIV (both)	5 mV
VERT MODE	ADD

b. Connect 10 mV standard amplitude signal from calibration generator to both inputs via 50 Ω cables and dual-input coupler.

CHECK—Display of 4 div, within 3%, if gain adjustments in Step 13 were not changed —or— 4 div, within 1%, if gain adjustments in Step 13 were changed.

16. CHECK COMPRESSION AND EXPANSION

a. Set:

CH 2 AC-GND-DC	GND
VERT MODE	CH 1

b. Adjust CH 1 VAR control for 2 div display centered about center horizontal graticule line.

c. Position top of display to top graticule line.

CHECK—Display compression or expansion is 0.1 div or less.

d. Position bottom of display to bottom graticule line.

CHECK—Display compression or expansion is 0.1 div or less.

e. Set CH 1 VAR control to detent position.

f. Disconnect calibration generator.

17. CHECK/ADJUST OUTPUT LOW-FREQUENCY COMPENSATION

a. Set:

A TIME/DIV	0.2 ms
VERT MODE	CH 1
AC-GND-DC (both)	DC
VOLTS/DIV (both)	5 mV

b. Connect fast-rise, + output of square-wave generator to CH 1 input via GR-to-BNC adapter, 50 Ω cable, X10 attenuator and 50 Ω termination.

c. Adjust square-wave generator to maintain 5 div display throughout Step 17.

d. Adjust square-wave generator for signal indicated in Table 5-C-2.

CHECK—Display overshoot or roll-off is within 3% (4.85 to 5.15 div for exactly a 5 div display).

TABLE 5-C-2

Maximum Overshoot or Roll-Off

Square-Wave Generator Signal	A TIME/DIV Setting	Maximum Overshoot Or Roll-off in div
100 Hz	2 ms	4.85 to 5.15
1 kHz	.2 ms	4.85 to 5.15
10 kHz	20 μs	4.85 to 5.15
100 kHz	2 μs	4.85 to 5.15

e. If above checks are within 3%, proceed to Step 18.

f. If not, make following adjustments for best flat-top waveform.

ADJUST– – – – – – – – – – TABLE 5-C-3

Overshoot or Roll-off Adjustment

Square-Wave Generator Signal	A TIME/DIV Setting	Transistor Output Adjustment	IC Output Adjustment
100 Hz	2 ms	–	R444
1 kHz	.2 ms	–	R445
10 kHz	20 μs	R402	R446
100 kHz	2 μs	R107, C107	R453, R107, C107
		R107, C107	

INTERACTION–R402, R403, C404 or R444, R445, R446, R453, R107 and C107. Readjust as needed for best overall response within 3%.

g. Set VERT MODE switch to CH 2.

h. Connect square-wave generator to CH 2 input.

CHECK–Display overshoot or roll-off is within 3% (4.85 to 5.15 div for exactly a 5 div display) using Table 5-C-2.

ADJUST–R207, C207 for best flat-top waveform, using 100 kHz square-wave generator signal.

NOTE

It may be necessary to compromise the adjustments in Steps d through h to obtain the best response between CH 1 and CH 2.

18. CHECK/ADJUST CH 1 VOLTS/DIV COMPENSATION

a. Set: A TIME/DIV .5 ms
VERT MODE CH 1

b. Add 20 pF normalizer between 50 Ω termination and CH 1 input. Change 50 Ω cable to high-amplitude output of square-wave generator.

c. Adjust square-wave generator, add or remove attenuators and finally remove the 50 Ω termination to maintain 5 div, 1 kHz display throughout Step 18.

CHECK–Display overshoot, roll-off and flat-top is within 2% (4.9 to 5.1 div for exactly a 5 div display) for all VOLTS/DIV switch settings.

d. Remove 20 pF normalizer. Adjust square-wave generator and add or remove attenuators to maintain 5 div display throughout Step 18.

CHECK—Display overshoot, roll-off and flat-top is within 2% (4.9 to 5.1 div for exactly a 5 div display) for all positions of VOLTS/DIV switch.

e. If above checks are within 2%, proceed to Step 19.

f. If not, make following adjustments for best flat-top and leading-edge waveform using a low-capacity screwdriver.

g. Set VOLTS/DIV switch to 5 mV.

ADJUST—C10 for best flat-top display.

h. Set VOLTS/DIV switch to 10 mV.

ADJUST—C37 for best flat-top display.

i. Remove 20 pF normalizer from test setup.

ADJUST—C36 for best flat corner.

INTERACTION—C37 and C36. Readjust as needed for optimum flat response.

ADJUST—Compensations as shown in Table 5-C-4 for optimum flat response. Readjust each adjustment pair as needed for optimum flat response.

TABLE 5-C-4
VOLTS/DIV COMPENSATION

VOLT/DIV Setting	Normalizer		Adjust	
	In	Out	Flat	Corner
10 mV	X	X	C37	C36 } Interact
20 mV	X	X	C35	C34 } Interact
50 mV	X	X	C33	C32 } Interact
.1 V	X	X	Check	Check
.2 V	X	X	Check	Check
.5 V	X	X	C31	C30 } Interact
1 V	X	X	Check	Check
2 V	X	X	Check	Check
5 V	X	X	Check	Check

19. CHECK/ADJUST CH 2 VOLTS/DIV COMPENSATION

a. Add 20 pF normalizer between 50 Ω termination and CH 2 input. Move test setup to CH 2 input.

b. Adjust square-wave generator and add or remove attenuators to maintain 5 div display throughout Step 19.

CHECK—Display overshoot, roll-off and flat-top is within 2% (4.9 to 5.1 div for exactly a 5 div display) for all positions of the VOLTS/DIV switch.

c. Remove 20 pF normalizer. Adjust square-wave generator and add or remove attenuators to maintain 5 div display throughout Step 19.

CHECK—Display overshoot, roll-off and flat-top is within 2% (4.9 to 5.1 div for exactly a 5 div display) for all positions of VOLTS/DIV switch.

d. If above checks are within 2%, proceed to Step 20.

e. If not, make following adjustments for best flat-top and leading-edge waveform using low-capacitance screwdriver.

f. Set VOLTS/DIV switch to 5 mV.

ADJUST—C10 for best flat-top display.

g. Set VOLTS/DIV switch to 10 mV.

ADJUST—C37 for best flat-top display.

h. Remove 20 pF normalizer from test setup.

ADJUST—C36 for best flat corner.

INTERACTION—C37 and C36. Readjust as needed for optimum flat response.

ADJUST—Compensations as shown in Table 5-C-4 for optimum flat response. Readjust each adjustment pair as needed for optimum flat response.

i. Disconnect test setup.

20. CHECK/ADJUST CH 2 AND OUTPUT HIGH-FREQUENCY COMPENSATION

a. Set: VOLTS/DIV (both) 5 mV
A TRIGGER SLOPE +

b. Connect fast-rise, + output of square-wave generator to CH 2 input via GR-to-BNC adapter, 50 Ω cable, X10 attenuator and 50 Ω termination.

NOTE

Steps 20 through 26 are adjustment related. Perform all the checks, but not the adjustments, in these steps before making any adjustments (unless calibration is being performed after repair or replacement of vertical components).

If all checks are within the given limits, proceed to Step 27.

If not, perform checks and adjustments in Steps 20 through 26, using low-capacitance screwdriver.

Still not within the given limits?—Perform Steps 6 through 26.

Still not within the given limits?—Compromise the adjustment of Vertical Output Bias (R478), setting it to minimize the aberrations in Steps 21a and b.

c. Adjust square-wave generator for 100 kHz to 1 MHz display, 5 div high.

d. Set A TIME/DIV to about 2 μs.

CHECK—Flat-top display with aberrations within 3% (4.85 to 5.15 with exactly a 5 div display).

ADJUST— C409, R409, C451, R451, C428, R428, C455, R455, C233, C208, R208, C312 and R312, in the order given, for best flat-top waveform with fastest risetime.

e. Connect test setup to fast-rise, − output of square-wave generator.

f. Set A TRIGGER SLOPE to −.

CHECK—Flat-bottom display with aberrations within 5% (4.75 to 5.25 div for exactly a 5 div display).

INTERACTION—Adjustments in Step 20d affect negative-step aberrations. Optimize risetime and minimum aberrations on both positive- and negative-going displays in Steps 20d and f.

21. CHECK CH 2 POSITION EFFECT

a. Position bottom of display to top graticule line.

CHECK—Display aberrations are within 7% (4.65 to 5.35 div for exactly a 5 div display).

b. Set A TRIGGER SLOPE control to +.

c. Connect test setup to fast-rise, + output of square-wave generator.

d. Position top of display to bottom graticule line.

CHECK—Display aberrations are within 5% (4.75 to 5.25 div for exactly a 5 div display).

22. CHECK/ADJUST CH 1 HIGH-FREQUENCY COMPENSATION

a. Move test signal from CH 2 input to CH 1 input.

CHECK—Flat-top display with aberrations within 3% (4.85 to 5.15 div for exactly a 5 div display).

ADJUST—C133, C108, R108, C302 and R302, in the order given, for best flat-top display.

b. Connect test setup to fast-rise, − output of square-wave generator.

c. Set A TRIGGER SLOPE to −.

CHECK—Flat-bottom display with aberrations within 5% (4.75 to 5.25 div for exactly a 5 div display).

INTERACTION—Adjustments in Step 22a affect negative step. Optimize risetime and minimum aberrations on both positive- and negative-going displays in Steps 28a and c.

23. CHECK CH 1 POSITION EFFECT

a. Position bottom of display to top graticule line.

CHECK—Display aberrations are within 7% (4.65 to 5.35 div for exactly a 5 div display).

b. Set A TRIGGER SLOPE control to +.

c. Connect test setup to fast-rise, + output of square-wave generator.

d. Position top of display to bottom graticule line.

CHECK—Display aberrations are within 5% (4.75 to 5.25 div for exactly a 5 div display).

24. CHECK CH 1 TRANSIENT RESPONSE

a. Set A TRIGGER LEVEL to +.

b. Connect output of fast-rise, high-amplitude output of square-wave generator to CH 1 input via GR-to-BNC adapter, 50 Ω cable, 2 X10 attenuators and 50 Ω termination.

c. Adjust generator and add or remove attenuators to maintain a 5 div display throughout Step 24.

NOTE

It is possible to obtain more signal intensity. Set Storage Mode switch to VAR PERS and adjust STORAGE LEVEL, VIEW TIME and INTEN controls for most usable trace.

CHECK—Display flat-top and aberrations are within 3% (4.85 to 5.15 for exactly a 5 div display).

25. CHECK CH 2 TRANSIENT RESPONSE

a. Set VERT MODE to CH 2.

b. Move test setup to CH 2.

c. Adjust generator and add or remove attenuators to maintain a 5 div display throughout Step 25.

CHECK—Display flat-top and aberrations are within 3% (4.85 to 5.15 div for exactly a 5 div display).

d. Remove test setup.

26. CHECK BANDWIDTH

a. Set: A TIME/DIV .2 ms

b. Connect about 50 kHz reference signal from leveled sine-wave generator to CH 2 input via X10 attenuator and 50 Ω termination.

c. Adjust generator for 5 div display.

d. Set generator for 100 MHz output frequency.

CHECK—Display amplitude is 3.5 div or more.

e. Repeat Steps 25c and d for 10 mV through 2 V positions of VOLTS/DIV switch.

f. Change VERT MODE to CH 1. Change test setup to CH 1 input.

g. Repeat Steps 26c and d for 5 mV through 2 V positions of VOLTS/DIV switch.

h. Disconnect test setup.

27. CHECK CASCADED GAIN AND BANDWIDTH

a. Set:

VOLTS/DIV (both)	5 mV
AC-GND-DC (both)	DC
VERT MODE	CH 2
A TIME/DIV	1 ms

b. Connect CH 1 VERT SIGNAL OUT (on rear panel) to CH 2 input via 50 Ω cable and 50 Ω termination. Connect standard amplitude signal from calibration generator to CH 1 input via 50 Ω cable.

c. Set calibration generator for 5 mV output.

CHECK—Display is 5 div or more.

d. Remove test setup from CH 1 input.

e. Connect about 50 kHz reference signal from leveled sine-wave generator to CH 1 input via 50 Ω cable, X10 attenuator and 50 Ω termination.

f. Adjust generator for 5 div display.

g. Set generator for 50 MHz output frequency.

CHECK—Display amplitude is 3.5 div or more.

h. Disconnect test setup.

28. CHECK CHANNEL ISOLATION

a. Set:

CH 2 VOLTS/DIV	.2 V
VERT MODE	CH 2
CH 1 AC-GND-DC	GND

b. Connect 25 MHz signal from leveled sine-wave generator to CH 2 input via 50 Ω cable and 50 Ω termination.

c. Adjust generator for 2 div display.

d. Set:

VOLT/DIV (both)	20 mV
VERT MODE	CH 1

CHECK—Display amplitude is 0.2 div or less.

e. Move test setup from CH 2 input to CH 1.

f. Set:

CH 1 AC-GND-DC	DC
CH 2 AC-GND-DC	GND
CH 1 VOLTS/DIV	.2 V

g. Adjust generator for 2 div display.

h. Set VERT MODE switch to CH 2.

CHECK—Display amplitude is 0.2 div or less.

i. Disconnect test setup.

29. CHECK COMMON-MODE REJECTION RATIO

a. Set:

VOLT/DIV (both)	5 mV
AC-GND-DC (both)	DC
VERT MODE	CH 1
CH 2 INVERT	Invert (pushed in)

b. Connect 20 MHz signal from leveled sine-wave generator to CH 1 and CH 2 inputs via 50 Ω cable, X10 attenuator, 50 Ω termination and dual-input coupler.

c. Set generator for 6 div display.

d. Set VERT MODE switch to ADD.

CHECK—Display is 0.6 div or less (indicates CMRR of at least 10:1 at 20 MHz).

e. Proceed to Step 29j if CHECK meets requirement.

f. Set VERT MODE switch to CH 1.

g. Set generator for 6 div display of 50 kHz reference signal.

h. Set VERT MODE switch to ADD.

ADJUST—CH 2 Gain Adj (R192) for minimum display (best CMRR).

i. Set generator for 20 MHz output frequency.

CHECK—Display is 0.6 div or less (indicates CMRR of at least 10:1 at 20 MHz).

j. Release CH 2 INVERT switch and disconnect test setup.

30. CHECK BANDWIDTH LIMIT OPERATION

a. Set: 20 MHz BW (PULL) — Pull out (shows yellow)
CH 1 AC-GND-DC — DC

b. Connect about 50 kHz reference signal from leveled sine-wave generator to CH 1 input via 50 Ω cable and 50 Ω termination.

c. Set generator for 6 div display.

d. Increase generator output frequency until display is 4.2 div.

CHECK—Generator output frequency is between 16 and 24 MHz.

e. Disconnect test setup.

D. TRIGGER

Equipment Required

1. Leveled Sine-Wave Generator
2. Low-Frequency Generator
3. Time-Mark Generator
4. Calibration Generator
5. 50-Ohm Signal Pickoff Unit (Type CT-3)
6. X10 Probe
7. 42-inch 50-Ohm BNC Cable
8. GR-to-BNC Female Adapter
9. X10 BNC Attenuator
10. 50-Ohm BNC Termination (2 required)
11. Dual-Input Coupler (2 required)
12. BNC-T Connector
13. 18-inch 50-Ohm BNC Cable (2 required)
14. GR-to-BNC Male Adapter
15. Female-to-Female BNC Adapter
16. Screwdriver

See ADJUSTMENT LOCATIONS 3 pull-out pages for adjustments and test points (TP).

466 CONTROL SETTINGS (* Indicates change from previous step)

POWER	ON

CRT

INTEN	As desired
REDUCED SCAN (PULL)	Push in
FOCUS	As desired
SCALE ILLUM	As desired

Vertical (CH 1 and CH 2)

VERT MODE	CH 1
POSITION	Midrange
* CH 1 VOLTS/DIV	* 10 mV
* CH 2 VOLTS/DIV	* .1 V
VAR VOLTS/DIV	Calibrated detent
AC-GND-DC	DC
INVERT	Off (button out)
20 MHz BW (PULL)	Full bandwidth (push in, then release. Shows no yellow)

Storage

NON STORE	On (button in)
STORAGE LEVEL	NORM
INTEN (SAVE)	Midrange
SAVE	Off (button out)
VIEW TIME	NORM

Trigger (A and B)

COUPLING	AC
LEVEL	Midramge

SLOPE	+
A TRIGGER SOURCE	NORM
*B (DLY'D) TRIGGER SOURCE	NORM
TRIG MODE	AUTO
A TRIG HOLD OFF	NORM

Sweep (A and B)

HORIZ DISPLAY	A
*A TIME/DIV	*.05 μs
*B TIME/DIV	*.05 μs
VAR TIME/DIV	Calibrated detent
DELAY TIME POSITION	Full counterclockwise
X10 MAG (IN)	Off (button out)
POSITION (Horiz)	Midrange
FINE	Midrange

1. CHECK/ADJUST A TRIGGER SENSITIVITY AND TRIG LAMP

a. Connect 25 MHz signal from leveled sine-wave generator to A and B External Trigger inputs via 50 Ω cable, GR to BNC female adapter CT-3 thru output, GR-to-BNC male adapter, X10 attenuator, 50 Ω termination and dual-input coupler.

b. Connect CT-3 Sig Out 10% signal to CH 1 and CH 2 inputs via 50 Ω termination and dual-input coupler.

c. Set generator for 3 div display.

d. Set CH 1 VOLTS/DIV switch to .1 V (0.3 div display).

CHECK - Stable triggered display obtained by rotating A TRIGGER LEVEL control in both + and - slopes.

CHECK - TRIG lamp is lit during stable display.

e. Set CH 1 VOLTS/DIV switch to .2 V (0.15 div display).

CHECK - No stable triggered display is obtained by rotating A TRIGGER LEVEL control in both + and - slopes.

f. If CHECKS in d and e meet the requirements, move to Step 2.

g. Set CH 1 VOLTS/DIV switch to 10 mV and adjust generator for 2.5 div display.

h. Set CH 1 VOLTS/DIV switch to .1 V.

ADJUST - A Trig. Sens (R655) so stable triggered display is just obtained by rotating A TRIGGER LEVEL control in both + and - slopes.

i. Set CH 1 VOLTS/DIV switch to 10 mV and adjust generator for 3 div display.

j. Set CH 1 VOLTS/DIV switch to .2 V.

CHECK - No stable triggered display is obtained by rotating A TRIGGER LEVEL control. If a stable triggered display is obtained, the trigger is too sensitive. Readjust A Trig. Sens (R655) for a stable triggered display with a 0.3 div display but no stable triggered display with a 0.15 div display (see steps d and e).

2. CHECK/ADJUST B TRIGGER SENSITIVITY

a. Set: HORIZ DISPLAY B DLY'D

CH 1 VOLTS/DIV 10 mV

A TRIGGER LEVEL Full clockwise

b. Set leveled sine-wave generator for 3 div display.

c. Set CH 1 VOLTS/DIV switch to .1 V (0.3 div display).

CHECK - Stable triggered display obtained by rotating B TRIGGER LEVEL control in both + and - slopes.

d. Set CH 1 VOLTS/DIV switch to .2 V (0.15 div display).

CHECK - No stable triggered display is obtained by rotating A TRIGGER LEVEL control.

e. If CHECKS in c and d meet requirements, move to Step 3.

f. Set CH 1 VOLTS/DIV switch to 10 mV and adjust generator for 2.5 div display.

g. Set CH 1 VOLTS/DIV switch to .1 V.

ADJUST - B Trig Sens (R555) so stable triggered display is just obtained by rotating B TRIGGER LEVEL control in both + and - slopes.

h. Set CH 1 VOLTS/DIV switch to 10 mV and adjust generator for 3 div display.

i. Set CH 1 VOLTS/DIV switch to .2 V.

CHECK - No stable triggered display is obtained by rotating B TRIGGER LEVEL control. If a stable triggered display is obtained, the trigger is too sensitive. Readjust B Trig Sens (R555) for a stable triggered display with a 0.3 div

display but no stable triggered display with a 0.15 div display (see Steps d and e).

3. CHECK/ADJUST B TRIGGER SLOPE AND LEVEL CENTERING

a. Set:

TIME/DIV (both)	10 µs
B TRIGGER LEVEL	0
CH 1 VOLTS/DIV	10 mV

b. Set leveled sine-wave generator for 4 div, 50 kHz display.

c. Vertically center display about center horizontal graticule line. Horizontally move display as needed to view sweep start.

d. Switch B TRIGGER SLOPE switch between + and -.

CHECK--Display begins at the same vertical point, the center graticule line, in both + and - slope.

ADJUST--B Trig Slope (R545) for + and - sine-wave portions to start at same point on sine wave.

ADJUST--B Trig Level (R535) for starting point of display to be at graticule center.

4. CHECK/ADJUST A TRIGGER SLOPE AND LEVEL CENTERING.

a. Set:

HORIZ DISPLAY	A
A TRIGGER LEVEL	0

b. Switch A TRIGGER SLOPE switch between + and -.

CHECK--Display begins at the same vertical point, the center graticule line, in both + and - slopes.

ADJUST--A Trig Slope (R645) for + and - sine-wave portions to start at same point on sine wave.

ADJUST--A Trig Level (R635) for starting point of display to be at graticule center.

5. CHECK/ADJUST A TRIGGER DC LEVELS

a. Set leveled sine-wave generator for 5 div (50 mV) display.

b. Set CH 1 VOLTS/DIV switch to 50 mV and vertically center display about center horizontal graticule line.

c. Adjust A TRIGGER LEVEL control for stable display with both + and - slopes.

NOTE

Steps d, e and f: A TRIGGER LEVEL control must remain at 0 for proper adjustment. To check or reset the control, change A TRIGGER COUPLING to AC and adjust A TRIGGER LEVEL control for a stable display with both + and - slopes. Return trigger to dc-coupled mode.

d. Set A TRIGGER COUPLING switch to DC.

CHECK--Stable display, starting at graticule center line, with both + and - slopes.

ADJUST--Norm DC Trig Bal (R341) for stable display, starting at graticule center line, with both + and - slopes.

e. Set A TRIGGER SOURCE switch to CH 1.

CHECK--Stable display, starting at center graticule line, with both + and - slopes.

ADJUST--CH 1 DC Trig Bal (R152) for stable display, starting at graticule center with both ± and - slopes.

f. Set:

A TRIGGER SOURCE	CH 2
VERT MODE	CH 2
CH 2 VOLTS/DIV	50 mV

CHECK--Stable display, starting at center graticule line, with both + and - slope.

ADJUST--CH 2 DC Trig Bal (R252) for stable display, starting at graticule center with both + and - slopes.

6. CHECK B TRIGGER DC LEVELS

a. Set:

HORIZ DISPLAY	B DLY'D
VERT MODE	CH 1
A TRIGGER LEVEL	Full clockwise
B TRIGGER LEVEL	0
COUPLING (both)	DC
SOURCE (both)	NORM

b. Use CH 1 POSITION control as needed.

CHECK--Stable display, starting within 0.2 div of graticule center, with both + and - slopes for these modes:

B TRIGGER SOURCE	VERT MODE	CH 1 POSITION CONTROL
NORM	CH 1	Moves display away from triggering point.
CH 1	CH 1	Does not affect triggering.
CH 2	CH 2	Does not affect triggering.

b. Set: B TRIGGER SOURCE switch to NORM and use CH 2 POSITION control as needed.

CHECK - Stable display, starting within 1 div of graticule center, with both + and - slopes.

7. CHECK B INTERNAL 25 MHz TRIGGERING

a. Set:

TRIGGER MODE (both)	AC
CH 1 VOLTS/DIV	.1 V
CH 2 VOLTS/DIV	10 mV
A TIME/DIV	.2 µs
B TIME/DIV	.05 µs

b. Set leveled sine-wave generator for 3 div (30 mV), 25 MHz display.

c. Set CH 2 VOLTS/DIV switch to .1 V.

d. Use B TRIGGER LEVEL control as needed.

CHECK - Stable display, with both + and - slopes for these modes:

VERT MODE	B TRIGGER SOURCE	B TRIGGER COUPLING
CH 2	CH 2	AC, DC
CH 1	CH 1	DC, AC
CH 1	NORM	AC, DC

e. Set: CH 1 VOLTS/DIV 10 mV

B TRIGGER COUPLING LF REJ

f. Set leveled sine-wave generator for 5 div (50 mV) 25 MHz display.

g. Set CH 1 VOLTS/DIV switch to .1 V.

h. Use B TRIGGER LEVEL as needed.

CHECK - Stable display, with both + and - slope for these modes:

B TRIGGER SOURCE

NORM

CH 1

CH 2

i. Set B TRIGGER COUPLING switch to HF REJ.

CHECK - No stable display for these modes:

B TRIGGER SOURCE

CH 2

CH 1

NORM

8. Check A INTERNAL 25 MHz TRIGGERING

a. Set:

HORIZ DISPLAY	A
A TIME/DIV	.05
A TRIG LEVEL	0
CH 1 VOLTS/DIV	10 mV

b. Set leveled sine-wave generator for 3 div (30 mV), 25 MHz display.

c. Set CH 1 VOLTS/DIV switch to .1 V.

d. Use A TRIGGER LEVEL control as needed.

CHECK - Stable display, with both + and - slope for these modes:

A TRIGGER

SOURCE	COUPLING
NORM	AC, DC
CH 1	DC, AC
CH 2	AC, DC

e. Set:

CH 1 VOLTS/DIV	10 mV
A TRIGGER COUPLING	LF REJ

f. Set leveled sine-wave generator for 5 div (50 mV) 25 MHz display.

g. Set CH 1 VOLTS/DIV switch to .1 V.

h. Use A TRIGGER LEVEL as needed.

CHECK - Stable display, with both + and - slopes for these modes:

A TRIGGER SOURCE
CH 2
CH 1
NORM

i. Set A TRIGGER COUPLING switch to HF REJ.

CHECK - No stable display for these modes:

A TRIGGER SOURCE
NORM
CH 1
CH 2

9. Check A EXTERNAL 25 MHz TRIGGERING

a. Set:

VOLTS/DIV (both)	10 mV
TRIGGERING COUPLING (both)	AC
SOURCE (both)	EXT

b. Set leveled sine-wave generator to maintain 5 div (50 mV) display throughout Steps 9 and 10.

CHECK - Stable display, with both + and - slopes for these modes:

A TRIGGER COUPLING
AC, DC

c. Set:

CH 1 VOLTS/DIV	20 mV
A TRIGGER COUPLING	LF REJ

d. Set leveled sine-wave generator for 5 div (100 mV), 25 MHz display.

e. Use A TRIGGER LEVEL control as needed.

CHECK - Stable display, with both + and - slopes.

f. Set A TRIGGER COUPLING switch to HF REJ.

CHECK - No stable display.

g. Remove X10 attenuator from external trigger setup and change A TRIGGER SOURCE switch to EXT ÷ 10.

CHECK - No stable display.

h. Set A TRIGGER COUPLING switch to LF REJ.

CHECK - Stable display, with both + and - slopes.

i. Set: CH 1 VOLTS/DIV 10 mV

A TRIGGER COUPLING AC

j. Set leveled sine-wave generator for 5 div (50 mV), 25 MHz display.

CHECK - Stable display, with both + and - slopes for these modes.

A TRIGGER COUPLING

AC, DC

10. CHECK B EXTERNAL 25 MHz TRIGGERING

a. Set: HORIZ DISPLAY B DLY'D

A TIME/DIV .2 μ s

B TIME/DIV .05 μs

b. Add X10 attenuator to the external trigger setup.

CHECK--Stable display, with both + and - slope for these modes:

B TRIGGER COUPLING
AC, DC

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

d. Adjust leveled sine-wave generator for 5 div (100 mV) 25 MHz display.

e. Set B TRIGGER COUPLING Switch to LF REJ and use B TRIGGER LEVEL control as needed.

CHECK-- Stable display, with both + and - slopes.

Set B TRIGGER COUPLING switch to HF REJ.

CHECK--No stable display.

11. CHECK B AND A EXTERNAL 100 MHz TRIGGERING

a. Set: TRIGGER COUPLING (both) AC

CH 1 VOLTS/DIV 5D mV

b. Connect 25 MHz signal from leveled sine-wave generator to B External Trigger input via 50Ω BNC cable, GR-to-BNC female adaptor, CT-3 thru output, GR-to-BNC male adapter, X10 attenuator and 50Ω termination.

c. Connect CT-3 Sig Out 10% signal to CH 1 input via 50 BNC cable and 50Ω termination.

d. Set leveled sine-wave generator for 3 div (150mV) 25 MHz display, then change frequency to 100 MHz. Do not readjust signal amplitude.

e. Push in X10 MAG (IN) button and use B TRIGGER LEVEL control as needed.

CHECK - Stable display, with 0.1 div or less jitter, with + and - slopes for these modes:

B TRIGGER COUPLING

AC, DC

f. Set leveled sine-wave generator for 6 div (300mV), 25 MHz display, then change frequency to 100 MHz. Do not readjust signal amplitude.

g. Set B TRIGGER COUPLING switch to LF REJ and use B TRIGGER LEVEL control as needed:

CHECK - Stable display, with 0.1 div or less jitter, with both + and - slopes.

h. Set B TRIGGER COUPLING switch to HF REJ.

CHECK - No stable display.

i. Set:

HORIZ DISPLAY	A
A TIME/DIV	.05
A TRIGGER MODE	LF REJ.
A TRIGGER SOURCE	EXT

j. Move leveled sine-wave generator signal to A External Trigger input.

k. Use A TRIGGER LEVEL control as needed:

CHECK - Stable display, with 0.1 div or less jitter, with both + and - slopes.

l. Set A TRIGGER COUPLING to HF REJ.

CHECK - No stable display.

m. Set: A TRIGGER COUPLING AC

n. Set leveled sine-wave generator for 3 div (150 mV) 25 MHz display, then change frequency to 100 MHz. Do not readjust signal amplitude.

o. Use A TRIGGER LEVEL control as needed.

CHECK - Stable display, with 0.1 div or less jitter, with both + and - slopes:

A TRIGGER COUPLING
AC, DC

p. Remove X10 attenuator from External trigger setup and change A TRIGGER SOURCE switch to 10.

q. Use A TRIGGER LEVEL control as needed.

CHECK - Stable display, with 0.1 div or less jitter, with both + and - slopes:

A TRIGGER COUPLING
DC, AC

r. Set leveled sine-wave generator for 6 div (300 mV) 25 MHz display, then change frequency to 100 MHz. Do not readjust signal amplitude.

s. Set A TRIGGER COUPLING to LF REJ and use A TRIGGER LEVEL as needed.

CHECK - Stable display, with 0.1 div or less jitter, with both + and - slopes.

t. Set A TRIGGER COUPLING to HF REJ.

CHECK - No stable display.

12. CHECK A INTERNAL 100 MHz TRIGGERING.

a. Set: VOLTS/DIV (both) 50 mV

TRIGGER SOURCE (both) NORM

TRIGGER COUPLING (both) AC

b. Add X10 attenuator to external trigger setup. Adjust leveled sine-wave generator for 1.5 div 100 MHz display.

Connect CT-3 Sig Out 10% signal to CH 1 and CH 2 inputs via 50 ohm BNC cable 50 ohm termination and dual-input coupler.

CHECK - Stable display, with 0.1 div jitter, with + and - slope, for these modes:

A TRIGGER

SOURCE	COUPLING
NORM	AC, LF REJ, DC
CH 1	DC, LF REJ, AC
CH 2	AC, LF REJ, DC

c. Set A TRIGGER COUPLING switch to HF REJ.

CHECK - No stable display.

13. CHECK B INTERNAL 100 MHz TRIGGERING

a. Set: HORIZ DISPLAY B DLY'D

A TIME/DIV .2 µs

B TIME/DIV .05 µs

CHECK - Stable display, with 0.1 div jitter, with + and - slope, for these modes:

B TRIGGER

SOURCE	COUPLING
NORM	AC, LF REJ, DC
CH 1	DC, LF REJ, AC
CH 2	AC, LF REJ, DC

b. Set B TRIGGER COUPLING switch to HF REJ.

CHECK--No stable display.

14. CHECK A AND B HF REJ TRIGGERING

a. Set:

HORIZ DISPLAY	A
TIME/DIV (both)	10 µs
X10 MAG	Off (button out)
TRIGGER COUPLING (both)	HF REJ
CH 1 VOLTS/DIV	.1 V
CH 2 VOLTS/DIV	10 mV
VERT MODE	CH 2

b. Connect 50 kHz signal from leveled sine-wave generator to CH 1 and CH 2 inputs via 50 Ω BNC cable, 50 Ω termination and dual-input coupler.

c. Set generator for 5 div (50 mV) display in CH 2.

d. Set CH 2 VOLTS/DIV switch to .1 V. Adjust A TRIGGER LEVEL for stable display, with both + and - slope.

e. Set generator frequency for 1 MHz signal and push in X10 MAG (IN) button.

CHECK--No stable display with A TRIGGER SOURCE switch in NORM, CH 1 or CH 2.

f. Set:

A TRIGGER LEVEL	Full clockwise
HORIZ DISPLAY	B DLY'D

CHECK--No stable display with B TRIGGER SOURCE switch in NORM, CH 1 or CH 2.

15. CHECK SINGLE SWEEP

a. Set:

A TRIGGER COUPLING	AC
SOURCE	NORM
LEVEL	0
HORIZ DISPLAY	A
VERT MODE	CH 1
X10 MAG (IN)	Off (button out)

b. Set leveled sine-wave generator for 2 div 50 kHz display and adjust A TRIGGER LEVEL control to have sweep start about 0.5 div away from the 0 LEVEL setting.

TIME/DIV (both)	10 ms

c. Set:

CH 1 AC-GND-DC	GND
TRIG MODE	SINGL SWP (push in)

CHECK--Ready lamp lights.

d. Set CH 1 AC-GND-DC switch to DC.

CHECK--A single sweep occurs and READY lamp goes out.

e. Press SINGL SWP button.

CHECK--A single sweep occurs each time SINGL SWP button is pressed.

f. Remove test setup.

16. CHECK 30 Hz INTERNAL TRIGGERING

a. Set:

TIME/DIV (both)	5 ms
A TRIGGER MODE	NORM
CH 1 VOLTS/DIV	10 mV

b. Connect 30 Hz low-frequency generator signal to CH 1 input via 50 Ω cable, BNC tee and 50 Ω termination.

From BNC tee, connect 50 Ω cable and 50 Ω termination to B EXT Input.

c. Set low-frequency generator for 3 div (30 mV) display.

d. Set CH 1 VOLTS/DIV switch to .1 V.

CHECK--Stable display, with both + and - slopes for these modes:

A TRIGGER COUPLING
AC, DC

e. Set CH 1 VOLTS/DIV 10 mV

A TRIGGER COUPLING HF REJ

f. Set low-frequency generator for 5 div (50 mV) 30 Hz display.

g. Use A TRIGGER LEVEL as needed.

CHECK--Stable display, with both + and - slopes.

h. Set A TRIGGER COUPLING switch to LF REJ.

CHECK--No stable trigger.

i. Set:

A TRIG MODE	AUTO
LEVEL	Full clockwise
A TIME/DIV	10 ms
B TIME/DIV	5 ms
B TRIGGER SOURCE	NORM
B TRIGGER COUPLING	HF REJ
HORIZ DISPLAY	B DLY'D
CH 1 VOLTS/DIV	.1 V

CHECK--Stable display, with both + and - slopes.

j. Set: B TRIGGER COUPLING switch to LF REJ.

CHECK--No stable display.

k. Set: CH 1 VOLTS/DIV 10 mV

B TRIG COUPLING AC

l. Set low-frequency generator for 3 div (30 mV) 30 Hz display.

m. Set CH 1 VOLTS/DIV switch to .1V and use B TRIGGER LEVEL control as needed.

CHECK--Stable display, with both + and - slopes for these modes.

B TRIGGER COUPLING

AC, DC

17. CHECK 30 Hz EXTERNAL TRIGGERING

a. Set:

B TRIGGER COUPLING	AC
CH 1 VOLTS/ DIV	10 mV

b. Set low-frequency generator for 5 div (50 mV) display.

c. Set B TRIGGER SOURCE switch to EXT.

CHECK--Stable display, with both + and - slopes for these modes:

B TRIGGER COUPLING

AC, HF REJ, DC

d. Set B TRIGGER COUPLING switch to LF REJ.

CHECK--No stable display.

e. Move signal cable from B EXT Input to A EXT Input.

g. Set:

HORIZ DISPLAY	A
A TRIGGER COUPLING	AC
A TRIG MODE	NORM
SOURCE	EXT
TRIGGER LEVEL	As needed

Check--Stable display, with both + and - slopes for these modes:

A TRIGGER COUPLING

AC, HF REJ, DC

g. Set A TRIGGER COUPLING switch LF REJ.

CHECK--No stable display.

h. Disconnect test setup.

18. CHECK LINE TRIGGERS

a. Set:

A TIME/DIV	5 ms
A TRIG MODE	AUTO
A TRIGGER SOURCE	LINE
SLOPE	+
CH 1 VOLTS/DIV	As required

b. Connect 10X probe from CH 1 Input to a line-frequency source.

CHECK--Stable display, starting on positive-going slope.

c. Set A TRIGGER SOURCE switch to -.

CHECK--Stable display, starting on negative-going slope.

d. Disconnect probe from line-frequency source, then from oscilloscope.

19. CHECK TRIGGER LEVEL RANGE

a. Set:

TRIG COUPLING (both)	AC
TRIG SOURCE (both)	EXT
TRIGGER SLOPE (both)	+
VERT MODE	CH 1
CH 1 VOLTS/DIV	1 V
HORIZ DISPLAY	B DLY'D

b. Connect 1 kHz signal from low-frequency generator to CH 1 input and B External Trigger input via 50 Ω cable, BNC T (to B External input) and 50 Ω cable.

c. Adjust the generator for a 4 div display.

CHECK--Display is triggered along positive slope of waveform when B TRIGGER LEVEL control is rotated, but not triggered (free-runs) at either extreme of rotation.

d. Set B TRIG SLOPE to -.

CHECK--Display is triggered along negative slope of waveform when B TRIGGER LEVEL control is rotated, but not triggered at either extreme of rotation.

e. Move External Trigger signal to A External input.

f. Set HORIZ DISPLAY TO A.

CHECK--Display is triggered along positive slope of waveform when A TRIGGER LEVEL control is rotated, but not triggered at either extreme of rotation.

g. Set A TRIG SLOPE to -.

CHECK--Display is triggered along negative slope of waveform when A TRIGGER LEVEL control is rotated, but not triggered at either extreme of rotation.

h. Set:

CH 1 VOLTS/DIV	10 V
A TRIG SOURCE	EXT 10
A TRIG COUPLING	AC

i. Disconnect low-frequency generator signal and connect 50 volt standard amplitude signal from calibration generator via 50 Ω cable.

CHECK--Display is triggered along negative slope of waveform when A TRIG LEVEL control is rotated (Note--The applied signal is 50 volts peak-to-peak. The range of the A LEVEL control is only ±20, or 40 volts peak to peak, or greater;

therefore, untriggered operation at either extreme of rotation is not required).

j. Set A TRIG SLOPE to +.

CHECK--Display is triggered along positive slope of waveform when A TRIG LEVEL control is rotated (the note for step i applies to step j).

k. Disconnect calibration generator signal.

20. CHECK A NORMAL MODE

a. Set:

A TIME/DIV	1 ms
A TRIG SOURCE	NORM
COUPLING	DC
MODE	AUTO
CH 1 VOLTS/DIV	.5 V

b. Connect .1 s time marks from time-mark generator to CH 1 input via 50 Ω cable and 50 Ω termination.

CHECK--Display is triggered.

c. Set A TRIG MODE switch to NORM.

CHECK--Display is triggered.

d. Set CH 1 AC-GND-DC switch to GND.

CHECK--Display is not triggered.

21. CHECK AUTOMATIC RECOVERY TIME

a. Set:

CH 1 AC-GND-DC	DC
A TRIG MODE	AUTO

CHECK--Display is triggered.

b. Set time-mark generator for .5 s time marks.

CHECK--Display is not triggered.

c. Disconnect time-mark generator.

22. CHECK /ADJUST TRIGGER VIEW CENTERING

a. Set:

A TRIG COUPLING	AC
SOURCE	EXT
SLOPE	+
LEVEL	0
A TIME/DIV	.2 ms

b. Connect 0.2 volt standard amplitude signal from calibration generator to A External Trigger Input via 50 Ω cable.

c. Push TRIG VIEW button and hold it in.

CHECK--Display triggers symmetrically within 1 div of graticule center line when A TRIGGER SLOPE is switched between + and -.

ADJUST--Trig View Centering (R675) for symmetrical triggering about graticule center line.

d. Rotate A TRIGGER LEVEL control (with TRIG VIEW pushed in).

CHECK--Display top and bottom are triggered within 1 div of graticule center line.

e. Set A TRIG COUPLING switch to DC.

CHECK--Display top and bottom are triggered within 1 div of graticule center line.

23. CHECK TRIGGER VIEW GAIN

a. Push TRIG VIEW button and hold it in.

CHECK--Display amplitude is 3.2 to 4.8 div.

b. Disconnect calibration generator.

24. CHECK TRIGGER VIEW RISETIME

a. Set: A TIME/DIV switch to 1 μs

b. Connect 100 kHz fast-rise, + output signal from calibration generator to A External Trigger input via 50 Ω cable and 50 Ω termination.

c. Push TRIG VIEW button and hold it in. Use A TRIGGER LEVEL control to position top of display to 100% graticule line. Adjust calibration generator so bottom of display is at 0% graticule line.

d. Set: A TIME/DIV .05 μs

X10 MAG (IN) On (button in)

CHECK--Risetime between 10% and 90% point of display is 1 div or less (5 ns or less).

25. CHECK TRIGGER VIEW DELAY DIFFERENCE

a. Set A CH 1 VOLTS/DIV switch to 50 mV.

b. Connect 100 kHz fast-rise, + output signal from calibration generator to CH 1 input and A External Trigger input via 50 Ω cable, female-to-female BNC Adapter, BNC-T connector and 2 equal-length, 50 Ω cables--each terminated into 50 Ω.

c. Push TRIG VIEW button and hold it in. Adjust calibration generator for 4 div display. Use A TRIGGER LEVEL and (horizontal) POSITION controls to center display.

d. Release TRIG VIEW button and set A TRIG SOURCE to NORM.

e. Adjust CH 1 VAR VOLTS/DIV control for a 4 div display and CH 1 POSITION to vertically center display.

CHECK--Time difference, along graticule center line, between TRIG VIEW display and CH 1 display is 0.6 div or less (3 ns or less).

f. Disconnect calibration generator.

E. DM43 OR DM40 DIGITAL MULTIMETERS



OSCILLOSCOPES WITH DIGITAL MULTIMETERS ATTACHED, REFER TO THE CALIBRATION SECTION OF THE DIGITAL MULTIMETER MANUAL AT THIS POINT.

FOR CALIBRATION OF OSCILLOSCOPES WITHOUT DIGITAL MULTIMETERS CONTINUE TO PART F.

Equipment Required

1. Test oscilloscope
2. Time-mark generator
3. 50-Ohm BNC cable
4. 50-Ohm BNC termination
5. Screwdriver
6. Low-capacitance screwdriver
7. Light shield--for Delay-time Jitter only (step 15).

See ADJUSTMENT LOCATIONS pull-out page for adjustments and test points (TP).

466 CONTROL SETTINGS (* indicates changes from previous step)

POWER	ON
CRT	
INTEN	As desired
REDUCED SCAN (PULL)	Off (push INTEN in)
FOCUS	As desired
SCALE ILLUM	As desired
Vertical (CH 1 and CH 2)	
VERT MODE	CH 1
POSITION	Midrange
VOLTS/DIV	.5 V
VAR VOLTS/DIV	Calibrated detent

Vertical (CH 1 and CH 2) (cont.)

AC-GND-DC	DC
INVERT	Normal (button out)
20 MHz BW (PULL)	Full bandwidth (push in, then release. Shows no yellow.)

Storage

NON STORE	On (button in)
STORAGE LEVEL	NORM
INTEN (SAVE)	Midrange
SAVE	Off (button out)
VIEW TIME	NORM

Trigger (A and B)

COUPLING	AC
LEVEL	As needed for triggered display
SLOPE	+
A TRIGGER SOURCE	NORM
B (DLY'D) TRIGGER SOURCE	STARTS AFTER DELAY
TRIG MODE	AUTO
A TRIG HOLD OFF	NORM

Sweep (A and B)

*HORIZ DISPLAY	*A INTEN
A TIME/DIV	1 ms
*B TIME/DIV	*5 µs
VAR TIME/DIV	Calibrated detent
*DELAY TIME POSITION (DTP)	*1.00
X10 MAG	Off (button out)

Sweep (A and B) (cont.)

POSITION (Horiz)	As needed
FINE	As needed

TIMING CHECKS AND ADJUSTMENTS

A INTEN Mode--Verifies which time mark (or other timing signal) will be seen in B DLY'D mode. Adjust intensity and focus to permit observation of the intensified portion of the display. See Fig. 5-F-1.

B DLY'D Mode--Establishes the most accurate point for making checks and adjustments. Position the time mark (or other timing signal) so it begins at the left-hand edge (sweep start) of the trace--Do this with the DTP control when checking and when doing the calibration adjustment during calibration. Optimum intensity and focus settings for this mode are different from A INTEN mode. See Fig. 5-F-2.

Timing is checked and adjusted after a stable display is obtained and is referenced along the center horizontal graticule line.

Lowest usable intensity settings reduce the error contributed by trace thickness.

When a CHECK is indicated, use the A INTEN mode to identify the correct signal. Switch to B DLY'D and set the signal start at the left-hand edge (sweep start) using the DELAY TIME POSITION

(DTP) control, then make the measurement.

When an ADJUST is indicated, set the DELAY TIME POSITION (DTP) control to the required setting (for example--1.00 in step 1 a and b), then make the adjustment (in the same example--Sweep Start, R1115) to have the signal start at the sweep start (Sweep Start, R1115, is labeled Swp Start, R813, on early instruments).

Fig. 5-F-1. A INTEN mode.

Fig. 5-F-2. B DLY'D mode.

Fast-rise, Low-repetition Rate Signals. It may be difficult--because of high light levels, et., to observe the starting point of some signals. Use the sweep starting point just before the signal start.

In step 1 a and b, for example, if the signal start was set to start 0.5 minor divisions after the sweep start, the baseline beginning would appear as a small dot. See Fig. 5-F-3.

The error in this method is small, as long as B Sweep is 100 or more times faster than A Sweep. For example, with A TIME/DIV switch set to 1 ms and B TIME/DIV to 5 μs, the B DLY'D mode resolution is 0.5% per major graticule division. The use of the 0.5 minor division spot is 1/10 of that or 0.05%.

Fig. 5-F-3. Fast-rise, low-repetition rate signals.

1. CHECK/ADJUST SWEEP START AND A SWEEP TIMING

a. Connect 1 ms time marks from time-mark generator to CH 1 input via 50Ω cable and 50Ω termination.

b. Note 2nd time mark is intensified. Change HORIZ DISPLAY to B DLY'D and set signal start to sweep start with DTP.

CHECK - DTP control reads 1.00.

c. Set HORIZ DISPLAY to A INTEN, use DTP to move intensified portion to 10th time mark.

d. Change HORIZ DISPLAY to B DLY'D and set signal start to sweep start with DTP.

CHECK - DTP control reads 9.00.

ADJUST - A Swep Cal (R1145) for signal start at sweep start.

e. Set DTP control to 1.00.

CHECK - Signal starts at sweep start.

ADJUST - Swp Start (R1115) for signal start at sweep start. (Swp Start, R1115, is labeled Swp Start R813 on early instruments).

INTERACTION - A Swp Cal (R1145) and Swp Start (R1115) adjustments. Adjust both alternately until 2nd mark starts exactly at 1.00 and 10th mark starts exactly at 9.00.

2. CHECK DIFFERENTIAL TIME ACCURACY

a. Use DTP to set second time mark start to sweep start and note DTP reading (1.00 within 1 minor div, 0.99 to 1.01).

CHECK - Each successive time mark.

TABLE 5-F-1

TIME MARK	DTP SETTING +15°C to +35°C			DTP SETTING -15°C to +55°C		
3	1.98	2.02		1.95	2.05	
4	2.97	3.03		2.92	3.08	
5	3.96	4.04		3.90	4.10	
6	4.95	5.05		4.87	5.13	
7	5.94	to 6.06	or	5.85	to 6.15	
8	6.93	7.07		6.82	7.18	
9	7.92	8.08		7.80	8.20	
10	8.91	9.09		8.77	9.23	
11	9.90	10.10		9.75	10.25	

3. CHECK/ADJUST HORIZONTAL GAIN AND SWEEP LINEARITY

a. Set HORIZ DISPLAY switch to A and horizontally position display to have 1st time mark under left-hand graticule edge.

CHECK - 1 time mark/div, within 2% (9.8 to 10.2 for 11th mark, +20°C to +30°C), or within 3% (9.7 to 10.3 for 11th mark, -15°C to +55°C).

ADJUST - X1 Gain (R1257) for exactly 1 time mark/div over full 10 div.

3. CHECK/ADJUST HORIZONTAL GAIN AND SWEEP LINEARITY (cont.)

b. Set time mark generator for 0.1 ms time marks.

c. Push in X10 MAG (IN) button.

CHECK - X10 MAG lamp is on when X10 MAG (IN) button is in.

CHECK - 1 time mark/div, within 3% (9.7 to 10.3 for 11th mark, +20°C to +30°C), or within 4% (9.6 to 10.4 for 11th mark, -15°C to +55°C).

ADJUST - X10 Gain (R1253) for exactly 1 time mark/div over full 10 div.

CHECK - Sweep accuracy over any 2 div portion of 10 div sweep is within 0.1 div (5%).

d. Release X10 MAG (IN) button.

e. Set time-mark generator for 1 ms time marks.

CHECK - Linearity over any 2 div portion of sweep is within 0.1 div (5%) of accurate timing.

4. CHECK/ADJUST MAGNIFIER REGISTRATION

a. Push in X10 MAG (IN) button.

b. Set time-mark generator for 5 ms time marks and position middle time mark to start at center vertical graticule line.

c. Release X10 MAG (IN) button.

CHECK - Middle time mark starts at center line, within 0.2 div.

4. CHECK/ADJUST MAGNIFIER REGISTRATION (cont)

ADJUST - Mag Reg (R1255) so middle time mark starts at center line. Repeat steps a through c until there is no display shift between magnifier on and off.

5. CHECK/ADJUST B SWEEP TIMING

a. Set time-mark generator for 1 ms time marks.

b. Set:

DELAY TIME POSITION	Full CCW
B TRIGGER SOURCE	Normal
B TIME/DIV	1 ms
HORIZ DISPLAY	B DLY'D

CHECK - 1 time mark/div, within 2% (9.8 to 10.2 for 11th mark, +20°C to +30°C), or within 3% (9.7 to 10.3 for 11th mark, -15°C to +55°C).

ADJUST - B Swp Cal (R1175) for exactly 1 time mark/div over full 10 div.

6. CHECK A SWEEP LENGTH

a. Set HORIZ DISPLAY switch to A.

b. Set time-mark generator for 5 ms time marks and position 3rd time mark to center vertical graticule line.

7. CHECK VAR TIME/DIV RANGE

a. Set: A TIME/DIV 2 ms

VAR TIME/DIV Full counterclockwise

CHECK - UNCAL lamp lights when VAR TIME/DIV control is out of detent.

CHECK - 1 time mark/div or more.

b. Set VAR TIME/DIV control to detent (calibrated).

8. CHECK HORIZONTAL POSITION RANGE

a. Set FINE and POSITION controls full clockwise.

CHECK - Sweep starts to right of center vertical graticule line.

b. Set FINE and POSITION controls full counterclockwise.

CHECK - Sweep ends to left of center vertical graticule line.

9. CHECK/ADJUST A SWEEP HIGH SPEED TIMING

a. Set time-mark generator for 0.5 µs time marks.

b. Set: DELAY TIME POSITION 1.50

B TRIGGER SOURCE STARTS AFTER DELAY

A TIME/DIV .5 µs

B TIME/DIV .05 µs

HORIZ DISPLAY A

9. CHECK/ADJUST A SWEEP HIGH SPEED TIMING (cont.)

CHECK - 1 time mark/div, within 2% (9.8 to 10.2 for 11th mark, +20°C to +30°C), or within 3% (9.7 to 10.3 for 11th mark, -15°C to +55°C).

c. Set time-mark generator for 0.2 µs time marks.

d. Set A TIME/DIV switch to .2 µs.

CHECK - 1 time mark/div, within 2% (9.8 to 10.2 for 11th time mark, +20°C to +30°C) or within 3% (9.7 to 10.3 for 11th time mark, -15°C to +55°C).

e. If steps b and d requirements are met, proceed to step 10.

f. Set time-mark generator for 0.5 µs time marks.

g. Set A TIME/DIV switch to .5 µs and readjust C1137 for 1 time mark/div, using low-capacitance screwdriver.

h. Set HORIZ DISPLAY switch to B DLY'D and horizontally position the displayed time mark to cross center vertical graticule line. See Point A, Fig. 5-F-4.

i. Set DTP control to 8.50.

ADJUST - C1137 to position the displayed time mark to cross center line.

INTERACTION - C1137 and the 1.50 and 8.50 DTP settings. Set DTP control to 1.50 and repeat steps h and i until there is no visible interaction.

9. CHECK/ADJUST A SWEEP HIG SPEED TIMING (cont.)

j. Set:

A TIME/DIV	.2 µs
DELAY TIME POSITION	1.50
HORIZ DISPLAY	A

k. Set time-mark generator for 0.2 µs time marks and note 1 time mark/div.

l. Set HORIZ DISPLAY switch to B DLY'D (verify B TIME/DIV is set to .05 µs) and horizontally position the 2nd displayed time mark to cross center vertical graticule line. See Point A, Fig. 5-F-5.

m. Set DTP control to 8.50. There is a time mark crossing center vertical line between an 8.45 to 8.55 DTP control setting. If not, repeat steps f through l, adjusting C1137 to get both the .2 µs range and .5 µs range within a DTP reading of 8.45 to 8.55.

10. CHECK/ADJUST B SWEEP HIGH SPEED TIMING

a. Set:

DELAY TIME POSITION	Full counterclockwise
HORIZ DISPLAY	B DLY'D
B TRIGGER SOURCE	NORM
A TIME/DIV	1 µs
B TIME/DIV	.5 µs

b. Set time-mark generator for 0.5 µs time marks.

10. CHECK/ADJUST B SWEEP HIGH SPEED TIMING (cont.)

CHECK - 1 time mark/div, within 2% (9.8 to 10.2 for 11th mark +20°C to +30°C) or within 3% (9.7 to 10.2 for 11th mark, -15°C to +55°C).

ADJUST - C1167 for 1 time mark/div.

11. CHECK B AND A TIME/DIV ACCURACY

a. Set: B TIME/DIV .05 µs

A TIME/DIV .5 µs

b. Set time-mark generator for 50 ns time marks.

CHECK - B Time/Div accuracy using control settings given in Table 5-F-2, over first 10 div of display. 1 time mark/div within 2% (9.8 to 10.2 for 11th mark, +20°C to +30°C) or within 3% (9.7 to 10.3 for 11th mark, -15°C to +55°C).

Fig. 5-F-4. 0.2 µs/div timing.

Fig. 5-F-5. 0.5 µs/div timing.

TABLE 5-F-2

A and B Timing Accuracy

A and B TIME/DIV Switch Setting		Time-Mark Generator Output
A	B	
.5 μs	.05 μs	50 nanosecond
.5 μs	.1 μs	0.1 microsecond
.5 μs	.2 μs	0.2 microsecond
A & B	.5 μs	0.5 microsecond
	1 μs	1 microsecond
	2 μs	2 microsecond
	5 μs	5 microsecond
	10 μs	10 microsecond
	20 μs	20 microsecond
	50 μs	50 microsecond
	.1 ms	0.1 millisecond
	.2 ms	0.2 millisecond
	.5 ms	0.5 millisecond
	1 ms	1 millisecond
	2 ms	2 millisecond
	5 ms	5 millisecond
	10 ms	10 millisecond
	20 ms	* 20 millisecond
	50 ms	* 50 millisecond
		A SWEEP ONLY
	.1 s	* 0.1 second
	.2 s	* 0.2 second
	.5 s	* 0.5 second
* Change A TRIG MODE to NORM.		

c. Set: HORIZ DISPLAY A

A TIME/DIV .05 μs

TRIG MODE AUTO

d. Set time-mark generator for 50 ns time marks.

CHECK - A TIME/DIV accuracy using control settings given in Table 9, over first 10 div of display. 1 time mark/div, within 2% (9.8 to 10.2 for 11th mark, +20°C to +30°C) or within 3% (9.7 to 10.3 for 11th mark, -15°C to +55°C).

12. CHECK/ADJUST HIGH SPEED MAGNIFIED TIMING

a. Set time-mark generator for 10 ns time marks.

b. Set:

A TRIG MODE	AUTO
A TIME/DIV	.05 μs
X10 MAG (IN)	On (button in)

CHECK - 1 time mark/2 div, within 3% (9.7 to 10.3 for 6th mark, +20°C to +30°C) or within 4% (9.6 to 10.4 for 6th mark, -15°C to +55°C). This applies to the full sweep length, excluding the first and last 10 divisions of magnified sweep length.

To determine the first portion to be excluded, release X10 MAG (IN) button. Position sweep start 1.5 div left of center vertical graticule line. Push in X10 MAG (IN) button--the first 10 div of sweep is magnified to the left and is off screen.

To determine the last portion to be excluded on the .05 μs/div range, release X10 MAG (IN) button. Position sweep stop 1.5 div right of center vertical graticule line. Push in X10 MAG (IN) button--the last 50 ns of sweep is magnified to the right and is off screen.

ADJUST - C1262 and C1265 for 1 cycle/2 div, with low-capacitance screwdriver, excluding the first and last 10 div (which are off screen).

13. CHECK A AND B MAGNIFIED ACCURACY

a. Push in X10 MAG (IN) button.

CHECK - A TIME/DIV accuracy using control settings given in Table 5-F-3. 1 time mark/div, within 3% (9.7 to 10.3 for 11th mark, +20°C to +30°C) or within 4% (9.6 to 10.4 for 11th mark, -15°C to +55°C). Exclude portions of the sweep as indicated.

Table 5-F-3

A and B Magnified Accuracy

A and B TIME/DIV Switch Setting	Time-Mark Generator Output	Portions of total magnified sweep length to exclude from measurement
.05 μs	10 nanosecond	First and last 10 divisions
.1 μs	10 nanosecond	First and last 5 divisions
.2 μs	20 nanosecond	First and last 2½ divisions
.5 μs	50 nanosecond	
1 μs	0.1 microsecond	
2 μs	0.2 microsecond	
5 μs	0.5 microsecond	
10 μs	1 microsecond	
20 μs	2 microsecond	
50 μs	5 microsecond	
.1 ms	10 microsecond	
.2 ms	20 microsecond	
.5 ms	50 microsecond	
1 ms	0.1 millisecond	
2 ms	0.2 millisecond	
5 ms	0.5 millisecond	
10 ms	1 millisecond	
20 ms	* 2 millisecond	
50 ms	* 5 millisecond	
A SWEEP ONLY		
.1 s	* 10 millisecond	
.2 s	* 20 millisecond	
.5 s	* 50 millisecond	

* Change A TRIG MODE to NORM.

13. CHECK A AND B MAGNIFIED ACCURACY (cont.)

b. Set:

HORIZ DISPLAY	B DLY'D
A TRIG MODE	AUTO
A TIME/DIV	.2 µs
B TIME/DIV	.05 µs

c. Set time-mark generator for 10 ns time marks.

CHECK - 1 time mark/2 div, within 3% (9.7 to 10.3 for 6th mark, +20°C to +30°C) or within 4% (9.6 to 10.4 for 6th mark, -15°C to +55°C). This applies to the full sweep length, excluding the first and last 10 divisions of magnified sweep length.

CHECK - B TIME/DIV accuracy using control settings given in Table 5-F-3. 1 time mark/div, within 3% (9.7 to 10.3 for 11th mark, +20°C to +30°C) or within 4% (9.6 to 10.4 for 11th mark, -15°C to +55°C). Exclude portions of the sweep as indicated.

14. CHECK DELAY TIME ACCURACY

a. Set time-mark generator for 0.1 µs time marks.

b. Set:

X10 MAG (IN)	Off (button out)
B TRIGGER SOURCE	STARTS AFTER DELAY
A TIME/DIV	.2 µs
B TIME/DIV	.05 µs
DELAY TIME POSITION	1.50

14. CHECK A AND B MAGNIFIED ACCURACY (cont.)

c. Horizontally position 1st displayed marker to center vertical graticule line. See Fig. 5-F-6.

d. Set DTP control to 8.50, then move DTP control to position 1st displayed marker to center vertical line.

CHECK - DTP reading is 8.50 $\pm$0.05 (8.45 to 8.55, +15°C to +35°C), or 8.50 $\pm$0.12 (8.35 to 8.62, -15°C to +55°C).

e. Set time-mark generator for .5 µs time marks.

f. Set: DELAY TIME POSITION 1.50

A TIME/DIV .5 µs

Fig. 5-F-6. Delay-time accuracy.

14. CHECK A AND B MAGNIFIED ACCURACY (cont.)

g. Position displayed marker to center vertical line.

h. Set DTP control to 8.50, then move DTP control to position displayed marker to center vertical line.

CHECK - DTP reading is 8.50 ±0.05 (8.45 to 8.55, +15°C to +35°C), or 8.50 ±0.12 (8.38 to 8.62,-15°C to +55°C).

CHECK - Delayed sweep accuracy using control settings given in Table S-F-4. Use 1.00 for 1st DPT setting and 9.0 for 2nd setting. If 1st time-mark start is not visible, use 2nd time mark. Final DTP setting is 9.00 ±0.06 (8.94 to 9.06, +15°C to +35°C) or 9.00 ±0.14 (8.86 to 9.14,-15°C to +55°C).

TABLE S-F-4

Delayed Sweep Accuracy

Time-Mark Generator Output	A TIME/DIV Switch Setting	B TIME/DIV Switch Setting	DTP Setting
1 microsecond 2 microsecond 5 microsecond	1 μs 2 μs 5 μs	.1 μs .2 μs .5 μs	8.94 to 9.06 (+15°C to +35°C) or 8.86 to 9.14 (−15°C to +55°C)
10 microsecond 20 microsecond 50 microsecond	10 μs 20 μs 50 μs	1 μs 2 μs 5 μs	
.1 millisecond .2 millisecond .5 millisecond	.1 ms .2 ms .5 ms	10 μs 20 μs 50 μs	
1 millisecond 2 millisecond 5 millisecond	1 ms 2 ms 5 ms	.1 ms .2 ms .5 ms	
10 millisecond 20 millisecond 50 millisecond	10 ms 20 ms 50 ms	1 ms * 2 ms * 5 ms	
.1 second .2 second .5 second	.1 s .2 s .5 s	* 10 ms * 20 ms * 50 ms	
* Change A TRIG MODE to NORM.			

15. CHECK DELAY TIME JITTER

a. Set time-mark generator for 1 ms time marks.

b. Set:

DELAY TIME POSITION	1.00
A TRIG MODE	AUTO
A TIME/DIV	1 ms
B TIME/DIV	.2 μs

c. Attach light shield to graticule housing.

TABLE 5-F-4

A and B Magnified Accuracy

A and B TIME/DIV Switch Setting	Time-Mark Generator Output	Portions of total magnified sweep length to exclude from measurement
.05 μs	10 nanosecond	First and last 10 divisions
.1 μs	10 nanosecond	First and last 5 divisions
.2 μs	20 nanosecond	First and last 2½ divisions
.5 μs	50 nanosecond	
1 μs	0.1 microsecond	
2 μs	0.2 microsecond	
5 μs	0.5 microsecond	
10 μs	1 microsecond	
20 μs	2 microsecond	
50 μs	5 microsecond	
.1 ms	10 microsecond	
.2 ms	20 microsecond	
.5 ms	50 microsecond	
1 ms	0.1 millisecond	
2 ms	0.2 millisecond	
5 ms	0.5 millisecond	
10 ms	1 millisecond	
20 ms	* 2 millisecond	
50 ms	* 5 millisecond	
A SWEEP ONLY		
.1 s	* 10 millisecond	
.2 s	* 20 millisecond	
.5 s	* 50 millisecond	

* Change A TRIG MODE to NORM.

CALIBRATION AID-The low repetition rate of this check makes viewing difficult. Additional intensity may be obtained by using storage.

Push in VAR PERS button and adjust INTEN, STORAGE LEVEL and VIEW TIME for a usable trace.

d. Set DTP control to position time mark to graticule center.

e. CHECK - Jitter is 1 div or less (60 Hertz power line) or 2.5 div or less (50 Hertz power line).

e. Set DTP control to about 9.00 to position time mark to graticule center.

CHECK - Jitter is 1 div or less (60 Hertz power line) or 2.5 div or less (50 Hertz power line).

f. Push in NON STORE button and remove light shield.

16. CHECK MIXED SWEEP ACCURACY

NOTE

The following portions of MIXED SWEEP mode are excluded: (1) The first 0.5 div after display start, (2) The first 0.2 div or 0.1 μs, whichever is greater, after the transition from A Sweep to B Sweep.

a. Set:	DELAY TIME POSITION	Full counterclockwise
	B TRIGGER SOURCE	NORMAL
	LEVEL	Full counterclockwise (untriggered)
	HORIZ DISPLAY	A
	A TIME/DIV	1 ms
	B TIME/DIV	.5 ms

16. b. Horizontally position 2nd time mark to left-hand graticule line and note A Sweep timing accuracy over 9 div.

c. Change HORIZ DISPLAY control to MIX and position 2nd time mark to left-hand graticule line.

CHECK - A Sweep accuracy is within 2% of accuracy noted in Step b.

d. Set B TRIGGER SOURCE switch to STARTS AFTER DELAY and position 2nd marker to 2nd graticule line (1st mark goes off screen).

CHECK - B Sweep accuracy is within 2% (7.84 to 8.16 for 8 div display).

e. Set time-mark generator for 0.2 μs markers.

f. Set:

B TRIGGER SOURCE	NORMAL
HORIZ DISPLAY	A
A TIME/DIV	.2 μs
B TIME/DIV	.1 μs

g. Horizontally position 2nd time mark to left-hand graticule line and note A Sweep timing accuracy over 9 div.

h. Change HORIZ DISPLAY control to MIX and position 2nd time mark to left-hand graticule line.

CHECK - A Sweep error is within 2% of accuracy noted in Step g.

i. Set B TRIGGER SOURCE switch to STARTS AFTER DELAY and position 2nd marker to left-hand graticule line (1st mark goes off screen).

CHECK - B Sweep accuracy is within 2% (7.84 to 8.16 for centered 8 div display).

17. CHECK B ENDS A OPERATION

a. Set:

HORIZ DISPLAY	A INTEN
A TIME/DIV	1 ms
B TIME/DIV	.1 ms
B TRIG MODE	STARTS AFTER DELAY
A TRIG HOLDOFF	B ENDS A (clockwise detent)
DELAY TIME POSITION	About 1.00
INTEN	A Sweep is visible

b. Rotate DELAY TIME POSITION control through its range.

CHECK - A Sweep ends after B intensified portion at any DTP setting.

18. CHECK A TRIGGER HOLDOFF

a. Set:

HORIZ DISPLAY	A
A TIME/DIV	10 µs
A TRIG HOLDOFF	NORM (full counterclockwise)
LEVEL	Full clockwise

b. Set test oscilloscope:

Vertical mode	Channel 1
Channel 1 Volts/Div	1 Volt
Horiz Mode	A Sweep
A Trig Slope	-
A Trig Mode	AUTO

c. Connect test oscilloscope CH 1 input to + A GATE Output (on oscilloscope being calibrated) via 50 Ω cable.

18. d. Adjust test oscilloscope Var Volts/Div so negative-portion of gate (holdoff time) is 1 div long.

e. Rotate A TRIG HOLDOFF control clockwise, but not into A ENDS B detent.

CHECK - Holdoff time of A GATE is increased 10 times or more.

f. Set the A TRIG HOLDOFF control to NORM.

g. Disconnect time-mark generator.

G. REDUCED SCAN AND STORAGE

Equipment Required

1. Leveled Sine-Wave Generator
2. Calibration Generator
3. Time-Mark Generator
4. Test Oscilloscope
5.]0X Probe
6. 42-inch 50-Ohm BNC Cable
7. 50-Ohm BNC Termination
8. Three-inch screwdriver
9. Low-Capacitance screwdriver

See ADJUSTMENT LOCATIONS 1 pull-out page for adjustments and test points (TP).

466 CONTROL SETTINGS (*indicates changes from the previous step)

POWER	ON
CRT	
INTEN	As desired
REDUCED SCAN (PULL)	Push INTEN in
FOCUS	Midrange
SCALE ILLUM	As desired

466 CONTROL SETTINGS (cont)

Vertical (CH 1 and CH 2)

VERT MODE	CH 1
POSITION	Midrange
*VOLTS/DIV	*50 mV
VAR VOLTS/DIV	Calibrated detent
*AC-GND-DC	*GND
INVERT	Normal (button out)
20 MHz BW (PULL)	Full bandwidth (push in, then release. Shows no yellow)

Storage

NON STORE	On (button in)
STORAGE LEVEL	NORM
INTEN (SAVE)	Midrange
SAVE	Off (button out)
VIEW TIME	NORM

Trigger

COUPLING	AC
LEVEL	As needed for triggered display
SLOPE	+
A TRIGGER SOURCE	NORM
B (DLY'D) TRIGGER SOURCE	STARTS AFTER DELAY
TRIG MODE	AUTO
A TRIG HOLD OFF	NORM

466 CONTROL SETTINGS (cont.)

Sweep (A and B)

HORIZ DISPLAY	A
A TIME/DIV	1 ms
B TIME/DIV	1 ms
VAR TIME/DIV	Calibrated detent
DELAY TIME POSITION	Full counterclockwise
X10 MAG	Off (button out)
POSITION (Horiz.)	Midrange
FINE	Midrange

1. Check/Adjust Reduced Scan

NOTE

All measurements and readings in this step are referenced to the small graticule in the center crt screen unless otherwise stated.

a. Pull INTENSITY control for Reduced Scan mode.

CHECK - REDUCED SCAN lamp lights when INTENSITY control is in REDUCED SCAN mode.

CHECK - Trace is parallel to center horizontal graticule line.

ADJUST - Trace Rot (R1554) for trace parallel to graticule line.

b. Connect 0.1 ms time marks from time-mark generator to CH 1 input via 50 ohm cable and 50 ohm termination.

c. Set:

X10 MAG (IN)	On (push in)
CH 1 AC-GND-DC	DC
VOLTS/DIV	.1

d. Vertically position display baseline 2 div below center line (bottom line of reduced graticule) and horizontally position a time mark to center vertical graticule line.

CHECK - Time mark is parallel to center vertical graticule line.

ADJUST - 3 kV Y Axis (R1564) for time mark parallel to graticule line.

e. Set:

X10 MAG (IN)	Off (button out)
INTEN	Full Scan (push in)
CH 1 VOLTS/DIV	.5

Set time mark generator for 1 ms time marks and adjust INTENS, FOCUS and ASTIG controls for best focused display.

f. Set:

INTEN	Reduced Scan (pull out)
CH 1 VOLTS/DIV	.2

CHECK - Display is focused without adjusting FOCUS control.

ADJUST - Astigmatism (R1573) for best focused display, using same FOCUS setting as full scan mode.

g. Set time mark generator for .1 ms time marks and push in X10 MAG (IN) button.

CHECK - 1 time mark/div, within 2% (9.8 to 10.2 for 11th mark, +20°C to +30°C), or within 3% (9.7 to 10.3 for 11th mark, -15°C to +55°C).

ADJUST - R1464 for 1 time mark/(small) div.

h. Disconnect time-mark generator.

i. Connect 20 mV standard amplitude signal from calibration generator to CH 1 input via 50 ohm cable.

j. Set CH 1 VOLTS/DIV switch to 5 mV.

CHECK - Display is 4 div within 3% (3.88 to 4.12 div).

ADJUST - Vert CAl (R1527) for 4 (small) div.

INTERACTION Astigmatism (R1573) and Vert Cal (R1527). Readjust as needed for no interaction.

2. Adjust/Check VAR PERS

a. Set:

Storage Mode	VAR PERS (push in)
STORAGE LEVEL	MAX (full clockwise)
VIEW TIME	MAX (full clockwise)
INTEN	Minimum (full counter-clockwise
REDUCED SCAN (FULL)	Push INTEN in (full scan)

NOTE

If storage board has been changed or misadjustments have been made, preset Front Mesh Prep (R1927) and Fast Mesh Transfer (R1987) full counter-clockwise.

b. Push ERASE button and note intensity level of crt screen.

ADJUST - Front Mesh Op level, (R1933) until sides of crt screen begin to darken. Push ERASE button after each adjustment of R1933. Adjust R1933 for best uniform intensity with no dark areas, which should be just above (brighter than) point where sides begin to darken.

BOLD

NOTE

This sets STORAGE LEVEL maximum range. If set too high, screen fades positive (grows brighter).

c. Push ERASE button and note intensity level of crt screen.

2. Adjust/Check VAR PER (cont.)

ADJUST - Front Mesh Prep Level (R1927) until sides of crt screen begin to darken. Push ERASE button after each adjustment of R1927. Adjust R1927 for best uniform intensity with no dark areas, which should be just above point where sides begin to darken.

d. Set STORAGE LEVEL control to minimum (full counter-clockwise) and push ERASE button.

CHECK - Entire screen erases (failure to erase completely indicates Front Mesh Prep Level (R1927) is set too high, repeat step c as needed.

3. Preadjust FAST

NOTE

If storage board has been changed or misadjustments have been made, perform steps a through d--otherwise proceed to step e.

a. Set: Storage Mode — FAST
A TRIG LEVEL — Full counter-clockwise

b. Set: test oscilloscope
Channel 1 volts/div — .1
Vertical Mode — CH 1

c. Connect 10X probe from test oscilloscope to P1951, pin 5.

3. Preadjust FAST (cont.)

d. Push ERASE button and preadjust Fast Prep (R1982) for 2 V reading on test oscilloscope.

e. Disconnect 10X probe.

4. Adjust FAST

a. Set:

A TIME/DIV	.1 µs
Storage Mode	NON STORE (push in)
INTEN	Midrange
VIEW TIME	Minimum (full counter-clockwise)
STORAGE LEVEL	Minimum (full counter-clockwise)

b. Connect 7.5 MHz signal from leveled sine-wave generator to CH 1 input via 50 ohm cable and 50 ohm termination.

c. Adjust generator for 6.4 div display.

d. Set:

A TRIG LEVEL	Stable display
INTEN	Off (full counter-clockwise)
Storage Mode	FAST (push in)

e. After each erase cycle increase STORAGE LEVEL until background noise begins to store. Set VIEW TIME control to MAX and A TRIG LEVEL full counter-clockwise.

f. Push ERASE button and wait 15 seconds.

4. Adjust FAST (cont.)

g. Trigger sweep by turning A TRIG LEVEL clockwise and note (brightness) level of stored information (background noise).

h. Immediately push ERASE button to trigger another sweep and compare level of stored information to that noted in step k.

CHECK - No fade up or fade down.

ADJUST - Front Mesh Hold Level (R1935) for no fade up or fade down, after 15 seconds.

i. Push ERASE button and wait 1 minute.

j. Trigger sweep by turning A TRIG LEVEL clockwise and note (brightness) level of stored information (background noise).

k. Immediately push ERASE button and compare level of stored information to that noted in step n.

CHECK - No fade up or fade down.

ADJUST - Front Mesh Hold Level (R1935) for no fade up or fade down, after 15 seconds. (If 1st display fades up, turn R1935 clockwise.)

l. Set Storage Mode to NON STORE mode.

m. Connect 10X probe from test oscilloscope to TP1443 (Z-Axis).

4. Adjust FAST (cont.)

n. Adjust INTEN control for +70 V signal from test oscilloscope ground (50 V grid drive). DO NOT CHANGE INTEN CONTROL SETTING FOR REST OF STEP 4 THROUGH STEP 6 . Obtain triggered, well-focused display.

o. Disconnect 10X probe.

p. Set:

Storage Mode	FAST (push in)
VIEW TIME	Minimum (full counter-clockwise)
STORAGE LEVEL	About midway between NORM and MAX (3 o'clock)
Fine Fast Transfer Level (R1989)	Midrange

q. Wait several erase cycles.

ADJUST - Course Fast Transfer Level (R1987) for best display transfer. Change STORAGE LEVEL control as needed to obtain best transfer.

ADJUST - Fine Fast Transfer Level (R1989) for best display transfer.

r. Set:

VIEW TIME	MAX
A TRIG LEVEL	full clockwise

s. Push ERASE button and wait 15 seconds.

t. Trigger sweep by turning A TRIG LEVEL counter-clockwise and note (brightness) level of stored display and background level.

4. Adjust FAST (cont.)

u. Immediately push ERASE button to trigger another sweep and compare level of stored information to that noted in step t.

CHECK - No fade up or fade down.

ADJUST - Fast Prep (R1982) for no fade up or fade down, after 15 seconds.

v. Push ERASE button and wait 1 minute.

w. Trigger sweep by turning A TRIG LEVEL counter-clockwise and note brightness of stored information.

x. Immediately push ERASE button and compare level of stored information to that noted in step w.

CHECK - No fade up or fade down.

ADJUST - Fast Prep (R1982) for no fade up or fade down. (If 1st display fades up, turn R1982 clockwise.)

INTERACTION - Fast Prep (R1982) and Fine Fast Transfer Level (R1989). Readjust as needed for best display transfer.

5. Adjust SAVE Modulation

a. Push ERASE button to trigger sweep.

b. Push SAVE button.

ADJUST - Front Modulation (R1858) for most even brightness of stored display.

WRITING SPEED

NOTE

All writing speed checks are made with +70 volt blanking level. Once the STORAGE LEVEL control is set do not change it until the procedure indicates a change (step 7, Reduced Scan writing speed). Obtaining maximum writing speed may require readjustment of the transfer level, steps 4 p through t.

6. Check Full Scan Writing Rate

a. Set: Storage Mode — NON STORE (push in)

STORAGE LEVEL — NORM

b. Connect 7.5 MHz signal from leveled sine-wave generator to CH 1 input via 50 ohm cable and 50 ohm termination.

c. Connect 10X probe from test oscilloscope to TP1443 (Z-Axis).

d. Adjust INTEN control for +70 V signal from test oscilloscope chassis to ground (50 V grid drive). Adjust FOCUS and ASTIG controls for best display.

e. Disconnect 10X probe.

f. Adjust generator for 6.4 div display.

g. Set: VIEW TIME — Minimum (full counter-clockwise)

Storage Mode — FAST (push in)

STORAGE LEVEL — best writing speed

6. Check Full Scan Writing Rate (cont.)

h. Set VIEW TIME control to MAX and push in ERASE button.

CHECK - Trace is stored and distinguishable from background, everywhere within center 8 x 6 div, for 15 seconds or more.

i. Set:

STORAGE MODE	NON STORE (push in)
A TIME/DIV VAR	Full counter-clockwise

j. Adjust leveled sine-wave generator for 6.4 div, 2.5 MHz display.

k. Adjust FOCUS and ASTIG controls for best display.

l. Set:

Storage Mode	FAST (push in)
VIEW TIME	Minimum (full counter-clockwise)
STORAGE LEVEL	Best writing speed

m. Set:

VIEW TIME	MAX
A TRIG LEVEL	Full clockwise

n. Push ERASE button and wait 3 minutes.

o. Trigger sweep by turning A TRIG LEVEL control counter-clockwise.

CHECK - Trace is stored and distinguishable from background, everywhere within center 8 x 6 div, for 15 seconds or more.

6. Check Full Scan Writing Rate (cont.)

p. Set:

A TIME/DIV	10 µs
Storage Mode	NON STORE

q. Adjust leveled sine-wave generator for 3.2 div, 50 kHz display (adjust A TRIG LEVEL control as needed for stable display).

r. Adjust A TIME/DIV VAR control for about 1 cycle/div.

s. Set:

Storage Mode	VAR PERS (push in)
VIEW TIME	MAX
STORAGE LEVEL	NORM
A TRIG LEVEL	Full clockwise
A TRIG MODE	SINGL SWP

t. Push ERASE button.

u. Rotate STORAGE LEVEL control clockwise until screen starts to brighten.

v. Trigger sweep by turning A TRIG LEVEL control counter-clockwise.

CHECK - Trace is stored and distinguishable from background, everywhere within center 8 x 6 div, for 15 seconds or more.

7. Check Reduced Scan Writing Rate

NOTE

All writing speed in step 7 is referenced to the small center graticule (.45 cm = 1 div). All voltage amplitudes and TIME/DIV settings are referenced to the large graticule (0.9 cm = 1 div).

7. Check Reduced Scan Writing Rate (cont.)

a. Set:

Storage Mode	NON STORE (push in)
A TRIG MODE	AUTO
INTEN	Do not rotate
REDUCED SCAN	Pull
A TIME/DIV	1 μs

b. Adjust leveled sine-wave generator for 1.4 large div, 350 kHz display.

c. Set A TRIG LEVEL control as needed for stable display and A TIME/DIV VAR control for about 1 cycle/large div.

d. Adjust INTEN, FOCUS and ASTIG controls for best display.

e. Set:

A TRIG LEVEL	Full clockwise
A TRIG MODE	SINGL SWP
Storage Mode	VAR PERS
VIEW TIME	MAX

f. Set STORAGE LEVEL control to where screen just starts to brighten.

g. Trigger sweep by turning A TRIG LEVEL control counter-clockwise.

CHECK - Trace is stored and distinguishable from background, everywhere within small graticule, for 15 seconds or more.

h. Set:

Storage Mode	NON STORE
A TRIG MODE	AUTO
A TIME/DIV	.05 μs
X10 MAG (IN)	On (push in)

7. Check Reduced Scan Writing Rate (cont.)

i. Adjust leveled sine-wave generator for 5 large div, 96 MHz display.

j. Set A TRIG LEVEL control as needed for stable display and A TIME/DIV VAR control for about 1 cycle/large div.

k. Set STORAGE MODE switch to FAST and push ERASE button.

l. Adjust STORAGE LEVEL control for best writing rate. Do not readjust STORAGE LEVEL control for rest of step 86.

m. Set A TRIG LEVEL control full clockwise, push ERASE button and wait 1 minute.

n. Trigger sweep by turning A TRIG LEVEL control counter-clockwise.

CHECK - Trace is stored and distinguishable from background, everywhere within small graticule for 15 seconds or more.

o. Set:	Storage Mode	NON STORE (push in)
	A TRIG LEVEL	Stable display
	A TIME/DIV	.1 μs

p. Adjust leveled sine-wave generator for 5 large div, 25 MHz display.

q. Adjust A TIME/DIV VAR control for about 1 cycle/large div.

r. Set A TRIG LEVEL control full clockwise, Storage Mode switch to FAST, push ERASE button and wait 3 minutes.

7. Check Reduced Scan Writing Rate (cont.)

s. Trigger sweep by turning A TRIG LEVEL control counter-clockwise.

CHECK - Trace is stored and distinguishable from background, everywhere within small graticule, for 15 seconds or more.

8. Check Storage View Time

a. Set Storage Mode switch to NON STORE.

b. Adjust leveled sine-wave generator for 6.4 large div, 96 MHz display.

c. Set:

A TRIG LEVEL	Stable display
A TIME/DIV	.05 µs
A TIME/DIV VAR	About 1 cycle/div
SAVE INTEN	Full counter-clockwise
Storage Mode	FAST
VIEW TIME	MAX

d. Push ERASE button, wait for display to store, then push SAVE button.

e. Wait 6 1/4 minutes.

f. Turn SAVE INTEN clockwise to view display.

CHECK - Trace is completely stored within small graticule.

8. Check Storage View Time (cont.)

g. Set:

Storage Mode	NON STORE
SAVE	Off (button out)
SAVE INTEN	Full counter-clockwise
A TIME/DIV	1 μs
X10 MAG	Off (button out)

h. Adjust leveled sine-wave generator for 1.4 large div, 350 kHz display.

i. Set A TRIG LEVEL control as needed for stable display and A TIME/DIV VAR control for about 1 cycle/large div.

j. Set:

A TRIG LEVEL	Full clockwise
A TRIG MODE	SINGL SWEEP
Storage Mode	VAR PERS
VIEW TIME	MAX

k. Push ERASE button.

l. Set STORAGE LEVEL to where screen just starts to brighten.

m. Trigger sweep by turning A TRIG LEVEL control counter-clockwise, wait for display to store, then push SAVE button.

n. Wait 6 1/4 minutes.

o. Turn SAVE INTEN control clockwise to view display.

CHECK - Trace is completely stored within small graticule.

8. Check Storage View Time (cont.)

p. Set Storage Mode switch to NON STORE and A TRIG MODE switch to AUTO.

q. Disconnect leveled sine-wave generator.

H. X-Y DISPLAY, Z-AXIS AND GATE OUTPUTS

Equipment Required

1. Digital Multimeter
2. Calibration Generator
3. Leveled Sine-Wave Generator
4. Test Oscilloscope
5. 42-inch 50-Ohm BNC Cable (2 required)
6. 50-Ohm BNC Termination
7. Dual-Input Coupler
8. BNC T Connector
9. Three-inch screwdriver
10. Shorting Strap

See ADJUSTMENT LOCATIONS 1 pull-out page for adjustments and test points (TP).

466 CONTROL SETTINGS (* indicates changes from the previous step)

POWER	ON
CRT	
INTEN	Midrange
*REDUCED SCAN (PULL)	*Push INTEN in
FOCUS	Midrange
SCALE ILLUM	As desired

466 CONTROL SETTINGS (cont)

Vertical (CH 1 and CH 2)

*VERT MODE	*CH 2 or X-Y
POSITION	Midrange
VOLTS/DIV	5 mV
VAR VOLTS/DIV	Calibrated detent
*CH 1 AC-GND-DC	*AC
*CH 2 AC-GND-DC	*GND
INVERT	Normal (button out)
20 MHz BW (PULL)	Full bandwidth (push in, then release. Shows no yellow)

Storage

NON STORE	On (button in)
STORAGE LEVEL	NORM
INTEN (SAVE)	Midrange
SAVE	Off (button out)
VIEW TIME	NORM

Trigger (A and B)

COUPLING	AC
LEVEL	Midrange
SLOPE	+
A TRIGGER SOURCE	NORM
B (DLY'D) TRIGGER SOURCE	STARTS AFTER DELAY
TRIG MODE	AUTO
A TRIG HOLD OFF	NORM

466 CONTROL SETTINGS (cont)

Sweep (A and B)

HORIZ DISPLAY	A
*A TIME/DIV	*X-Y
*B TIME/DIV	*X-Y
*VAR TIME/DIV	*Calibrated detent
DELAY TIME POSITION	Full counterclockwise
X10 MAG	Off (button out)
POSITION (Horiz.)	Midrange
FINE	Midrange

1. Check/Adjust X Gain

a. Connect 50 mV standard amplitude signal from calibration generator to CH 1 input via 50 ohm cable.

CHECK - Display is 2 dots, with dot centers 10 div apart, within 4% (9.6 to 10.4 div).

ADJUST - X-Axis Gain (R1214) for 2 dot display, with dot centers 10 div apart.

b. Set calibration generator for 20 mV signal.

CHECK - Display is 2 dots, with dot centers 4 div apart, within 4% (3.84 to 4.16 div).

c. Set AC-GND-DC switch to DC.

CHECK - Display is 2 dots, with dot centers 4 div apart, within 4% (3.84 to 4.16 div).

d. Disconnect calibration generator.

2. Check X-Y Phasing

a. Connect leveled sine-wave generator signal to both inputs via 50 ohm cable, 50 ohm termination, dual-input coupler to CH 1 input and CH 2 inputs.

b. Adjust leveled sine-wave generator for 8 div, 50 kHz signal.

c. Set CH 2 AC-GND-DC switch to DC.

d. Adjust CH 2 POSITION control and Horizontal POSITION controls to center display (see Fig. 5-H-1).

CHECK - Opening is 0.4 div or less, measured along center graticule line (see Fig. 5-H-1).

Fig. 5-H-1. X-Y phasing check.

3. Check X-Axis Bandwidth

a. Set CH 2 AC-GND-DC switch to GND.

b. Remove dual-input coupler and connect leveled sine-wave generator to CH 1 input via 50 ohm cable and 50 ohm termination.

c. Adjust leveled sine-wave generator for 10 div, 50 kHz display.

d. Adjust leveled sine-wave generator to 4.0 MHz.

CHECK - Display is 7 div or more.

e. Disconnect leveled sine-wave generator.

4. Check Z-Axis Sensitivity

a. Set: A TIME/DIV .2 ms

A TRIG SOURCE EXT

b. Connect 5 V standard amplitude signal from calibration generator via 50 ohm cable, BNC T-connector and 50 ohm cable to EXT Z AXIS input and A EXT Trigger input.

c. Adjust A TRIG LEVEL control for triggered display (TRIG lamp is lit).

CHECK - Trace is intensity modulated at normal (and low) INTEN control settings.

d. Disconnect calibration generator.

5. Check Z-Axis Maximum Usable Frequency

a. Set: A TIME/DIV .05 µs

CH 2 VOLTS/DIV 1

CH 2 AC-GND-DC DC

b. Connect leveled sine-wave generator, via 50 ohm cable, GNC T-connector and 50 ohm cable to A EXT Trigger input and CH 2 input.

c. Set leveled sine-wave generator for 5 div (5 V) 50 MHz display.

d. Move cable from CH 2 input to EXT Z-AXIS input.

CHECK - Trace is intensity modulated at normal (and lower INTEN control settings.

5. Check Z-Axis Maximum Usable Frequency (cont)

e. Disconnect leveled sine-wave generator.

6. Check A and B GATES OUT

a. Set:

TIME/DIV (both)	50 µs
B TRIGGER SOURCE	STARTS AFTER DELAY
DELAY TIME POSITION	0.02

b. Set: test oscilloscope:

Vertical Mode	Channel 1
Channel 1 Volts/Division	1 volt
A Time/Division	0.2 ms

c. Connect test oscilloscope input to + A GATE output via 50 ohm cable.

CHECK - Display is positive, rectangular pulse, about 5.5V high.

d. Move 50 ohm cable to + B GATE output.

e. Set HORIZ DISPLAY switch to B DLY'D.

CHECK - Display is positive, rectangular pulse, about 5.5 V high.

f. Disconnect test oscilloscope.

g. End of procedure.

ELECTRICAL REPLACEABLE PARTS LIST

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX MFR. CODE NUMBER TO MANUFACTURER

MFR.CODE	MANUFACTURER	ADDRESS	CITY,STATE,ZIP
00779	AMP, Inc.	P. O. Box 3608	Harrisburg, PA 17105
00853	Sangamo Electric Co., S. Carolina Div.	P. O. Box 128	Pickens, SC 29671
01002	General Electric Co., Industrial and Power Capacitor Products Dept.	John St.	Hudson Falls, NY 12839
01121	Allen-Bradley Co.	1201 2nd St. South	Milwaukee, WI 53204
01295	Texas Instruments, Inc., Components Group	P. O. Box 5012	Dallas, TX 75222
01884	Sprague Electric Co., Dearborn Electronics	P. O. Box 1076	Longwood, FL 32750
02735	RCA Corp., Solid State Division	Route 202	Somerville, NY 08876
03508	General Electric Co., Semi-Conductor Products Dept.	Electronics Park	Syracuse, NY 13201
04713	Motorola, Inc., Semiconductor Products Div.	5005 E. McDowell Rd.	Phoenix, AZ 85008
07263	Fairchild Semiconductor, A Div. of Fairchild Camera and Instrument Corp.	464 Ellis St.	Mountain View, CA 94040
07910	Teledyne Semiconductor	12515 Chadron Ave.	Hawthorne, CA 90250
08806	General Electric Co., Miniature Lamp Products Dept.	Nela PK.	Cleveland, OH 44112
09353	C and K Components, Inc.	103 Morse Street	Watertown, MA 02172
12040	National Semiconductor Corp.	Commerce Drive	Danbury, CT 06810
12969	Unitrode Corp.	580 Pleasant St.	Watertown, MA 02172
13715	Fairchild Semiconductor, A Div. of Fairchild Camera and Instrument Corp.	4300 Redwood HWY.	San Rafael, CA 94903
14099	Semtech Corp.	652 Mitchell Rd.	Newbury Park, CA 91320
14193	Cal-R, Inc.	1601 Olympic Blvd.	Santa Monica, CA 90404
14936	General Instrument Corp., Semiconductor Products Group	600 W. John St.	Hicksville, NY 11802
18324	Signetics Corp.	811 E. Arques	Sunnyvale, CA 94086
24931	Specialty Connector Co., Inc.	3560 Madison Ave.	Indianapolis, IN 46227
25088	Siemens Corp.	186 Wood Ave. S	Iselin, NJ 08830
27014	National Semi-Conductor Corp.	2900 San Ysidro Way	Santa Clara, CA 95051
56289	Sprague Electric Co.		North Adams, MA 01247
71590	Centralab Electronics, Div. of Globe-Union, Inc.	5757 N. Green Bay Ave.	Milwaukee, WI 53201
72982	Erie Technological Products, Inc.	644 W. 12th St.	Erie, PA 16512
73138	Beckman Instruments, Inc., Helipot Div.	2500 Harbor Blvd.	Fullerton, CA 92634
73445	Amperex Electronic Corp.	230 Duffy Ave.	Hicksville, L. I., NY 11802
75042	TRW Electronic Components, IRC Fixed Resistors, Philadelphia Division	401 N. Broad St.	Philadelphia, PA 19108
80009	Tektronix, Inc.	P. O. Box 500	Beaverton, OR 97005
80031	Mepco/Electa Inc., A North American Phillips Co.	Columbia Rd.	Morristown, NJ 07960
80294	Bourns, Inc., Instrument Div.	6135 Magnolia Ave.	Riverside, CA 92506
81483	International Rectifier Corp.	9220 Sunset Blvd.	Los Angeles, CA 90069
82389	Switchcraft, Inc.	5555 N. Elston Ave.	Chicago, IL 60630
83003	Varo, Inc.	800 W. Garland Ave.	Garland, TX 75040
90201	Mallory Capacitor Co., Div. of P. R. Mallory Co., Inc.	3029 E. Washington St.	Indianapolis, IN 46206
91637	Dale Electronics, Inc.	P. O. Box 609	Columbus, NB 68601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-3254-00			CKT BOARD ASSY:--VERT ATTEN	80009	670-3254-00
A2	670-2810-00			CKT BOARD ASSY:--PRE AMPL	80009	670-2810-00
A3	670-2809-00			CKT BOARD ASSY:--VERT MODE SWITCHING	80009	670-2809-00
A4	670-2811-00	B010100	B010299	CKT BOARD ASSY:--VERT OUTPUT	80009	670-2811-00
A4	670-3631-00	B010300		CKT BOARD ASSY:--VERT OUTPUT	80009	670-3631-00
A5	670-3324-00			CKT BOARD ASSY:--TRIG GEN/SWP LOGIC	80009	670-3324-00
A6	670-2805-00	B010100	B010134	CKT BOARD ASSY:--INTERFACE	80009	670-2805-00
A6	670-2805-01	B010135		CKT BOARD ASSY:--INTERFACE	80009	670-2805-01
A7	670-2807-00	B010100	B010299	CKT BOARD ASSY:--TIMING	80009	670-2807-00
A7	670-3466-00	B010300		CKT BOARD ASSY:--TIMING	80009	670-3466-00
A8	670-2754-00			CKT BOARD ASSY:--HIGH VOLTAGE MULTIPLIER	80009	670-2754-00
A9	670-2279-01			CKT BOARD ASSY:--GRAT ILLUM	80009	670-2279-01
A10	670-2808-00			CKT BOARD ASSY:--STORAGE LOGIC	80009	670-2808-00
A11	670-2245-00			CKT BOARD ASSY:--FAN MOTOR	80009	670-2245-00
A12	670-2744-01			CKT BOARD ASSY:--DC INVERTER(OPTION 7)	80009	670-2744-01
B1690	147-0035-00			MOTOR,DC:BRUSHLESS,10-15VDC,145MA	25088	1AD3001-0A
C10(2)	281-0064-00			CAP.,VAR,PLSTC:0.25-1.5PF,600V	72982	530-002
C12(2)	285-0816-01			CAP.,FXD,PLSTC:0.19UF,10%,600V		
C20(2)	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C21(2)	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C30(2)	307-1014-01			ATTENUATOR,FXD:100X ATTEN	80009	307-1014-01
C31						
C32(2)	307-1013-01			ATTENUATOR,FXD:10X ATTEN	80009	307-1013-01
C33						
C34(2)	307-1011-00			ATTENUATOR,FXD:4X ATTEN	80009	307-1011-00
C35						
C36(2)	307-1010-01			ATTENAUTOR,FXD:2X ATTEN	80009	307-1010-01
C37						
C42(2)	283-0156-00			CAP.,FXD,CER DI:1000PF,+100-0%,200V	72982	8111A208E102Z
C72	281-0547-00			CAP.,FXD,CER DI:2.7PF,10%,500V	72982	301-000C0J0279C
C73	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C74	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C75	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C82	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	72982	8131N075651224M
C87	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C107	281-0167-00			CAP.,VAR,CER DI:9-45PF,200V	72982	538-011-D 9-45
C108	281-0207-00			CAP.,VAR,PLSTC:2-18PF,100V	80031	HT10EA-218
C111	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C118	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C133	281-0207-00			CAP.,VAR,PLSTC:2-18PF,100V	80031	HT10EA-218
C142	283-0067-00			CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C144	281-0512-00			CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	72982	308-000C0G0270K
C147	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C148	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C155	281-0540-00			CAP.,FXD,CER DI:51PF,5%,500V	72982	301-000U2J0510J
C157	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C158	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C161	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C162	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C172	281-0547-00			CAP.,FXD,CER DI:2.7PF,10%,500V	72982	301-000C0J0279C
C173	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C174	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C175	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C182	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	72982	8131N075651224M
C187	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C207	281-0167-00			CAP.,VAR,CER DI:9-45PF,200V	72982	538-011-D 9-45
C208	281-0207-00			CAP.,VAR,PLSTC:2-18PF,100V	80031	HT10EA-218
C211	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C218	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C233	281-0207-00			CAP.,VAR,PLSTC:2-18PF,100V	80031	HT10EA-218
C238	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C242	283-0067-00			CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C244	281-0579-00			CAP.,FXD,CER DI:21PF,5%,500V	72982	301-050C0G0210J
C247	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C248	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C253	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C255	281-0540-00			CAP.,FXD,CER DI:51PF,5%,500V	72982	301-000U2J0510J
C261	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C262	281-0536-00			CAP.,FXD,CER DI:1000PF,+/-100PF,500V		
C302	281-0122-00			CAP.,VAR,CER DI:2.5-9PF,100V	72982	518-000A2.5-9
C312	281-0122-00			CAP.,VAR,CER DI:2.5-9PF,100V	72982	518-000A2.5-9
C321	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C328	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C329	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	72982	301-000X5U0471M
C331	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C334	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C338	281-0579-00			CAP.,FXD,CER DI:21PF,5%,500V	72982	301-050C0G0210J
C339	281-0589-00			CAP.,FXD,CER DI:170PF,5%,500V	72982	301-057Z5D0171J
C348	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C351	281-0549-00			CAP.,FXD,CER DI:68PF,10%,500V	72982	301-000U2J0680K
C352	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C354	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C355	281-0549-00			CAP.,FXD,CER DI:68PF,10%,500V	72982	301-000U2J0680K
C357	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C364	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C368	283-0058-00			CAP.,FXD,CER DI:0.027UF,10%,100V	72982	8131N147W5R273K
C374	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C375	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C382	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C383	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C384	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C385	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C392	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C402	283-0023-00	B010100	B010299	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C402	283-0032-00	B010300		CAP.,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C403	283-0625-00	XB010300		CAP.,FXD,MICA D:220PF,1%,500V		
C404	281-0546-00	B010100	B010299	CAP.,FXD,CER DI:330PF,10%,500V	72982	301-000X5P0331K
C404	281-0208-00	B010300		CAP.,VAR,PLSTC:5.5-50PF,100V		
C405	283-0618-00	B010100	B010299	CAP.,FXD,MICA D:130PF,2%,300V	00853	D153E131G0
C405	283-0115-00	B010300		CAP.,FXD,CER DI:47PF,5%,200V		
C406	281-0602-00	B010100	B010299	CAP.,FXD,CER DI:68PF,5%,500V	72982	308-000P2G0680J
C406	281-0603-00	B010300		CAP.,FXD,CER DI:39PF,5%,500V	72982	308-000C0G0390J
C409	281-0096-00	B010100	B010299	CAP.,VAR,AIR DI:5.5-18PF		
C409	281-0089-00	B010300		CAP.,VAR,CER DI:2-8PF		
C413	283-0067-00	B010100	B010299X	CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C416	281-0576-00	B010100	B010299X	CAP.,FXD,CER DI:11PF,5%,500V	72982	301-050C0G0110J
C417	283-0081-00	B010100	B010299X	CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C422	283-0032-00	XB010300		CAP.,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C423	283-0067-00	B010100	B010299X	CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C426	281-0576-00	B010100	B010299X	CAP.,FXD,CER DI:11PF,5%,500V	72982	301-050C0G0110J
C428	281-0097-00	B010100	B010299X	CAP.,VAR,CER DI:9-35PF		
C432	283-0032-00	XB010300		CAP.,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C437	283-0067-00	B010100	B010299X	CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C438	283-0067-00	B010100	B010299X	CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C443	283-0109-00	XB010300		CAP.,FXD,CER DI:27PF,5%,1000V		
C444	283-0268-00	B010100	B010299X	CAP.,FXD,CER DI:0.015UF,10%,50V		
C445	283-0083-00	B010100	B010299X	CAP.,FXD,CER DI:0.0047UF,20%,500V	72982	811-565C472J
C446	283-0116-00	B010100	B010299	CAP.,FXD,CER DI:820PF,5%,500V		
C446	285-0809-00	B010300		CAP.,FXD,PLSTC:1UF,10%,50V	01884	LP88A1A105K

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C447	283-0054-00	B010100	B010299	CAP.,FXD,CER DI:150PF,5%,200V		
C447	283-0078-00	B010300		CAP.,FXD,CER DI:0.001UF,20%,500V	56289	20C114A8
C451	281-0097-00	XB010300		CAP.,VAR,CER DI:9-35PF		
C453	283-0331-00	B010100	B010299X	CAP.,FXD,CER DI:43PF,2%,100V		
C455	281-0089-00	B010100	B010299X	CAP.,VAR,CER DI:2-8PF		
C456	285-0598-00	XB010300		CAP.,FXD,PLSTC:0.01UF,5%,100V	01002	64F10AC103
C457	283-0260-00	B010100	B010299	CAP.,FXD,CER DI:5.6PF,5%,200V		
C457	281-0519-00	B010300		CAP.,FXD,CER DI:47PF,+/-4.7PF,500V	72982	308-000C0G0470K
C462	281-0611-00	B010100	B010299	CAP.,FXD,CER DI:2.7PF		
C462	283-0000-00	B010300		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C472	283-0023-00	B010100	B010299	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C472	283-0000-00	B010300		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C475	283-0023-00	B010100	B010299X	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C476	283-0000-00	B010100	B010299X	CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C484	281-0580-00	XB010300		CAP.,FXD,CER DI:470PF,10%,500V	72982	301-000Z5D0471K
C485	283-0080-00	XB010300		CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C487	283-0178-00	B010100	B010299	CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C487	283-0178-00	B010300		CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C490	283-0023-00	XB010300		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C491	283-0081-00	XB010300		CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C492	283-0081-00	B010100	B010299	CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C492	283-0023-00	B010300		CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C493	283-0081-00	B010100	B010299X	CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C494	283-0023-00	B010100	B010299	CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C494	283-0000-00	B010300		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C495	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C496	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C497	283-0178-00	XB010300		CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C498	283-0080-00	XB010300		CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C502	281-0579-00			CAP.,FXD,CER DI:21PF,5%,500V	72982	301-050C0G0210J
C503	281-0603-00			CAP.,FXD,CER DI:39PF,5%,500V	72982	308-000C0G0390J
C511	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C512	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C515	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C522	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C525	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C528	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C531	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C549	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C582	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C583	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C584	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C585	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C601	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C603	281-0529-00			CAP.,FXD,CER DI:1.5PF,0.25PF,500V	72982	301-000C0K0159C
C604	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C606	281-0578-00			CAP.,FXD,CER DI:18PF,5%,500V	72982	301-000C0G0180J
C607	281-0620-00			CAP.,FXD,CER DI:21PF,1%,500V	72982	301-000C0G0210F
C611	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C612	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C615	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C622	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C625	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C628	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C631	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C649	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C676	281-0513-00			CAP.,FXD,CER DI:27PF,+/-5.4PF,500V	72982	301-000P2G0270M
C691	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C812	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	56289	19C611
C815	290-0519-00			CAP.,FXD,ELCTLT:100UF,20%,20V	56289	196D107X0020MA3
C822	283-0067-00			CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C843	281-0577-00			CAP.,FXD,CER DI:14PF,5%,500V	72982	301-050C0G0140J
C845	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C874	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C882	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C885	290-0529-00			CAP.,FXD,ELCTLT:47UF,20%,20V	56289	196D476X0020LA3
C887	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C895	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C897	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C922	281-0500-00			CAP.,FXD,CER DI:2.2PF,+/-0.5PF,500V	72982	301-000C0J0229D
C925	281-0511-00			CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	72982	301-000C0G0220K
C942	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C943	281-0508-00			CAP.,FXD,CER DI:12PF,+/-0.6PF,500V	72982	301-000C0G0120J
C944	290-0522-00			CAP.,FXD,ELCTLT:1UF,20%,50V	56289	196D105X0050HA1
C945	281-0524-00			CAP.,FXD,CER DI:150PF,+/-30PF,500V	72982	301-000X5U0151M
C947	281-0543-00			CAP.,FXD,CER DI:270PF,10%,500V	72982	301-055X5P1271K
C952	281-0518-00			CAP.,FXD,CER DI:47PF,+/-9.4PF,500V	72982	301-000U2J0470M
C956	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,30V	56289	273C16
C958	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C965	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C967	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C968	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C987	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C992	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C993	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C994	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C1000	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1002	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1003	281-0637-00			CAP.,FXD,CER DI:91PF,5%,500V	72982	301-000Z5D0910J
C1008	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1021	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1024	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C1026	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C1030	281-0662-00			CAP.,FXD,CER DI:10PF,+/-0.5PF,500V	72982	301-000H3M0100D
C1031	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1036	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C1038	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C1062	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1063	281-0637-00			CAP.,FXD,CER DI:91PF,5%,500V	72982	301-000Z5D0910J
C1081	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1084	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C1086	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C1091	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1095	281-0662-00			CAP.,FXD,CER DI:10PF,+/-0.5PF,500V	72982	301-000H3M0100D
C1131[1,3]	295-0175-00			CAP.SET,MTCHD:	80009	295-0175-00
C1132	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C1133[1,3]	295-0175-00			CAP.SET,MTCHD:	80009	295-0175-00
C1135						
C1136	281-0096-00	XB010300		CAP.,VAR,AIR DI:5.5-18PF		
C1137	281-0089-00			CAP.,VAR,CER DI:2-8PF		
C1138	283-0331-00			CAP.,FXD,CER DI:43PF,2%,100V		
C1144	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1151	283-0268-00			CAP.,FXD,CER DI:0.015UF,10%,50V		
C1152	290-0245-00			CAP.,FXD,ELCTLT:1.5UF,10%,10V		
C1153	283-0645-00			CAP.,FXD,MICA D:790PF,1%,100V	00853	D151E791F0
C1161[2,3]	295-0157-00			CAP.SET,MTCHD:	80009	295-0157-00
C1162	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,350V	72982	301-000U2M0101M
C1163[2,3]	295-0157-00			CAP.SET,MTCHD:	80009	295-0157-00
C1165						
C1167	281-0089-00			CAP.,VAR,CER DI:2-8PF		

[1]C1131,C1133 and C1135 furnished as a unit.
[2]C1161,C1163 and C1165 furnished as a unit.
[3]Individual timing capacitors in this assembly must be ordered by the 9 digit part number, letter suffix and tolerance printed on the timing capacitor to be replaced. The letter suffix and the tolerance should be the same for all of the timing capacitors inc the assembly.
EXAMPLE: 285-XXXX-XX F-

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C1168	283-0331-00			CAP.,FXD,CER DI:43PF,2%,100V		
C1171	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1203	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,10V	56289	20C374
C1223	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1237	290-0650-00			CAP.,FXD,ELCTLT:1000UF,20%,10V		
C1239	283-0006-00			CAP.,FXD,CER DI:0.02UF,+80-20%,500V	71590	DA049-2278
C1246	290-0215-00			CAP.,FXD,ELCTLT:100UF,+75-10%,25V	56289	30D107G025DC4
C1262	281-0064-00			CAP.,VAR,PLSTC:0.25-1.5PF,600V	72982	530-002
C1263	281-0526-00			CAP.,FXD,CER DI:1.5PF,+/-0.5PF,500V	72982	301-000S2K0159D
C1264	281-0526-00			CAP.,FXD,CER DI:1.5PF,+/-0.5PF,500V	72982	301-000S2K0159D
C1265	281-0064-00			CAP.,VAR,PLSTC:0.25-1.5PF,600V	72982	530-002
C1272	283-0092-00			CAP.,FXD,CER DI:0.03UF,+80-20%,200V	72982	845-534E303Z
C1275	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1276	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1281	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,30V	56289	273C16
C1282	283-0024-00			CAP.,FXD,CER DI:0.1UF,+80-20%,30V	56289	273C16
C1283	283-0092-00			CAP.,FXD,CER DI:0.03UF,+80-20%,200V	72982	845-534E303Z
C1286	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1288	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1364	285-0686-00			CAP.,FXD,PLSTC:0.068UF,10%,100V		
C1373	281-0551-00			CAP.,FXD,CER DI:390PF,10%,500V	72982	301-000X5P0391K
C1374	290-0532-00			CAP.,FXD,ELCTLT:150VF,20%,6V	90201	TDC157M006CL
C1375	281-0513-00			CAP.,FXD,CER DI:27PF,+/-5.4PF,500V	72982	301-000P2G0270M
C1414	281-0580-00			CAP.,FXD,CER DI:470PF,10%,500V	72982	301-000Z5D0471K
C1423	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C1432	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C1433	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1434	281-0661-00			CAP.,FXD,CER DI:0.8PF,+/-0.1PF,500V	72982	301-000C0G0808B
C1435	281-0064-00			CAP.,VAR,PLSTC:0.25-1.5PF,600V	72982	530-002
C1437	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C1443	283-0071-00			CAP.,FXD,CER DI:0.0068UF,+80-30%,5000V	56289	45C10A1
C1444	285-1040-00			CAP.,FXD,PLSTC:0.0012UF,10%,4000V		
C1452	290-0164-00			CAP.,FXD,ELCTLT:1UF,+50-10%,150V	56289	30D105F150BA4
C1455	290-0194-00			CAP.,FXD,ELCTLT:10UF,+50-10%,100V	56289	30D106F100DC4
C1462	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C1465	285-0894-00			CAP.,FXD,PLSTC:5UF,5%,50V		
C1472	283-0059-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8141N038651105Z
C1473	285-0598-00			CAP.,FXD,PLSTC:0.01UF,5%,100V	01002	64F10AC103
C1483	283-0010-00			CAP.,FXD,CER DI:0.05UF,+100-20%,50V	56289	273C20
C1487	290-0316-00			CAP.,FXD,ELCTLT:47UF,20%,35V		
C1494	290-0523-00			CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0025HA1
C1498	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1503	283-0071-00			CAP.,FXD,CER DI:0.0068UF,+80-30%,5000V	56289	45C10A1
C1504	283-0071-00			CAP.,FXD,CER DI:0.0068UF,+80-30%,5000V	56289	45C10A1
C1505	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1506	283-0043-00			CAP.,FXD,CER DI:0.0068UF,3000V		
C1507	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1508	283-0043-00			CAP.,FXD,CER DI:0.0068UF,3000V		
C1512	283-0013-00			CAP.,FXD,CER DI:0.01UF,-0+100%,1000V	56289	33C29A7
C1514	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010CL
C1517	283-0126-00			CAP.,FXD,CER DI:82PF,5%,1000V	56289	33C180
C1524	285-1040-00			CAP.,FXD,PLSTC:0.0012UF,10%,4000V		
C1526	285-1040-00			CAP.,FXD,PLSTC:0.0012UF,10%,4000V		
C1527	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1556	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1574	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1582	283-0345-00			CAP.,FXD,CER DI:0.001UF,10%,10,000V		
C1583	283-0345-00			CAP.,FXD,CER DI:0.001UF,10%,10,000V		
C1585	283-0345-00			CAP.,FXD,CER DI:0.001UF,10%,10,000V		
C1601[1]	290-0667-00			CAP.,FXD,ELCTLT:330UF,+75-10%,50V		

[1]Option 7 only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C1603[1]	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1605[1]	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010CL
C1609[1]	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1614[1]	290-0573-00			CAP.,FXD,ELCTLT:2.7UF,20%,50V	56289	196D275X0050JA1
C1622[1]	290-0533-00			CAP.,FXD,ELCTLT:330UF,20%,6V		
C1626[1]	290-0528-00			CAP.,FXD,ELCTLT:15UF,20%,50V		
C1652[1]	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C1654[1]	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C1662[1]	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C1664[1]	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C1671[1]	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C1672[1]	283-0263-00			CAP.,FXD,CER DI:0.0022UF,20%,3000V		
C1674[1]	283-0263-00			CAP.,FXD,CER DI:0.0022UF,20%,3000V		
C1681[1]	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C1682[1]	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C1683[1]	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1684[1]	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1685[1]	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1686[1]	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1687[1]	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1698	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C1712	290-0560-00			CAP.,FXD,ELCTLT:47UF,20%,25V		
C1713	290-0560-00			CAP.,FXD,ELCTLT:47UF,20%,25V		
C1718	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1722	290-0468-00			CAP.,FXD,ELCTLT:250UF,+75-10%,150V		
C1723	290-0638-00			CAP.,FXD,ELCTLT:1200UF,+75-10%,100V		
C1724	283-0178-00			CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651104Z
C1725	283-0004-00			CAP.,FXD,CER DI:0.02UF,+80-20%,150V	72982	855016Z5V0203Z
C1735	281-0623-00			CAP.,FXD,CER DI:650PF,5%,500V	72982	301-000Y5D0651J
C1737	290-0392-00			CAP.,FXD,ELCTLT:3.6UF,10%,125V		
C1743	281-0580-00			CAP.,FXD,CER DI:470PF,10%,500V	72982	301-000Z5D0471K
C1744	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	274C10
C1751	290-0584-00			CAP.,FXD,ELCTLT:5500UF,+100-10%,30V		
C1757	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C1761	290-0584-00			CAP.,FXD,ELCTLT:5500UF,+100-10%,30V		
C1767	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C1768	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1771	290-0584-00			CAP.,FXD,ELCTLT:5500UF,+100-10%,30V		
C1777	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C1778	283-0267-00			CAP.,FXD,CER DI:0.01UF,20%,500V	72982	841-541C103M
C1781	290-0570-00			CAP.,FXD,ELCTLT:500UF,+75-10%,50V		
C1787	290-0528-00			CAP.,FXD,ELCTLT:15UF,20%,50V		
C1802	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1812	283-0150-00			CAP.,FXD,CER DI:650PF,5%,200V		
C1826	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C1831	290-0114-00			CAP.,FXD,ELCTLT:47UF,20%,6V	56289	150D476X0006B2
C1834	290-0524-00			CAP.,FXD,ELCTLT:4.7UF,20%,10V	90201	TDC475M010EL
C1835	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1842	283-0198-00			CAP.,FXD,CER DI:0.22UF,20%,50V	72982	8131N075651224M
C1845	283-0054-00			CAP.,FXD,CER DI:150PF,5%,200V		
C1846	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C1847	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C1848	283-0150-00			CAP.,FXD,CER DI:650PF,5%,200V		
C1855	283-0220-00			CAP.,FXD,CER DI:0.01UF,20%,50V	72982	8121N075W5R103M
C1862	290-0246-00			CAP.,FXD,ELCTLT:3.3UF,10%,15V	56289	162D335X9015C02
C1869	290-0531-00			CAP.,FXD,ELCTLT:100UF,20%,10V	90201	TDC107M010CL
C1942	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1945	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
C1947	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1962	281-0637-00			CAP.,FXD,CER DI:91PF,5%,500V	72982	301-000Z5D0910J

[1]Option 7 only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C1964	281-0637-00			CAP.,FXD,CER DI:91PF,5%,500V	72982	301-000Z5D0910J
C1967	290-0164-00			CAP.,FXD,ELCTLT:1UF,+50-10%,150V	56289	30D105F150BA4
C1991[1]						
C1992	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C1995	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C1996	283-0067-00			CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C1998	283-0092-00			CAP.,FXD,CER DI:0.03UF,+80-20%,200V	72982	845-534E303Z
C2023	283-0067-00			CAP.,FXD,CER DI:0.001UF,10%,200V	72982	835-515B102K
C2025	283-0150-00			CAP.,FXD,CER DI:650PF,5%,200V		
C2074	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	72982	855-547E103Z
C2078	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
C2094	290-0526-00			CAP.,FXD,ELCTLT:6.8UF,20%,6V	90201	TDC685M006EL
C2095	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C2096	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C2097	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	56289	196D685X0035KA1
C2099	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	56289	36C600
CR72	152-0323-00			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-00
CR73	152-0323-00			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-00
CR75	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR76	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR114	152-0422-00			SEMICOND DEVICE:SILICON,VVC,4V,7PF		
CR117	152-0422-00			SEMICOND DEVICE:SILICON,VVC,4V,7PF		
CR148	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR156	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR157	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR158	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR159	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR172	152-0323-00			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-00
CR173	152-0323-00			SEMICOND DEVICE:SILICON,35V,100MA	80009	152-0323-00
CR175	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR176	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR214	152-0422-00			SEMICOND DEVICE:SILICON,VVC,4V,7PF		
CR217	152-0422-00			SEMICOND DEVICE:SILICON,VVC,4V,7PF		
CR248	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR304	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR305	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR307	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR308	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR314	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR315	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR317	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR318	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR342	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR362	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR368	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR372	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR378	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR475	152-0141-02	XB010300		SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR517	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR550	152-0125-00			SEMICOND DEVICE:TUNNEL,15PF,4.7MA	80009	152-0125-00
CR552	152-0125-00			SEMICOND DEVICE:TUNNEL,15PF,4.7MA	80009	152-0125-00
CR553	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR554	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR617	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR650	152-0125-00			SEMICOND DEVICE:TUNNEL,15PF,4.7MA	80009	152-0125-00
CR652	152-0125-00			SEMICOND DEVICE:TUNNEL,15PF,4.7MA	80009	152-0125-00
CR821	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR822	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR823	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220

[1]Part of Circuit Board.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR824	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR834	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR846	152-0322-00			SEMICOND DEVICE:SILICON,15V	01295	A1108
CR851	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR852	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR853	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR857	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR858	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR865	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR874	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR882	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR884	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR885	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR887	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR888	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR892	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR893	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR894	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR895	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR896	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR897	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR908	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR914	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR916	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR917	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR943	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR945	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR946	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR948	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH6012
CR957	152-0322-00			SEMICOND DEVICE:SILICON,15V	01295	A1108
CR962	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR986	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR987	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR989	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1001	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1004	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1011	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1024	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1035	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1036	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1061	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1062	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1064	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1068	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1095	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1098	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1099	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1202	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1205	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1218	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1262	152-0322-00			SEMICOND DEVICE:SILICON,15V	01295	A1108
CR1263	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR1264	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR1265	152-0322-00			SEMICOND DEVICE:SILICON,15V	01295	A1108
CR1271	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1281	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1285	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1364	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1372	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1401	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR1405	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH6012
CR1411	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1412	152-0153-00			SEMICOND DEVICE:SILICON,15V,50MA	13715	FD7003
CR1413	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1425	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1427	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH6012
CR1432	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1439	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1442	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1444	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1445	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	12969	NDP341
CR1452	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1454	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1461	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1462	152-0075-00			SEMICOND DEVICE:GE,25V,40MA	72982	ED48
CR1466	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1477	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1482	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1486	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH6012
CR1497	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1503	152-0409-00			SEMICOND DEVICE:SILICON,1200V,5MA	83003	VG12X
CR1506	152-0409-00			SEMICOND DEVICE:SILICON,1200V,5MA	83003	VG12X
CR1507	152-0409-00			SEMICOND DEVICE:SILICON,1200V,5MA	83003	VG12X
CR1512	152-0331-00			SEMICOND DEVICE:SILICON,800V,25MA		
CR1514	152-0413-00			SEMICOND DEVICE:SILICON,400V,750MA	04713	MR814
CR1533	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1535	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR1536	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR1543	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR1552	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1554	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1562	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1564	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1573	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1582	152-0409-00			SEMICOND DEVICE:SILICON,1200V,5MA	83003	VG12X
CR1583	152-0409-00			SEMICOND DEVICE:SILICON,1200V,5MA	83003	VG12X
CR1601[1]	152-0198-00			SEMICOND DEVICE:SILICON,200V,3A	04713	1N4721
CR1624[1]	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH6012
CR1625[1]	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1626[1]	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1627[1]	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1628[1]	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1633[1]	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH6012
CR1634[1]	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH6012
CR1643[1]	152-0198-00			SEMICOND DEVICE:SILICON,200V,3A	04713	1N4721
CR1691	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1692	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1694	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1696	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1699	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1711	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1712	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1717	152-0107-00			SEMICOND DEVICE:SILICON,375V,400MA	80009	152-0107-00
CR1718	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1719	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1721	152-0497-00			SEMICOND DEVICE:SILICON,600V,1.5A		
CR1723	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1724	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1732	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1733	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220

[1]Option 7 only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR1734	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1737	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1751	152-0556-00			SEMICOND DEVICE:SILICON,50V,2.5A		
CR1757	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1761	152-0488-00			SEMICOND DEVICE:SILICON,200V,1500MA	14936	KBP-02-8
CR1767	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1771	152-0488-00			SEMICOND DEVICE:SILICON,200V,1500MA	14936	KBP-02-8
CR1777	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1781	152-0488-00			SEMICOND DEVICE:SILICON,200V,1500MA	14936	KBP-02-8
CR1787	152-0066-00			SEMICOND DEVICE:SILICON,400V,7 50MA	02735	1N3194
CR1814	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1815	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1822	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1825	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1835	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1845	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1848	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1866	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1869	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1875	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1876	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1877	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1923	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1924	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1925	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1926	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1927	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1928	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1932	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1933	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1934	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1935	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1936	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1937	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1938	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1941	152-0040-00			SEMICOND DEVICE:SILICON,600V,1A	14099	SC-6
CR1947	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1962	152-0040-00			SEMICOND DEVICE:SILICON,600V,1A	14099	SC-6
CR1963	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1965	152-0040-00			SEMICOND DEVICE:SILICON,600V,1A	14099	SC-6
CR1966	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	13715	FD2161
CR1981	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1982	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1983	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1984	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1985	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1986	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1987	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1988	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR1996	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2012	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2013	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2014	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2015	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2016	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2026	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2032	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2033	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2034	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2035	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR2036	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2042	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2043	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2044	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2045	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2052	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2053	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2054	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
CR2055	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	CD8220
DL339	119-0481-00			DELAY LINE ELEC:		
DS52	150-0130-00			LAMP,INCAND:5V,60MA		
DS54	150-0130-00			LAMP,INCAND:5V,60MA		
DS58	150-0035-00			LAMP,GLOW:90V,0.3MA	08806	A1D-T
DS62	150-0130-00			LAMP,INCAND:5V,60MA		
DS64	150-0130-00			LAMP,INCAND:5V,60MA		
DS68	150-0035-00			LAMP,GLOW:90V,0.3MA	08806	A1D-T
DS965	150-0130-00			LAMP,INCAND:5V,60MA		
DS967	150-0130-00			LAMP,INCAND:5V,60MA		
DS1140	150-0035-00			LAMP,GLOW:90V,0.3MA	08806	A1D-T
DS1239	150-0035-00			LAMP,GLOW:90V,0.3MA	08806	A1D-T
DS1524	150-0002-00			LAMP,GLOW:		
DS1525	150-0002-00			LAMP,GLOW:		
DS1572	150-0035-00			LAMP,GLOW:90V,0.3MA	08806	A1D-T
DS1792	150-0129-00			LAMP,INCAND,6.3V,200MA		
DS1794	150-0129-00			LAMP,INCAND,6.3V,200MA		
F1487	159-0016-00			FUSE,CARTRIDGE:1.5A,3AG,FAST-BLOW		
F1601[1]	159-0038-00			FUSE,CARTRIDGE:15A,3AG,FAST-BLOW		
F1701	159-0016-00			FUSE,CARTRIDGE:1.5A,3AG,FAST-BLOW		
J1	136-0499-14			CONNECTOR,RCPT,:14 CONTACT	00779	4-380949-4
J2	136-0499-16			SOCKET,CKT CARD:16 CONTACT		
J5	136-0499-12			SOCKET,CKT CARD:12 CONTACT		
J6	136-0499-12			SOCKET,CKT CARD:12 CONATCT		
J8	136-0577-00			SOCKET,CKT CARD:6 CONTACT		
J10(2)	131-0679-00			CONNECTOR,RCPT,:BNC W/HARDWARE	24931	28JR168-1
J145	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J154	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J155	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J158	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J159	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J255	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J338	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J339	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J349	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J351	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J359	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J500	131-0352-02			CONNECTOR,RCPT,:BNC,FEMALE		
J571	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J573	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J575	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J600	131-0352-02			CONNECTOR,RCPT,:BNC,FEMALE		
J678	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J688	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J858	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J859	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J917	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
J918	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE	24931	28JR200-1
J919	131-1003-00			CONNECTOR BODY,:CKT BD MT,3 PRONG	80009	131-1003-00
L302	108-0181-01			COIL,RF:0.2UH		

[1]Option 7 only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
L312	108-0181-01			COIL,RF:0.2UH		
L338	108-0182-00			COIL,RF:0.3UH		
L339	108-0182-00			COIL,RF:0.3UH		
L428	108-0370-00	B010100	B010299X	COIL,RF:0.14UH		
L463	108-0557-00	B010100	B010299X	COIL,RF:35NH		
L464	108-0557-00	B010100	B010299X	COIL,RF:35NH		
L466	108-0570-00	XB010300		COIL,RF:75NH		
L471	108-0538-00	B010100	B010299X	COIL,RF:2.7UH		
L476	108-0570-00	XB010300		COIL,RF:75NH		
L483	108-0740-00	B010100	B010299X	COIL,RF:225NH		
L486	108-0740-00	B010100	B010299X	COIL,RF:225NH		
L487	108-0538-00	B010100	B010299X	COIL,RF:2.7UH		
L492	108-0538-00	B010100	B010299X	COIL,RF:2.7UH		
L494	108-0538-00	B010100	B010299X	COIL,RF:2.7UH		
L546	108-0370-00			COIL,RF:0.14UH		
L547	108-0370-00			COIL,RF:0.14UH		
L582	108-0538-00			COIL,RF:2.7UH		
L584	108-0538-00			COIL,RF:2.7UH		
L585	108-0538-00			COIL,RF:2.7UH		
L646	108-0370-00			COIL,RF:0.14UH		
L647	108-0370-00			COIL,RF:0.14UH		
L942	108-0538-00			COIL,RF:2.7UH		
L1374	108-0245-00			COIL,RF:3.9UH	80009	108-0245-00
L1487	108-0422-00			COIL,RF:80UH		
L1501	108-0663-00			COIL,RF:REED SWITCH,12V,20MA		
L1551	108-0779-00			COIL,RF:TRACE ROTATOR		
L1561	108-0714-00			COIL,RF:Y AXIS ALIGNMENT		
L2095	108-0538-00			COIL,RF:2.7UH		
L2096	108-0538-00			COIL,RF:2.7UH		
L2097	108-0538-00			COIL,RF:2.7UH		
L2099	108-0538-00			COIL,RF:2.7UH		
LR482	108-0284-00	B010100	B010299X	COIL,RF:0.1UH		
LR484	108-0284-00	B010100	B010299X	COIL,RF:0.1UH		
LR486	108-0328-00	XB010300		COIL,RF:0.3UH	80009	108-0328-00
LR496	108-0328-00	XB010300		COIL,RF:0.3UH	80009	108-0328-00
Q52	151-0281-00			TRANSISTOR:SILICON,NPN		
Q54	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q62	151-0281-00			TRANSISTOR:SILICON,NPN		
Q64	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q72A,B	151-1032-00			SEMICOND DVC SE:MATCHED PR,FET		
Q84	151-0441-00			TRANSISTOR:SILICON,NPN		
Q86	151-0441-00			TRANSISTOR:SILICON,NPN		
Q102, Q104	153-0597-00			TRANSISTOR:SILICON,PNP,MATCHED PR		
Q112	151-0441-00			TRANSISTOR:SILICON,NPN		
Q114	151-0441-00			TRANSISTOR:SILICON,NPN		
Q124	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	80009	151-0198-00
Q126	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	80009	151-0198-00
Q132	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q134	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q136	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q138	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q144	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q146	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q148	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q154	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q156	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q158	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q162	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q172A,B	151-1032-00			SEMICOND DVC SE:MATCHED PR,FET		
Q184	151-0441-00			TRANSITOR:SILICON,NPN		
Q186	151-0441-00			TRANSITOR:SILICON,NPN		
Q202, Q204	153-0597-00			TRANSITOR:SILICON,PNP,MATCHED PR		
Q212	151-0441-00			TRANSITOR:SILICON,NPN		
Q214	151-0441-00			TRANSITOR:SILICON,NPN		
Q220[1]	153-0547-00			TRANSITOR:SILICON,NPN,MATCHED PR		
Q222[2]	153-0547-00			TRANSITOR:SILICON,NPN,MATCHED PR		
Q224[1]	153-0547-00			TRANSITOR:SILICON,NPN,MATCHED PR		
Q226[2]	153-0547-00			TRANSITOR:SILICON,NPN,MATCHED PR		
Q232	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q234	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q236	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q238	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q244	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q246	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q248	151-0434-00			TRANSISTOR:SILICON,PNP	04713	2N4261
Q254	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q262	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q304	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q308	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q314	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q318	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q322	151-0442-00			TRANSISTOR:SILICON,PNP		
Q324	151-0442-00			TRANSISTOR:SILICON,PNP		
Q332	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q346	151-0198-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	80009	151-0198-00
Q348	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q352	151-0223-00			TRANSISTOR:SILICON,NPN	07263	S24848
Q358	151-0223-00			TRANSISTOR:SILICON,NPN	07263	S24848
Q364	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q374	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q412	151-0441-00	B010100	B010299X	TRANSISTOR:SILICON,NPN		
Q416	151-0221-00	B010100	B010299X	TRANSISTOR:SILICON,PNP	07263	S24849
Q422	151-0441-00	B010100	B010299	TRANSISTOR:SILICON,NPN		
Q422	151-0212-00	B010300		TRANSISTOR:SILICON,NPN	73445	A485
Q426	151-0221-00	B010100	B010299	TRANSISTOR:SILICON,PNP	07263	S24849
Q426	151-0212-00	B010300		TRANSISTOR:SILICON,NPN	73445	A485
Q432	151-0212-00	XB010300		TRANSISTOR:SILICON,NPN	73445	A485
Q436	151-0212-00	XB010300		TRANSISTOR:SILICON,NPN	73445	A485
Q442	151-0447-00	XB010300		TRANSISTOR:SILICON,NPN		
Q452	151-0447-00	XB010300		TRANSISTOR:SILICON,NPN		
Q462	151-0271-00	XB010300		TRANSISTOR:SILICON,PNP	01295	SRA4504
Q472	151-0271-00	XB010300		TRANSISTOR:SILICON,PNP	01295	SRA4504
Q482	151-0448-00	XB010300		TRANSISTOR:SILICON,NPN		
Q486	151-0211-00			TRANSISTOR:SILICON,NPN		
Q492	151-0448-00	XB010300		TRANSISTOR:SILICON,NPN		
Q496	151-0211-00			TRANSISTOR:SILICON,NPN		
Q522, Q524	151-1042-00			SEMICOND DVC SE:MATCHED PAIR FET	01295	2N5245
Q550	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q552	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q622, Q624	151-1042-00			SEMICOND DVC SE:MATCHED PAIR FET	01295	2N5245
Q650	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q652	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q672	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849
Q678	151-0223-00			TRANSISTOR:SILICON,NPN	07263	S24848
Q682	151-0221-00			TRANSISTOR:SILICON,PNP	07263	S24849

[1]Q220 and Q224 furnished as a matched pair.
[2]Q222 and Q226 furnished as a matched pair.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q688	151-0223-00			TRANSISTOR:SILICON,NPN	07263	S24848
Q820	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	12040	NS7348
Q822	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q824	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q834	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q844	151-0220-03			TRANSISTOR:SILICON,PNP	80009	151-0220-03
Q852	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q854	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q856	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q864	151-0220-03			TRANSISTOR:SILICON,PNP	80009	151-0220-03
Q866	151-0220-03			TRANSISTOR:SILICON,PNP	80009	151-0220-03
Q872	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q874	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q882	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q884	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q886	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q904	151-0220-03			TRANSISTOR:SILICON,PNP	80009	151-0220-03
Q906	151-0220-03			TRANSISTOR:SILICON,PNP	80009	151-0220-03
Q912	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q914	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q916	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q924	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q926	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q954	151-0220-03			TRANSISTOR:SILICON,PNP	80009	151-0220-03
Q964	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q982	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q984	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q986	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1002A,B	151-0354-00			TRANSISTOR:SILICON,PNP,DUAL		
Q1006	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1024	151-0283-00			TRANSISTOR:SILICON,NPN		
Q1030	151-1025-00			TRANSISTOR:SILICON,JFE,N-CHANNEL	01295	SBA8129
Q1036	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S006075
Q1038	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1062A,B	151-0354-00			TRANSISTOR:SILICON,PNP,DUAL		
Q1064	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1066	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1084	151-0283-00			TRANSISTOR:SILICON,NPN		
Q1090	151-1025-00			TRANSISTOR:SILICON,JFE,N-CHANNEL	01295	SBA8129
Q1096	151-0127-00			TRANSISTOR:SILICON,NPN	07263	S006075
Q1098	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1140	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1170	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1212	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1222	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q1232	151-0190-02			TRANSISTOR:SILICON,NPN	04713	2N3904
Q1236	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1242	151-0190-02			TRANSISTOR:SILICON,NPN	04713	2N3904
Q1246	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1272	151-0220-00			TRANSISTOR:SILICON,PNP	80009	151-0220-00
Q1274	151-0406-00			TRANSISTOR:SILICON,PNP		
Q1276	151-0407-00			TRANSISTOR:SILICON,NPN		
Q1282	151-0223-00			TRANSISTOR:SILICON,NPN	07263	S24848
Q1284	151-0407-00			TRANSISTOR:SILICON,NPN		
Q1286	151-0406-00			TRANSISTOR:SILICON,PNP		
Q1362	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q1372	151-0342-00			TRANSISTOR:SILICON,PNP	07263	2N4249
Q1376	151-0164-00			TRANSISTOR:SILICON,PNP	01295	SKB3334
Q1424	151-0223-00			TRANSISTOR:SILICON,NPN	07263	S24848
Q1428	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q1432	151-0407-00			TRANSISTOR:SILICON,NPN		
Q1436	151-0406-00			TRANSISTOR:SILICON,PNP		
Q1472	151-0126-00			TRANSISTOR:SILICON,NPN	07263	2N2484
Q1476	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1484	151-0136-00			TRANSISTOR:SILICON,NPN	02735	35495
Q1486	151-0140-00			TRANSISTOR:SILICON,NPN	02735	36568
Q1492	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1496	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1606[1]	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1608[1]	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1622[1]	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1626[1]	151-0506-00			TRANSISTOR:SILICON,SCR		
Q1642[1]	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1644[1]	151-0335-00			TRANSISTOR:SILICON,PNP	04713	SJE917
Q1652[1]	151-0436-00			TRANSISTOR:SILICON,NPN	80009	151-0436-00
Q1654[1]	151-0436-00			TRANSISTOR:SILICON,NPN	80009	151-0436-00
Q1662[1]	151-0436-00			TRANSISTOR:SILICON,NPN	80009	151-0436-00
Q1664[1]	151-0436-00			TRANSISTOR:SILICON,NPN	80009	151-0436-00
Q1698	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q1716	151-0311-01			TRANSISTOR:SILICON,NPN	04713	MJE340
Q1718	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q1732	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q1734	151-0476-00			TRANSISTOR:SILICON,NPN		
Q1736	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q1752	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1754	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1756	151-0477-00			TRANSISTOR:SILICON,NPN		
Q1762	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1764	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1766	151-0478-00			TRANSISTOR:SILICON,NPN		
Q1772	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1774	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1776	151-0478-00			TRANSISTOR:SILICON,NPN		
Q1780	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q1782	151-0341-00			TRANSISTOR:SILICON,NPN	07263	2N3565
Q1784	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1786	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q1788	151-0478-00			TRANSISTOR:SILICON,NPN		
Q1792	151-0390-00			TRANSISTOR:SILICON,NPN		
Q1802	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q1812	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1816	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1822	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q1832	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1834	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q1836	151-0508-00			TRANSISTOR:SILICON,NPN,UNIJUNCTION	03508	X13T520
Q1838	151-0508-00			TRANSISTOR:SILICON,NPN,UNIJUNCTION	03508	X13T520
Q1842	151-0508-00			TRANSISTOR:SILICON,NPN,UNIJUNCTION	03508	X13T520
Q1852	151-0508-00			TRANSISTOR:SILICON,NPN,UNIJUNCTION	03508	X13T520
Q1864	151-0508-00			TRANSISTOR:SILICON,NPN,UNIJUNCTION	03508	X13T520
Q1872	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q1938	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q1942	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q1944	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q1948	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q1952	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
Q1956	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q1962	151-0444-00			TRANSISTOR:SILICON,NPN		
Q1964	151-0444-00			TRANSISTOR:SILICON,NPN		
Q1966	151-0444-00			TRANSISTOR:SILICON,NPN		

[1]Option 7 only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q1968	151-0444-00			TRANSISTOR:SILICON,NPN		
Q1992	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q1994	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q1996	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q1998	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q2022	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q2024	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q2026	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q2032	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q2036	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q2042	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q2046	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q2054	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q2056	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q2072	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q2074	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
Q2078	151-0347-00			TRANSISTOR:SILICON,NPN	04713	2N5551
Q2092	151-0190-00			TRANSISTOR:SILICON,NPN	04713	2N3904
Q2094	151-0188-00			TRANSISTOR:SILICON,PNP	04713	2N3906
R10(2)	315-0750-00			RES.,FXD,COMP:75 OHM,5%,0.25W	01121	CB7505
R14	315-0105-00			RES.,FXD,COMP:1M OHM,5%,0.25W	01121	CB1055
R15	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R20(2)	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R39	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R42(2)	317-0474-00			RES.,FXD,COMP:470K OHM,5%,0.125W	01121	BB4745
R45(2)	315-0300-00			RES.,FXD,COMP:30 OHM,5%,0.25W	01121	CB3005
R52	315-0823-00			RES.,FXD,COMP:82K OHM,5%,0.25W	01121	CB8235
R53	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R54	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R55	315-0100-00			RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R58	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R62	315-0823-00			RES.,FXD,COMP:82K OHM,5%,0.25W	01121	CB8235
R63	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R64	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R65	315-0100-00			RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R68	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R72	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R73	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R74	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R75	315-0112-00			RES.,FXD,COMP:1.1K OHM,5%,0.25W	01121	CB1125
R76	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	75042	CEAT0-2371F
R78	321-0078-00			RES.,FXD,FILM:63.4 OHM,1%,0.125W	75042	CEAT0-63R40F
R82	315-0512-00			RES.,FXD,COMP:5.1K OHM,5%,0.25W	01121	CB5125
R83	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	75042	CEAT0-2371F
R84	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R85	315-0123-00			RES.,FXD,COMP:12K OHM,5%,0.25W	01121	CB1235
R86	315-0151-00			RES.,FXD,COMP:150 OHM,5%,0.25W	01121	CB1515
R87	315-0112-00			RES.,FXD,COMP:1.1K OHM,5%,0.25W	01121	CB1125
R91	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R92	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	80294	3389F-P31-102
R93	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R94	321-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.125W	75042	CEAT0-45R30F
R95	321-0026-00			RES.,FXD,FILM:18.2 OHM,1%,0.125W		
R96[1]	311-1364-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W		
R97	321-0026-00			RES.,FXD,FILM:18.2 OHM,1%,0.125W		
R98	321-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.125W	75042	CEAT0-45R30F
R102	321-0199-00			RES.,FXD,FILM:1.15K OHM,1%,0.125W	75042	CEAT0-1151F
R103	321-0199-00			RES.,FXD,FILM:1.15K OHM,1%,0.125W	75042	CEAT0-1151F
R104	321-0109-00			RES.,FXD,FILM:133 OHM,1%,0.125W	75042	CEAT0-1330F

[1]Furnished as a unit with S96.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R105	321-0109-00			RES.,FXD,FILM:133 OHM,1%,0.125W	75042	CEAT0-1330F
R106	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R107	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W		
R108	311-1466-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W		
R111	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R114	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R115	321-0132-00			RES.,FXD,FILM:232 OHM,1%,0.125W	75042	CEAT0-2320F
R116	321-0132-00			RES.,FXD,FILM:232 OHM,1%,0.125W	75042	CEAT0-2320F
R117	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R118	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R119	315-0274-00			RES.,FXD,COMP:270K OHM,5%,0.25W	01121	CB2745
R124	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R126	315-0151-00			RES.,FXD,COMP:150 OHM,5%,0.25W	01121	CB1515
R128	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	75042	CEAT0-1500F
R129	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	75042	CEAT0-1500F
R132	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R133	321-0089-00			RES.,FXD,FILM:82.5 OHM,1%,0.125W		
R134	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R136	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R137	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R138	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R141	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R142	315-0431-00			RES.,FXD,COMP:430 OHM,5%,0.25W	01121	CB4315
R143	321-0195-00			RES.,FXD,FILM:1.05K OHM,1%,0.125W	75042	CEAT0-1051F
R144	321-0087-00			RES.,FXD,FILM:78.7 OHM,1%,0.125W	75042	CEAT0-78R70F
R145	321-0195-00			RES.,FXD,FILM:1.05K OHM,1%,0.125W	75042	CEAT0-1051F
R146	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R147	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R148	321-0149-00			RES.,FXD,FILM:348 OHM,1%,0.125W	75042	CEAT0-3480F
R151	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	75042	CEAT0-1211F
R152	311-1224-00			RES.,VAR,NONWIR:500 OHM,20%,0.50W	80294	3389F-P31-501
R153	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R154	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R155	321-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.125W	75042	CEAT0-45R30F
R156	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R157	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R158	321-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.125W	75042	CEAT0-45R30F
R161	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R162	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R163	311-1311-00			RES.,VAR,NONWIR:1K OHM,20%,1W		
R164	321-0190-00			RES.,FXD,FILM:931 OHM,1%,0.125W	75042	CEAT0-9310F
R165	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R166	311-1559-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91A-10001M
R167	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R172	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R173	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R174	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	75042	CEAT0-20R0F
R175	315-0112-00			RES.,FXD,COMP:1.1K OHM,5%,0.25W	01121	CB1125
R176	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	75042	CEAT0-2371F
R178	321-0078-00			RES.,FXD,FILM:63.4 OHM,1%,0.125W	75042	CEAT0-63R40F
R182	315-0512-00			RES.,FXD,COMP:5.1K OHM,5%,0.25W	01121	CB5125
R183	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	75042	CEAT0-2371F
R184	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R185	315-0123-00			RES.,FXD,COMP:12K OHM,5%,0.25W	01121	CB1235
R186	315-0151-00			RES.,FXD,COMP:150 OHM,5%,0.25W	01121	CB1515
R187	315-0112-00			RES.,FXD,COMP:1.1K OHM,5%,0.25W	01121	CB1125
R191	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R192	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	80294	3389F-P31-102
R193	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	75042	CEAT0-75R00F
R194	321-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.125W	75042	CEAT0-45R30F

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R195	321-0026-00			RES.,FXD,FILM:182. OHM,1%,0.125W		
R196[1]	311-1364-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W		
R197	321-0026-00			RES.,FXD,FILM:18.2 OHM,1%,0.125W		
R198	321-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.125W	75042	CEAT0-45R30F
R202	321-0199-00			RES.,FXD,FILM:1.15K OHM,1%,0.125W	75042	CEAT0-1151F
R203	321-0199-00			RES.,FXD,FILM:1.15K OHM,1%,0.125W	75042	CEAT0-1151F
R204	321-0109-00			RES.,FXD,FILM:133 OHM,1%,0.125W	75042	CEAT0-1330F
R205	321-0109-00			RES.,FXD,FILM:133 OHM,1%,0.125W	75042	CEAT0-1330F
R206	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R207	311-1267-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W		
R208	311-1466-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W		
R211	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R212	311-1559-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91A-10001M
R213	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R214	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R215	321-0132-00			RES.,FXD,FILM:232 OHM,1%,0.125W	75042	CEAT0-2320F
R216	321-0132-00			RES.,FXD,FILM:232 OHM,1%,0.125W	75042	CEAT0-2320F
R217	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R218	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R219	315-0274-00			RES.,FXD,COMP:270K OHM,5%,0.25W	01121	CB2745
R220	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R221	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R222	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R223	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R224	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R225	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R226	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R227	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R228	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	75042	CEAT0-1500F
R229	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	75042	CEAT0-1500F
R232	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R233	321-0089-00			RES.,FXD,FILM:82.5 OHM,1%,0.125W		
R234	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R236	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R237	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R238	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R241	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R242	315-0431-00			RES.,FXD,COMP:430 OHM,5%,0.25W	01121	CB4315
R243	321-0195-00			RES.,FXD,FILM:1.05K OHM,1%,0.125W	75042	CEAT0-1051F
R244	321-0087-00			RES.,FXD,FILM:78.7 OHM,1%,0.125W	75042	CEAT0-78R70F
R245	321-0195-00			RES.,FXD,FILM:1.05K OHM,1%,0.125W	75042	CEAT0-1051F
R246	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R247	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R248	321-0149-00			RES.,FXD,FILM:348 OHM,1%,0.125W	75042	CEAT0-3480F
R251	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	75042	CEAT0-1211F
R252	311-1224-00			RES.,VAR,NONWIR:500 OHM,20%,0.50W	80294	3389F-P31-501
R253	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R255	321-0064-00			RES.,FXD,FILM:45.3 OHM,1%,0.125W	75042	CEAT0-45R30F
R261	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R262	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R263	311-1311-00			RES.,VAR,NONWIR:1K OHM,20%,1W		
R264	321-0190-00			RES.,FXD,FILM:931 OHM,1%,0.125W	75042	CEAT0-9310F
R265	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R266	311-1559-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91A-10001M
R267	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R302	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	73138	62PT-347-0
R304	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R308	315-0511-00			RES.,FXD,COMP:510 OHM,5%,0.25W	01121	CB5115
R312	311-1263-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	73138	62PT-347-0
R314	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515

[1]Furnished as a unit with S196.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R318	315-0511-00			RES.,FXD,COMP:510 OHM,5%,0.25W	01121	CB5115
R321	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R322	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R323	321-0134-00			RES.,FXD,FILM:243 OHM,1%,0.125W	75042	CEAT0-2430F
R324	321-0134-00			RES.,FXD,FILM:243 OHM,1%,0.125W	75042	CEAT0-2430F
R325	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R326	323-0161-00			RES.,FXD,FILM:464 OHM,1%,0.50W	75042	CECT0-4640F
R327	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R328	315-0750-00			RES.,FXD,COMP:75 OHM,5%,0.25W	01121	CB7505
R329	315-0750-00			RES.,FXD,COMP:75 OHM,5%,0.25W	01121	CB7505
R331	323-0106-00			RES.,FXD,FILM:124 OHM,1%,0.50W		
R332	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R334	315-0821-00			RES.,FXD,COMP:820 OHM,5%,0.25W	01121	CB8215
R335	321-0065-00			RES.,FXD,FILM:46.4 OHM,1%,0.125W	75042	CEAT0-46R40F
R336	321-0065-00			RES.,FXD,FILM:46.4 OHM,1%,0.125W	75042	CEAT0-46R40F
R341	311-1224-00			RES.,VAR,NONWIR:500 OHM,20%,0.50W	80294	3389F-P31-501
R342	321-0049-00			RES.,FXD,FILM:30.6 OHM,1%,0.125W	75042	CEAT0-31R60F
R343	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R344	321-0177-00			RES.,FXD,FILM:681 OHM,1%,0.125W	75042	CEAT0-6810F
R345	321-0206-00			RES.,FXD,FILM:1.37K OHM,1%,0.125W	75042	CEAT0-1371F
R346	323-0156-00			RES.,FXD,FILM:412 OHM,1%,0.50W	75042	CECT0-4120F
R347	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R348	315-0511-00			RES.,FXD,COMP:510 OHM,5%,0.25W	01121	CB5115
R349	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R351	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R352	321-0057-00			RES.,FXD,FILM:38.3 OHM,1%,0.125W	75042	CEAT0-38R30F
R355	315-0683-00			RES.,FXD,COMP:68K OHM,5%,0.25W	01121	CB6835
R356	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R357	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R358	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R359	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R361	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R362	321-0135-00			RES.,FXD,FILM:249 OHM,1%,0.125W	75042	CEAT0-2490F
R364	321-0211-00			RES.,FXD,FILM:1.54K OHM,1%,0.125W	75042	CEAT0-1541F
R365	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R367	315-0151-00			RES.,FXD,COMP:150 OHM,5%,0.25W	01121	CB1515
R368	321-0117-00			RES.,FXD,FILM:162 OHM,1%,0.125W	75042	CEAT0-1620F
R370	315-0622-00			RES.,FXD,COMP:6.2K OHM,5%,0.25W	01121	CB6225
R371	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R372	321-0135-00			RES.,FXD,FILM:249 OHM,1%,0.125W	75042	CEAT0-2490F
R374	321-0211-00			RES.,FXD,FILM:1.54K OHM,1%,0.125W	75042	CEAT0-1541F
R375	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R377	315-0151-00			RES.,FXD,COMP:150 OHM,5%,0.25W	01121	CB1515
R378	321-0117-00			RES.,FXD,FILM:162 OHM,1%,0.125W	75042	CEAT0-1620F
R402	321-0176-00	B010100	B010299	RES.,FXD,FILM:665 OHM,1%,0.125W	75042	CEAT0-6650F
R402	311-1228-00	B010300		RES.,VAR,NONWIR:10K OHM,20%,0.50W	80294	3389F-P31-103
R403	321-0176-00	B010100	B010299	RES.,FXD,FILM:665 OHM,1%,0.125W	75042	CEAT0-6650F
R403	311-1227-00	B010300		RES.,VAR,NONWIR:5K OHM,20%,0.50W	80294	3389F-P31-502
R404	315-0242-00	B010100	B010299	RES.,FXD,COMP:2.4K OHM,5%,0.25W	01121	CB2425
R404	321-0110-00	B010300		RES.,FXD,FILM:137 OHM,1%,0.125W	75042	CEAT0-1370F
R405	321-0209-00	B010100	B010299X	RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R406	321-0134-00	B010100	B010299	RES.,FXD,FILM:243 OHM,1%,0.125W	75042	CEAT0-2430F
R406	315-0182-00	B010300		RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R407	321-0075-00	B010100	B010299	RES.,FXD,FILM:59 OHM,1%,0.125W	75042	CEAT0-59R00F
R407	315-0101-00	B010300		RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R408	321-0075-00	B010100	B010299	RES.,FXD,FILM:59 OHM,1%,0.125W	75042	CEAT0-59R00F
R408	315-0101-00	B010300		RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R409	321-0162-00	B010100	B010299	RES.,FXD,FILM:475 OHM,1%,0.125W	75042	CEAT0-4750F
R409	311-1236-00	B010300		RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72X-22-0-251K
R410	315-0150-00	XB010300		RES.,FXD,COMP:15 OHM,5%,0.25W	01121	CB1505

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R411	321-0087-00	B010100	B010299X	RES.,FXD,FILM:78.7 OHM,1%,0.125W	75042	CEAT0-78R70F
R412	321-0068-00	B010100	B010299X	RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R413	315-0391-00	B010100	B010299	RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R413	321-0180-00	B010300		RES.,FXD,FILM:732 OHM,1%,0.125W	75042	CEAT0-7320F
R414	321-0076-00	B010100	B010299	RES.,FXD,FILM:60.4 OHM,1%,0.125W	75042	CEAT0-60R40F
R414	321-0083-00	B010300		RES.,FXD,FILM:71.5 OHM,1%,0.125W	75042	CEAT0-71R50F
R415	311-1248-00	B010100	B010299	RES.,VAR,NONWIR:500 OHM,10%,0.50W		
R415	321-0012-00	B010300		RES.,FXD,FILM:13 OHM,1%,0.125W		
R416	321-0058-00	B010100	B010299X	RES.,FXD,FILM:39.2 OHM,1%,0.125W	75042	CEAT0-39R20F
R417	321-0157-00	B010100	B010299X	RES.,FXD,FILM:422 OHM,1%,0.125W	75042	CEAT0-4220F
R418	315-0270-00	B010100	B010299	RES.,FXD,COMP:27 OHM,5%,0.25W	01121	CB2705
R418	321-0180-00	B010300		RES.,FXD,FILM:732 OHM,1%,0.125W	75042	CEAT0-7320F
R421	315-0911-00	B010100	B010299	RES.,FXD,COMP:910 OHM,5%,0.25W	01121	CB9115
R421	321-0068-00	B010300		RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R422	321-0068-00	B010100	B010299	RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R422	315-0201-00	B010300		RES.,FXD,COMP:200 OHM,5%,0.25W	01121	CB2015
R423	315-0391-00	B010100	B010299	RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R423	321-0097-00	B010300		RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R424	321-0076-00	B010100	B010299	RES.,FXD,FILM:60.4 OHM,1%,0.125W	75042	CEAT0-60R40F
R424	321-0097-00	B010300		RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R425	315-0270-00	B010100	B010299	RES.,FXD,COMP:27 OHM,5%,0.25W	01121	CB2705
R425	315-0220-00	B010300		RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R426	321-0058-00	B010100	B010299	RES.,FXD,FILM:39.2 OHM,1%,0.125W	75042	CEAT0-39R20F
R426	323-0132-00	B010300		RES.,FXD,FILM:232 OHM,1%,0.50W		
R427	321-0157-00	B010100	B010299X	RES.,FXD,FILM:422 OHM,1%,0.125W	75042	CEAT0-4220F
R428	311-1248-00	B010100	B010299X	RES.,VAR,NONWIR:500 OHM,10%,0.50W		
R431	321-0068-00	XB010300		RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R432	315-0201-00	XB010300		RES.,FXD,COMP:200 OHM,5%,0.25W	01121	CB2015
R433	315-0201-00	B010100	B010299	RES.,FXD,COMP:200 OHM,5%,0.25W	01121	CB2015
R433	321-0097-00	B010300		RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R434	315-0392-00	B010100	B010299	RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R434	321-0097-00	B010300		RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R435	321-0068-00	B010100	B010299	RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R435	315-0220-00	B010300		RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R436	321-0068-00	B010100	B010299	RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R436	323-0132-00	B010300		RES.,FXD,FILM:232 OHM,1%,0.50W		
R437	315-0621-00	B010100	B010299X	RES.,FXD,COMP:620 OHM,5%,0.25W	01121	CB6215
R438	315-0621-00	B010100	B010299	RES.,FXD,COMP:620 OHM,5%,0.25W	01121	CB6215
R438	323-0079-00	B010300		RES.,FXD,FILM:64.9 OHM,1%,0.50W	75042	CECT0-64R90F
R441	315-0100-00	XB010300		RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R442	321-0178-00	B010100	B010299	RES.,FXD,FILM:698 OHM,1%,0.125W	75042	CEAT0-6980F
R442	315-0100-00	B010300		RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R443	321-0178-00	B010100	B010299	RES.,FXD,FILM:698 OHM,1%,0.125W	75042	CEAT0-6980F
R443	321-0061-00	B010300		RES.,FXD,FILM:42.2 OHM,1%,0.125W	75042	CEAT0-42R20F
R444	311-1230-00	B010100	B010299	RES.,VAR,NONWIR:20K OHM,20%,0.50W	80294	3389F-P31-203
R444	323-0051-00	B010300		RES.,FXD,FILM:33.2 OHM,1%,0.50W	75042	CECT0-33R20F
R445	311-1227-00	B010100	B010299	RES.,VAR,NONWIR:5K OHM,20%,0.50W	80294	3389F-P31-502
R445	315-0201-00	B010300		RES.,FXD,COMP:200 OHM,5%,0.25W	01121	CB2015
R446	311-1227-00	B010100	B010299	RES.,VAR,NONWIR:5K OHM,20%,0.50W	80294	3389F-P31-502
R446	315-0562-00	B010300		RES.,FXD,COMP:5.6K OHM,5%,0.25W	01121	CB5625
R447	315-0472-00	B010100	B010299	RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R447	315-0103-00	B010300		RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R451	311-1236-00	XB010300		RES.,VAR,NONWIR:250 OHM,10%,0.50W	73138	72X-22-0-251K
R452	315-0100-00	XB010300		RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R453	311-1227-00	B010100	B010299	RES.,VAR,NONWIR:5K OHM,20%,0.50W	80294	3389F-P31-502
R453	323-0051-00	B010300		RES.,FXD,FILM:33.2 OHM,1%,0.50W	75042	CECT0-33R20F
R454	321-0073-00	B010100	B010299	RES.,FXD,FILM:56.2 OHM,1%,0.125W	75042	CEAT0-56R20F
R454	323-0077-00	B010300		RES.,FXD,FILM:61.9 OHM,1%,0.50W	75042	CECT0-61R90F
R455	311-1244-00	B010100	B010299	RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3386X-T07-101
R455	315-0201-00	B010300		RES.,FXD,COMP:200 OHM,5%,0.25W	01121	CB2015

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R456	321-0073-00	B010100	B010299	RES.,FXD,FILM:56.2 OHM,1%,0.125W	75042	CEAT0-56R20F
R456	315-0752-00	B010300		RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R457	321-0113-00	B010100	B010299	RES.,FXD,FILM:147 OHM,1%,0.125W	75042	CEAT0-1470F
R457	315-0102-00	B010300		RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R458	315-0622-00	XB010300		RES.,FXD,COMP:6.2K OHM,5%,0.25W	01121	CB6225
R462	315-0360-00	B010100	B010299	RES.,FXD,COMP:36 OHM,5%,0.25W	01121	CB3605
R462	315-0620-00	B010300		RES.,FXD,COMP:62 OHM,5%,0.25W	01121	CB6205
R463	321-0052-00	B010100	B010299	RES.,FXD,FILM:34 OHM,1%,0.125W		
R463	322-0043-00	B010300		RES.,FXD,FILM:27.4 OHM,1%,0.25W	75042	CEBT0-27R40F
R464	321-0052-00	B010100	B010299X	RES.,FXD,FILM:34 OHM,1%,0.125W		
R465	321-0080-00	B010100	B010299X	RES.,FXD,FILM:66.5 OHM,1%,0.125W	75042	CEAT0-66R50F
R466	321-0175-00	B010100	B010299	RES.,FXD,FILM:649 OHM,1%,0.125W	75042	CEAT0-6490F
R466	323-0088-00	B010300		RES.,FXD,FILM:80.6 OHM,1%,0.50W		
R467	323-0127-00	B010100	B010299	RES.,FXD,FILM:205 OHM,1%,0.50W		
R467	315-0131-00	B010300		RES.,FXD,COMP:130 OHM,5%,0.25W	01121	CB1315
R468	311-1239-00	XB010300		RES.,VAR,NONWIR:25K OHM,10%,0.50W	73138	72Y-26-0-252K
R471	315-0301-00	B010100	B010299X	RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R472	323-0144-00	B010100	B010299	RES.,FXD,FILM:309 OHM,1%,0.50W	75042	CECT0-3090F
R472	315-0620-00	B010300		RES.,FXD,COMP:62 OHM,5%,0.25W	01121	CB6205
R473	323-0144-00	B010100	B010299	RES.,FXD,FILM:309 OHM,1%,0.50W	75042	CECT0-3090F
R473	322-0043-00	B010300		RES.,FXD,FILM:27.4 OHM,1%,0.25W	75042	CEBT0-27R40F
R474	323-0144-00	B010100	B010299	RES.,FXD,FILM:309 OHM,1%,0.50W	75042	CECT0-3090F
R474	321-0243-00	B010300		RES.,FXD,FILM:3.32K OHM,1%,0.125W	75042	CEAT0-3321F
R475	323-0144-00	B010100	B010299	RES.,FXD,FILM:309 OHM,1%,0.50W	75042	CECT0-3090F
R475	321-0179-00	B010300		RES.,FXD,FILM:715 OHM,1%,0.125W	75042	CEAT0-7150F
R476	321-0121-00	B010100	B010299	RES.,FXD,FILM:178 OHM,1%,0.125W	75042	CEAT0-1780F
R476	323-0088-00	B010300		RES.,FXD,FILM:80.6 OHM,1%,0.50W		
R477	321-0172-00	B010100	B010299	RES.,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R477	315-0131-00	B010300		RES.,FXD,COMP:130 OHM,5%,0.25W	01121	CB1315
R478	311-1138-00	B010100	B010299X	RES.,VAR,NONWIR:1K OHM,20%,0.50W		
R481	323-0077-00	XB010300		RES.,FXD,FILM:61.9 OHM,1%,0.50W	75042	CECT0-61R90F
R482	317-0101-00	B010100	B010299	RES.,FXD,COMP:100 OHM,5%,0.125W	01121	BB1015
R482	323-0053-00	B010300		RES.,FXD,FILM:34.8 OHM,1%,0.50W		
R483	315-0100-00	XB010300		RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R484	315-0201-00	B010100	B010299	RES.,FXD,COMP:200 OHM,5%,0.25W	01121	CB2015
R484	301-0430-00	B010300		RES.,FXD,COMP:43 OHM,5%,0.50W	01121	EB4305
R485	317-0101-00	B010100	B010299	RES.,FXD,COMP:100 OHM,5%,0.125W	01121	BB1015
R485	315-0820-00	B010300		RES.,FXD,COMP:82 OHM,5%,0.25W	01121	CB8205
R486	308-0758-00	B010100	B010299X	RES.,FXD,WW:430 OHM,1%,7W		
R487	308-0758-00	XB010300		RES.,FXD,WW:430 OHM,1%,7W		
R488	315-0820-00	XB010300		RES.,FXD,COMP:82 OHM,5%,0.25W	01121	CB8205
R490	315-0181-00	XB010300		RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R491	323-0077-00	XB010300		RES.,FXD,FILM:61.9 OHM,1%,0.50W	75042	CECT0-61R90F
R492	323-0053-00	XB010300		RES.,FXD,FILM:34.8 OHM,1%,0.50W		
R493	323-0049-00	B010100	B010299	RES.,FXD,FILM:31.6 OHM,1%,0.50W		
R493	315-0100-00	B010300		RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R494	301-0430-00	XB010300		RES.,FXD,COMP:43 OHM,5%,0.50W	01121	EB4305
R495	315-0820-00	XB010300		RES.,FXD,COMP:82 OHM,5%,0.25W	01121	CB8205
R497	308-0758-00	XB010300		RES.,FXD,WW:430 OHM,1%,7W		
R498	301-0751-00			RES.,FXD,COMP:750 OHM,5%,0.50W	01121	EB7515
R502	315-0754-00			RES.,FXD,COMP:750K OHM,5%,0.25W	01121	CB7545
R503	315-0334-00			RES.,FXD,COMP:330K OHM,5%,0.25W	01121	CB3345
R507	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R508	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R509	321-0068-00			RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R511	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R512	315-0563-00			RES.,FXD,COMP:56K OHM,5%,0.25W	01121	CB5635
R516	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R517	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R518	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R522	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R523	315-0150-00			RES.,FXD,COMP:15 OHM,5%,0.25W	01121	CB1505
R524	315-0150-00			RES.,FXD,COMP:15 OHM,5%,0.25W	01121	CB1505
R525	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R527	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R528	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R529	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R530[1]	311-1647-00			RES.,VAR,NONWIR:10K OHM,10%,1W		
R531	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R535	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91A-20001M
R536	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R537	315-0560-00			RES.,FXD,COMP:56 OHM,5%,0.25W	01121	CB5605
R538	315-0362-00			RES.,FXD,COMP:3.6K OHM,5%,0.25W	01121	CB3625
R539	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R540	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R541	315-0682-00			RES.,FXD,COMP:6.8K OHM,5%,0.25W	01121	CB6825
R542	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R544	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R545	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91A-20001M
R546	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R547	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R549	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R550	315-0330-00			RES.,FXD,COMP:33 OHM,5%,0.25W	01121	CB3305
R551	323-0313-00			RES.,FXD,FILM:17.8K OHM,1%,0.50W	75042	CECT0-1782F
R552	315-0330-00			RES.,FXD,COMP:33 OHM,5%,0.25W	01121	CB3305
R553	315-0183-00			RES.,FXD,COMP:18K OHM,5%,0.25W	01121	CB1835
R554	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R555	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91A-20001M
R556	315-0562-00			RES.,FXD,COMP:5.6K OHM,5%,0.25W	01121	CB5625
R557	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R558	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R560	315-0304-00	XB010275		RES.,FXD,COMP:300K OHM,5%,0.25W	01121	CB3045
R562	315-0304-00	XB010275		RES.,FXD,COMP:300K OHM,5%,0.25W	01121	CB3045
R602	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R603	325-0073-00			RES.,FXD,FILM:3.57M OHM,1%,0.50W		
R604	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R606	323-0480-00			RES.,FXD,FILM:976K OHM,1%,0.50W	75042	CECT0-9763F
R607	321-0451-00			RES.,FXD,FILM:487K OHM,1%,0.125W	75042	CEAT0-4873F
R609	315-0274-00			RES.,FXD,COMP:270K OHM,5%,0.25W	01121	CB2745
R611	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R612	315-0563-00			RES.,FXD,COMP:56K OHM,5%,0.25W	01121	CB5635
R616	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	75042	CEAT0-1004F
R617	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R618	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R622	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R623	315-0150-00			RES.,FXD,COMP:15 OHM,5%,0.25W	01121	CB1505
R624	315-0150-00			RES.,FXD,COMP:15 OHM,5%,0.25W	01121	CB1505
R625	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R627	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R628	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R629	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R630[2]	311-1647-00			RES.,VAR,NONWIR:10K OHM,10%,1W		
R631	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R635	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91A-20001M
R636	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R637	315-0560-00			RES.,FXD,COMP:56 OHM,5%,0.25W	01121	CB5605
R638	315-0362-00			RES.,FXD,COMP:3.6K OHM,5%,0.25W	01121	CB3625
R639	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R640	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R641	315-0682-00			RES.,FXD,COMP:6.8K OHM,5%,0.25W	01121	CB6825

[1]Furnished as a unit with S530.
[2]Furnished as a unit with S630.

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R642	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R644	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R645	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91A-20001M
R646	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R647	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R649	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R650	315-0330-00			RES.,FXD,COMP:33 OHM,5%,0.25W	01121	CB3305
R651	323-0313-00			RES.,FXD,FILM:17.8K OHM,1%,0.50W	75042	CECT0-1782F
R652	315-0330-00			RES.,FXD,COMP:33 OHM,5%,0.25W	01121	CB3305
R655	311-1558-00			RES.,VAR,NONWIR:20K OHM,20%,0.50W	73138	91A-20001M
R656	315-0562-00			RES.,FXD,COMP:5.6K OHM,5%,0.25W	01121	CB5625
R657	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R658	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	75042	CEAT0-4751F
R660	315-0304-00	XB010275		RES.,FXD,COMP:300K OHM,5%,0.25W	01121	CB3045
R662	315-0304-00	XB010275		RES.,FXD,COMP:300K OHM,5%,0.25W	01121	CB3045
R672	315-0100-00			RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R673	315-0362-00			RES.,FXD,COMP:3.6K OHM,5%,0.25W	01121	CB3625
R674	315-0361-00			RES.,FXD,COMP:360 OHM,5%,0.25W	01121	CB3615
R675	311-1566-00			RES.,VAR,NONWIR:200 OHM,20%,0.50W	73138	91A-200R0M
R676	315-0330-00			RES.,FXD,COMP:33 OHM,5%,0.25W	01121	CB3305
R677	301-0821-00			RES.,FXD,COMP:820 OHM,5%,0.50W	01121	EB8215
R678	315-0430-00			RES.,FXD,COMP:43 OHM,5%,0.25W	01121	CB4305
R679	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R682	315-0100-00			RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R683	315-0362-00			RES.,FXD,COMP:3.6K OHM,5%,0.25W	01121	CB3625
R684	315-0361-00			RES.,FXD,COMP:360 OHM,5%,0.25W	01121	CB3615
R687	301-0821-00			RES.,FXD,COMP:820 OHM,5%,0.50W	01121	EB8215
R688	315-0430-00			RES.,FXD,COMP:43 OHM,5%,0.25W	01121	CB4305
R689	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R691	315-0302-00			RES.,FXD,COMP:3K OHM,5%,0.25W	01121	CB3025
R694	301-0221-00			RES.,FXD,COMP:220 OHM,5%,0.50W	01121	EB2215
R812	321-0125-00	B010100	B010299X	RES.,FXD,FILM:196 OHM,1%,0.125W	75042	CEAT0-1960F
R813	311-1244-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	80294	3386X-T07-101
R814	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	75042	CEAT0-2491F
R815	321-0068-00	B010100	B010299X	RES.,FXD,FILM:49.9 OHM,1%,0.125W	75042	CEAT0-49R90F
R816	311-1464-00			RES.,VAR,WW:2K OHM,5%,2W		
R817	321-0169-00	B010100	B010299X	RES.,FXD,FILM:562 OHM,1%,0.125W	75042	CEAT0-5620F
R822	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R823	321-0227-00			RES.,FXD,FILM:2.26K OHM,1%,0.125W	75042	CEAT0-2261F
R824	315-0431-00			RES.,FXD,COMP:430 OHM,5%,0.25W	01121	CB4315
R825	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R826	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R827	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R832	301-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.50W	01121	EB8225
R833	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R834	315-0241-00			RES.,FXD,COMP:240 OHM,5%,0.25W	01121	CB2415
R835	315-0561-00			RES.,FXD,COMP:560 OHM,5%,0.25W	01121	CB5615
R836	315-0112-00			RES.,FXD,COMP:1.1K OHM,5%,0.25W	01121	CB1125
R837	315-0183-00			RES.,FXD,COMP:18K OHM,5%,0.25W	01121	CB1835
R842	315-0132-00			RES.,FXD,COMP:1.3K OHM,5%,0.25W	01121	CB1325
R843	308-0758-00			RES.,FXD,WW:430 OHM,1%,7W		
R843	321-0206-00			RES.,FXD,FILM:1.37K OHM,1%,0.125W	75042	CEAT0-1371F
R844	321-0243-00			RES.,FXD,FILM:3.32K OHM,1%,0.125W	75042	CEAT0-3321F
R845	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R846	315-0391-00			RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R847	321-0186-00			RES.,FXD,FILM:845 OHM,1%,0.125W		
R851	315-0112-00			RES.,FXD,COMP:1.1K OHM,5%,0.25W	01121	CB1125
R852	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R853	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R854	321-0160-00			RES.,FXD,FILM:453 OHM,1%,0.125W	75042	CEAT0-4530F

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R855	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R856	321-0160-00			RES.,FXD,FILM:453 OHM,1%,0.125W	75042	CEAT0-4530F
R857	315-0911-00			RES.,FXD,COMP:910 OHM,5%,0.25W	01121	CB9115
R858	301-0471-00			RES.,FXD,COMP:470 OHM,5%,0.50W	01121	EB4715
R862	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R863	321-0211-00			RES.,FXD,FILM:1.54K OHM,1%,0.125W	75042	CEAT0-1541F
R864	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R865	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R866	315-0332-00			RES.,FXD,COMP:3.3K OHM,5%,0.25W	01121	CB3325
R867	315-0151-00			RES.,FXD,COMP:150 OHM,5%,0.25W	01121	CB1515
R872	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R873	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	75042	CEAT0-4990F
R874	321-0250-00			RES.,FXD,FILM:3.92K OHM,1%,0.125W	75042	CEAT0-3921F
R875	321-0195-00			RES.,FXD,FILM:1.05K OHM,1%,0.125W	75042	CEAT0-1051F
R876	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	75042	CEAT0-2321F
R877	321-0171-00			RES.,FXD,FILM:590 OHM,1%,0.125W	75042	CEAT0-5900F
R878	321-0192-00			RES.,FXD,FILM:976 OHM,1%,0.125W	75042	CEAT0-9760F
R882	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R883	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R884	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R885	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R886	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R887	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R888	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R889	315-0104-00	B010100	B010137X	RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R892	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R895	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R901	315-0390-00			RES.,FXD,COMP:39 OHM,5%,0.25W	01121	CB3905
R902	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R903	321-0160-00			RES.,FXD,FILM:453 OHM,1%,0.125W	75042	CEAT0-4530F
R904	321-0160-00			RES.,FXD,FILM:453 OHM,1%,0.125W	75042	CEAT0-4530F
R905	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R906	315-0332-00			RES.,FXD,COMP:3.3K OHM,5%,0.25W	01121	CB3325
R907	315-0151-00			RES.,FXD,COMP:150 OHM,5%,0.25W	01121	CB1515
R908	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R912	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	75042	CEAT0-1471F
R913	321-0150-00			RES.,FXD,FILM:357 OHM,1%,0.125W	75042	CEAT0-3570F
R914	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R915	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R916	315-0911-00			RES.,FXD,COMP:910 OHM,5%,0.25W	01121	CB9115
R917	301-0471-00			RES.,FXD,COMP:470 OHM,5%,0.50W	01121	EB4715
R922	321-0129-00			RES.,FXD,FILM:215 OHM,1%,0.125W	75042	CEAT0-2150F
R923	321-0187-00			RES.,FXD,FILM:866 OHM,1%,0.125W	75042	CEAT0-8660F
R924	321-0227-00			RES.,FXD,FILM:2.26K OHM,1%,0.125W	75042	CEAT0-2261F
R925	321-0284-00			RES.,FXD,FILM:8.87K OHM,1%,0.125W	75042	CEAT0-8871F
R926	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R927	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R943	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R944	315-0274-00			RES.,FXD,COMP:270K OHM,5%,0.25W	01121	CB2745
R945[1]	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R948	311-1666-00			RES.,VAR,NONWIR:20K OHM,10%,1W		
R952	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	75042	CEAT0-1211F
R953	321-0243-00			RES.,FXD,FILM:3.32K OHM,1%,0.125W	75042	CEAT0-3321F
R954	315-0132-00			RES.,FXD,COMP:1.3K OHM,5%,0.25W	01121	CB1325
R955	315-0270-00			RES.,FXD,COMP:27 OHM,5%,0.25W	01121	CB2705
R956	321-0195-00			RES.,FXD,FILM:1.05K OHM,1%,0.125W	75042	CEAT0-1051F
R957	315-0431-00			RES.,FXD,COMP:430 OHM,5%,0.25W	01121	CB4315
R958	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R962	315-0682-00			RES.,FXD,COMP:6.8K OHM,5%,0.25W	01121	CB6825
R965	315-0100-00			RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005

[1]Furnished as a unit with S948.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R967	315-0100-00			RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R981	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R982	315-0241-00			RES.,FXD,COMP:240 OHM,5%,0.25W	01121	CB2415
R983	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R984	315-0122-00			RES.,FXD,COMP:1.2K OHM,5%,0.25W	01121	CB1225
R985	315-0122-00			RES.,FXD,COMP:1.2K OHM,5%,0.25W	01121	CB1225
R986	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R987	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R988	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R989	315-0682-00			RES.,FXD,COMP:6.8K OHM,5%,0.25W	01121	CB6825
R992	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R993	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R994	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R1001	315-0360-00			RES.,FXD,COMP:36 OHM,5%,0.25W	01121	CB3605
R1002	303-0562-00			RES.,FXD,COMP:5.6K OHM,5%,1W	01121	GB5625
R1003	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1004	315-0360-00			RES.,FXD,COMP:36 OHM,5%,0.25W	01121	CB3605
R1005	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R1006	315-0560-00			RES.,FXD,COMP:56 OHM,5%,0.25W	01121	CB5605
R1008	321-0270-00			RES.,FXD,FILM:6.34K OHM,1%,0.125W	75042	CEAT0-6341F
R1021	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1022	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1024	321-0165-00			RES.,FXD,FILM:511 OHM,1%,0.125W	75042	CEAT0-5110F
R1026	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R1029	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1031	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1032	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1033	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	75042	CEAT0-4531F
R1035	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1036	315-0561-00			RES.,FXD,COMP:560 OHM,5%,0.25W	01121	CB5615
R1037	321-0251-01			RES.,FXD,FILM:4.02K OHM,0.5%,0.125W		
R1038	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1039	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	75042	CEAT0-2321F
R1042	315-0162-00			RES.,FXD,COMP:1.6K OHM,5%,0.25W	01121	CB1625
R1060	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1061	315-0360-00			RES.,FXD,COMP:36 OHM,5%,0.25W	01121	CB3605
R1062	301-0562-00			RES.,FXD,COMP:5.6K OHM,5%,0.50W	01121	EB5625
R1063	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1064	315-0360-00			RES.,FXD,COMP:36 OHM,5%,0.25W	01121	CB3605
R1065	315-0220-00			RES.,FXD,COMP:22 OHM,5%,0.25W	01121	CB2205
R1066	315-0560-00			RES.,FXD,COMP:56 OHM,5%,0.25W	01121	CB5605
R1067	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1068	315-0561-00			RES.,FXD,COMP:560 OHM,5%,0.25W	01121	CB5615
R1081	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1082	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	75042	CEAT0-1001F
R1084	321-0165-00			RES.,FXD,FILM:511 OHM,1%,0.125W	75042	CEAT0-5110F
R1086	315-0181-00			RES.,FXD,COMP:180 OHM,5%,0.25W	01121	CB1815
R1089	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1091	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1092	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1093	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	75042	CEAT0-4531F
R1095	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1097	321-0251-01			RES.,FXD,FILM:4.02K OHM,0.5%,0.125W		
R1098	321-0229-00			RES.,FXD,FILM:2.37K OHM,1%,0.125W	75042	CEAT0-2371F
R1099	315-0561-00			RES.,FXD,COMP:560 OHM,5%,0.25W	01121	CB5615
R1131	323-0498-04			RES.,FXD,FILM:1.5M OHM,0.1%,0.50W		
R1132	315-0101-00	B010100	B010299	RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1132	315-0100-00	B010300		RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R1133	323-0481-04			RES.,FXD,FILM:1M OHM,0.1%,0.50W		
R1134	321-0648-04			RES.,FXD,FILM:500K OHM,0.1%,0.125W		

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1135	321-0618-04			RES.,FXD,FILM:250K OHM,0.1%,0.125W		
R1136	321-0414-04			RES.,FXD,FILM:200K OHM,0.1%,0.125W		
R1137	321-0385-04			RES.,FXD,FILM:100K OHM,0.1%,0.125W		
R1138	321-0756-04			RES.,FXD,FILM:50K OHM,0.1%,0.125W	75042	CEAT2-5002B
R1140[1]	311-1374-00	B010100	B010299	RES.,VAR,NONWIR:50K OHM,20%,1W		
R1140	311-1701-00	B010300		RES.,VAR,NONWIR:50K OHM,20%,1W		
R1141	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R1142	321-0222-07	XB010300		RES.,FXD,FILM:2K OHM,0.1%,0.125W	75042	CEAT9-2001D
R1143	321-0193-07	XB010300		RES.,FXD,FILM:1K OHM,0.1%,0.125W	75042	CEAT9-1001B
R1144	321-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R1145	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W		
R1146	322-0258-00	B010100	B010299	RES.,FXD,FILM:4.75K OHM,1%,0.25W		
R1146	315-0472-00	B010300		RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R1147	321-0193-07	XB010300		RES.,FXD,FILM:1K OHM,0.1%,0.125W	75042	CEAT9-1001B
R1151	321-0436-00			RES.,FXD,FILM:340K OHM,1%,0.125W	75042	CEAT0-3403F
R1153	321-0345-00			RES.,FXD,FILM:38.3K OHM,1%,0.125W	75042	CEAT0-3832F
R1161	323-0498-04			RES.,FXD,FILM:1.5M OHM,0.1%,0.50W		
R1162	315-0101-00	B010100	B010299	RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1162	315-0100-00	B010300		RES.,FXD,COMP:10 OHM,5%,0.25W	01121	CB1005
R1163	323-0481-04			RES.,FXD,FILM:1M OHM,0.1%,0.50W		
R1164	321-0648-04			RES.,FXD,FILM:500K OHM,0.1%,0.125W		
R1165	321-0618-04			RES.,FXD,FILM:250K OHM,0.1%,0.125W		
R1166	321-0414-04			RES.,FXD,FILM:200K OHM,0.1%,0.125W		
R1167	321-0385-04			RES.,FXD,FILM:100K OHM,0.1%,0.125W		
R1168	321-0756-04			RES.,FXD,FILM:50K OHM,0.1%,0.125W	75042	CEAT2-5002B
R1170	315-0473-00			RES.,FXD,COMP:47K OHM,5%,0.25W	01121	CB4735
R1175	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W		
R1203	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R1205	321-0212-00			RES.,FXD,FILM:1.58K OHM,1%,0.125W	75042	CEAT0-1581F
R1212	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	75042	CEAT0-2000F
R1213	321-0264-00			RES.,FXD,FILM:5.49K OHM,1%,0.125W	75042	CEAT0-5491F
R1214	311-1222-00			RES.,VAR,NONWIR:100 OHM,20%,0.50W	80294	3389F-P31-101
R1215	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1216	321-0174-00			RES.,FXD,FILM:634 OHM,1%,0.125W	75042	CEAT0-6340F
R1217	321-0147-00			RES.,FXD,FILM:332 OHM,1%,0.125W	75042	CEAT0-3320F
R1218	315-0821-00			RES.,FXD,COMP:820 OHM,5%,0.25W	01121	CB8215
R1222	321-0164-00			RES.,FXD,FILM:499 OHM,1%,0.125W	75042	CEAT0-4990F
R1223	315-0332-00			RES.,FXD,COMP:3.3K OHM,5%,0.25W	01121	CB3325
R1224	315-0512-00			RES.,FXD,COMP:5.1K OHM,5%,0.25W	01121	CB5125
R1226	315-0823-00			RES.,FXD,COMP:82K OHM,5%,0.25W	01121	CB8235
R1227A,B	311-1670-00			RES.,VAR,NONWIR:10K OHM X 100K OHM,20%,0.50W		
R1232	321-0178-00			RES.,FXD,FILM:698 OHM,1%,0.125W	75042	CEAT0-6980F
R1233	321-0184-00			RES.,FXD,FILM:806 OHM,1%,0.125W	75042	CEAT0-8060F
R1234	322-0184-00			RES.,FXD,FILM:806 OHM,1%,0.25W	75042	CEBT0-8060F
R1236	323-0158-00			RES.,FXD,FILM:432 OHM,1%,0.50W	75042	CECT0-4320F
R1237	307-0106-00			RES.,FXD,COMP:4.7 OHM,5%,0.25W	01121	CB47G5
R1238	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	75042	CEAT0-2321F
R1239	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R1242	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	75042	CEAT0-2151F
R1243	315-0270-00			RES.,FXD,COMP:27 OHM,5%,0.25W	01121	CB2705
R1244	321-0184-00			RES.,FXD,FILM:806 OHM,1%,0.125W	75042	CEAT0-8060F
R1245	322-0184-00			RES.,FXD,FILM:806 OHM,1%,0.25W	75042	CEBT0-8060F
R1246	321-0097-00			RES.,FXD,FILM:100 OHM,1%,0.125W	75042	CEAT0-1000F
R1247	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	75042	CEAT0-2321F
R1252	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R1253	311-1222-00			RES.,VAR,NONWIR:100 OHM,20%,0.50W	80294	3389F-P31-101
R1254	323-0303-00			RES.,FXD,FILM:14K OHM,1%,0.50W	75042	CECT0-1402F
R1255	311-1226-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	80294	3389F-P31-252
R1256	323-0303-00			RES.,FXD,FILM:14K OHM,1%,0.50W	75042	CECT0-1402F
R1257	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	80294	3389F-P31-102

[1]Furnished as a unit with S1140.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1258	321-0111-00			RES.,FXD,FILM:140 OHM,1%,0.125W	75042	CEAT0-1400F
R1262	323-0309-00			RES.,FXD,FILM:16.2K OHM,1%,0.50W	75042	CECT0-1622F
R1263	322-0280-00			RES.,FXD,FILM:8.06K OHM,1%,0.50W		
R1264	322-0280-00			RES.,FXD,FILM:8.06K OHM,1%,0.50W		
R1265	323-0309-00			RES.,FXD,FILM:16.2K OHM,1%,0.50W	75042	CECT0-1622F
R1266	315-0333-00			RES.,FXD,COMP:33K OHM,5%,0.25W	01121	CB3335
R1267	315-0333-00			RES.,FXD,COMP:33K OHM,5%,0.25W	01121	CB3335
R1268	321-0347-00			RES.,FXD,FILM:40.2K OHM,1%,0.125W	75042	CEAT0-4022F
R1271	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R1272	301-0393-00			RES.,FXD,COMP:39K OHM,5%,0.50W	01121	EB3935
R1273	315-0621-00			RES.,FXD,COMP:620 OHM,5%,0.25W	01121	CB6215
R1274	321-0179-00			RES.,FXD,FILM:715 OHM,1%,0.125W	75042	CEAT0-7150F
R1275	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1276	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1277	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1278	321-0370-00			RES.,FXD,FILM:69.8K OHM,1%,0.125W	75042	CEAT0-6982F
R1281	301-0471-00			RES.,FXD,COMP:470 OHM,5%,0.50W	01121	EB4715
R1282	315-0751-00			RES.,FXD,COMP:750 OHM,5%,0.25W	01121	CB7515
R1283	301-0393-00			RES.,FXD,COMP:39K OHM,5%,0.50W	01121	EB3935
R1284	321-0179-00			RES.,FXD,FILM:715 OHM,1%,0.125W	75042	CEAT0-7150F
R1285	315-0621-00			RES.,FXD,COMP:620 OHM,5%,0.25W	01121	CB6215
R1286	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1287	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1288	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1289	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	75042	CEAT0-4991F
R1362	315-0512-00			RES.,FXD,COMP:5.1K OHM,5%,0.25W	01121	CB5125
R1363	315-0273-00			RES.,FXD,COMP:27K OHM,5%,0.25W	01121	CB2735
R1364	315-0913-00			RES.,FXD,COMP:91K OHM,5%,0.25W	01121	CB9135
R1365	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R1367	315-0912-00			RES.,FXD,COMP:9.1K OHM,5%,0.25W	01121	CB9125
R1372	315-0913-00			RES.,FXD,COMP:91K OHM,5%,0.25W	01121	CB9135
R1373	315-0512-00			RES.,FXD,COMP:5.1K OHM,5%,0.25W	01121	CB5125
R1375	311-1221-00			RES.,VAR,NONWIR:50 OHM,20%,0.50W	80294	3389F-P31-500
R1376	321-0107-00			RES.,FXD,FILM:127 OHM,1%,0.125W	75042	CEAT0-1270F
R1377	321-0001-00			RES.,FXD,FILM:10 OHM,1%,0.125W	75042	CEAT0-10R00F
R1403[1]	311-1718-00			RES.,VAR,NONWIR:5K OHM,20%,1W		
R1405	301-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.50W	01121	EB7525
R1407	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R1413	315-0302-00			RES.,FXD,COMP:3K OHM,5%,0.25W	01121	CB3025
R1414	301-0243-00			RES.,FXD,COMP:24K OHM,5%,0.50W	01121	EB2435
R1416	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R1417	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1422	321-0262-00			RES.,FXD,FILM:5.23K OHM,1%,0.125W	75042	CEAT0-5231F
R1423	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	75042	CEAT0-1501F
R1424	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1425	321-0297-00			RES.,FXD,FILM:12.1K OHM,1%,0.125W	75042	CEAT0-1212F
R1427	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1428	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1431	315-0391-00			RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R1432	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1433	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1434	321-0249-00			RES.,FXD,FILM:3.83K OHM,1%,0.125W	75042	CEAT0-3831F
R1435	323-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.5W	75042	CECT0-2212F
R1436	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1437	321-0179-00			RES.,FXD,FILM:715 OHM,1%,0.125W	75042	CEAT0-7150F
R1439	301-0393-00			RES.,FXD,COMP:39K OHM,5%,0.50W	01121	EB3935
R1442	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1443	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R1444	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1445	315-0226-00			RES.,FXD,COMP:22M OHM,5%,0.25W	01121	CB2265

[1]Furnished as a unit with S1403.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1446	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1453	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1454	311-1554-00			RES.,VAR,NONWIR:200K OHM,20%,0.50W	73138	91A-20002M
R1455	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1462	315-0124-00			RES.,FXD,COMP:120K OHM,5%,0.25W	01121	CB1245
R1463	321-0365-00			RES.,FXD,FILM:61.9K OHM,1%,0.125W	75042	CEAT0-6192F
R1464	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A-10002M
R1465	321-0433-00			RES.,FXD,FILM:316K OHM,1%,0.125W	75042	CEAT0-3163F
R1466	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1467	321-0414-00			RES.,FXD,FILM:200K OHM,1%,0.125W	75042	CEAT0-2003F
R1472	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R1473	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1474	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1475	315-0683-00			RES.,FXD,COMP:68K OHM,5%,0.25W	01121	CB6835
R1477	315-0122-00			RES.,FXD,COMP:1.2K OHM,5%,0.25W	01121	CB1225
R1482	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R1483	315-0562-00			RES.,FXD,COMP:5.6K OHM,5%,0.25W	01121	CB5625
R1486	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R1492	315-0271-00			RES.,FXD,COMP:270 OHM,5%,0.25W	01121	CB2715
R1493	315-0223-00			RES.,FXD,COMP:22K OHM,5%,0.25W	01121	CB2235
R1494	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1495	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1496	321-0284-00			RES.,FXD,FILM:8.87K OHM,1%,0.125W	75042	CEAT0-8871F
R1497	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	75042	CEAT0-1002F
R1498	321-0297-00			RES.,FXD,FILM:12.1K OHM,1%,0.125W	75042	CEAT0-1212F
R1501	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R1502	315-0205-00			RES.,FXD,COMP:2M OHM,5%,0.25W	01121	CB2055
R1504	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1505	315-0203-00			RES.,FXD,COMP:20K OHM,5%,0.25W	01121	CB2035
R1507	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1508	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1512	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1514	307-0061-00			RES.,FXD,COMP:7.5 OHM,5%,0.50W		
R1517	315-0754-00			RES.,FXD,COMP:750K OHM,5%,0.25W	01121	CB7545
R1518	315-0754-00			RES.,FXD,COMP:750K OHM,5%,0.25W	01121	CB7545
R1522	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1525A,B R1525C,D	307-0431-01			RES.,FXD,FILM:		
R1526	311-1717-00			RES.,VAR,NONWIR:2.5M OHM,10%,1W		
R1527	311-1550-00			RES.,VAR,NONWIR:2M OHM,20%,0.50W		
R1529	311-1716-00			RES.,VAR,NONWIR:1.5M OHM,1%,1W		
R1532	315-0625-00			RES.,FXD,COMP:6.2M OHM,5%,0.25W	01121	CB6255
R1533	315-0124-00			RES.,FXD,COMP:120K OHM,5%,0.25W	01121	CB1245
R1542	315-0106-00			RES.,FXD,COMP:10M OHM,5%,0.25W	01121	CB1065
R1543	315-0136-01			RES.,FXD,COMP:13M OHM,5%,0.25W		
R1545	315-0395-00			RES.,FXD,COMP:3.9M OHM,5%,0.25W	01121	CB3955
R1547	315-0206-01			RES.,FXD,COMP:20M OHM,5%,0.25W		
R1552	315-0361-00			RES.,FXD,COMP:360 OHM,5%,0.25W	01121	CB3615
R1553	311-1313-00			RES.,VAR,NONWIR:2K OHM,20%,1W		
R1554	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91A-25000M
R1556	311-1554-00			RES.,VAR,NONWIR:200K OHM,20%,0.50W	73138	91A-20002M
R1562	301-0301-00			RES.,FXD,COMP:300 OHM,5%,0.50W	01121	EB3015
R1563	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91A-25000M
R1564	311-1561-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	73138	91A-25000M
R1572	315-0204-00			RES.,FXD,COMP:200K OHM,5%,0.25W	01121	CB2045
R1573	311-1552-00			RES.,VAR,NONWIR:500K OHM,20%,0.50W		
R1574	315-0683-00			RES.,FXD,COMP:68K OHM,5%,0.25W	01121	CB6835
R1575	311-1372-00			RES.,VAR,NONWIR:100K OHM,20%,1W		
R1583	301-0305-00			RES.,FXD,COMP:3M OHM,5%,0.50W	01121	EB3055
R1584	301-0305-00			RES.,FXD,COMP 3M OHM,5%,0.50W	01121	EB3055

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1585	301-0305-00			RES.,FXD,COMP:3M OHM,5%,0.50W	01121	EB3055
R1586	301-0305-00			RES.,FXD,COMP:3M OHM,5%,0.50W	01121	EB3055
R1587	301-0305-00			RES.,FXD,COMP:3M OHM,5%,0.50W	01121	EB3055
R1604[1]	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R1605[1]	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R1607[1]	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R1609[1]	315-0511-00			RES.,FXD,COMP:510 OHM,5%,0.25W	01121	CB5115
R1611[1]	315-0511-00			RES.,FXD,COMP:510 OHM,5%,0.25W	01121	CB5115
R1613[1]	311-1248-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W		
R1614[1]	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R1617[1]	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1618[1]	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1622[1]	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1623[1]	316-0103-00			RES.,FXD,COMP:10K OHM,10%,0.25W	01121	CB1031
R1624[1]	315-0302-00			RES.,FXD,COMP:3K OHM,5%,0.25W	01121	CB3025
R1625[1]	316-0101-00			RES.,FXD,COMP:100 OHM,10%,0.25W	01121	CB1011
R1626[1]	308-0450-00			RES.,FXD,WW:70 OHM,1%,3W	91637	RS2B-B70R00F
R1631[1]	308-0450-00			RES.,FXD,WW:70 OHM,1%,3W	91637	RS2B-B70R00F
R1633[1]	311-1501-00			RES.,VAR,NONWIR:20 OHM,10%,0.50W		
R1639[1]	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1640[1]	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1641[1]	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1642[1]	315-0470-00			RES.,FXD,COMP:47 OHM,5%,0.25W	01121	CB4705
R1645[1]	307-0113-00			RES.,FXD,COMP:5.1 OHM,5%,0.25W	01121	CB51G5
R1652[1]	308-0459-00			RES.,FXD,WW:1.1 OHM,5%,3W	91637	RS2B-D1R100J
R1654[1]	308-0459-00			RES.,FXD,WW:1.1 OHM,5%,3W	91637	RS2B-D1R100J
R1662[1]	308-0459-00			RES.,FXD,WW:1.1 OHM,5%,3W	91637	RS2B-D1R100J
R1664[1]	308-0459-00			RES.,FXD,WW:1.1 OHM,5%,3W	91637	RS2B-D1R100J
R1671[1]	302-0102-00			RES.,FXD,COMP:1K OHM,10%,0.50W	01121	EB1021
R1691	303-0150-00			RES.,FXD,COMP:15 OHM,5%,1W	01121	GB1505
R1692	321-0062-00			RES.,FXD,FILM:43.2 OHM,1%,0.125W	75042	CEAT0-43R20F
R1693	323-0140-00			RES.,FXD,FILM:280 OHM,1%,0.50W	75042	CECT0-2800F
R1694	323-0140-00			RES.,FXD,FILM:280 OHM,1%,0.50W	75042	CECT0-2800F
R1695	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	75042	CEAT0-2321F
R1697	321-0201-00			RES.,FXD,FILM:1.21K OHM,1%,0.125W	75042	CEAT0-1211F
R1698	315-0363-00			RES.,FXD,COMP:36K OHM,5%,0.25W	01121	CB3635
R1712	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R1715	315-0392-00			RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R1716	307-0107-00			RES.,FXD,COMP:5.6 OHM,5%,0.25W	01121	CB56G5
R1717	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	75042	CEAT0-6040F
R1718	321-0369-00			RES.,FXD,FILM:68.1K OHM,1%,0.125W	75042	CEAT0-6812F
R1722	303-0333-00			RES.,FXD,COMP:33K OHM,5%,1W	01121	GB3335
R1723	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1724	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1725	321-0280-00			RES.,FXD,FILM:8.06K OHM,1%,0.125W	75042	CEAT0-8061F
R1726	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	75042	CEAT0-7501F
R1727	303-0682-00	XB010135		RES.,FXD,COMP:6.8K OHM,5%,1W	01121	GB6825
R1732	315-0331-00			RES.,FXD,COMP:330 OHM,5%,0.25W	01121	CB3315
R1733	315-0243-00			RES.,FXD,COMP:24K OHM,5%,0.25W	01121	CB2435
R1734	307-0052-00			RES.,FXD,COMP:3 OHM,5%,0.50W		
R1735	321-0362-00			RES.,FXD,FILM:57.6K OHM,1%,0.125W	75042	CEAT0-5762F
R1736	311-1226-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	80294	3389F-P31-252
R1737	321-0284-00			RES.,FXD,FILM:8.87K OHM,1%,0.125W	75042	CEAT0-8871F
R1743	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1744	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1752	321-0756-03			RES.,FXD,FILM:50K OHM,0.25%,0.125W	75042	CEAT2-5002C
R1753	321-0603-00			RES.,FXD,FILM:15K OHM,0.25%,0.125W	75042	CEAT2-1502C
R1754	315-0681-00			RES.,FXD,COMP:680 OHM,5%,0.25W	01121	CB6815
R1756	315-0163-00			RES.,FXD,COMP:16K OHM,5%,0.25W	01121	CB1635
R1757	308-0245-00			RES.,FXD,WW:0.6 OHM,5%,2W	91637	RS2B162ER6000J

[1]Option 7 only.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1762	321-0720-03			RES.,FXD,FILM:60K OHM,0.25%,0.125W	91637	MFF1816D6002C
R1763	321-0816-03			RES.,FXD,FILM:5K OHM,0.25%,0.125W		
R1765	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R1766	315-0472-00			RES.,FXD,COMP:4.7K OHM,5%,0.25W	01121	CB4725
R1767	308-0245-00			RES.,FXD,WW:0.6 OHM,5%,2W	91637	RS2B162ER6000J
R1772	321-0755-03			RES.,FXD,FILM:65K OHM,0.25%,0.125W	75042	CEAT2-6502C
R1773	321-0962-03			RES.,FXD,FILM:8K OHM,0.25%,0.125W		
R1774	321-0275-00			RES.,FXD,FILM:7.15K OHM,1%,0.125W	75042	CEAT0-7151F
R1775	315-0152-00			RES.,FXD,COMP:1.5K OHM,5%,0.25W	01121	CB1525
R1776	315-0163-00			RES.,FXD,COMP:16K OHM,5%,0.25W	01121	CB1635
R1777	308-0245-00			RES.,FXD,WW:0.6 OHM,5%,2W	91637	RS2B162ER6000J
R1778	315-0101-00			RES.,FXD,COMP:100 OHM,5%,0.25W	01121	CB1015
R1781	321-0622-00			RES.,FXD,FILM:37.96K OHM,0.25%,0.125W		
R1782	315-0332-00			RES.,FXD,COMP:3.3K OHM,5%,0.25W	01121	CB3325
R1783	321-1283-03			RES.,FXD,FILM:8.76K OHM,0.25%,0.125W	91637	MFF1816D87600C
R1784	315-0332-00			RES.,FXD,COMP:3.3K OHM,5%,0.25W	01121	CB3325
R1785	315-0682-00			RES.,FXD,COMP:6.8K OHM,5%,0.25W	01121	CB6825
R1786	315-0301-00			RES.,FXD,COMP:300 OHM,5%,0.25W	01121	CB3015
R1787	315-0163-00			RES.,FXD,COMP:16K OHM,5%,0.25W	01121	CB1635
R1788	307-0052-00			RES.,FXD,COMP:3 OHM,5%,0.50W		
R1792	315-0392-00	B010100	B010134	RES.,FXD,COMP:3.9K OHM,5%,0.25W	01121	CB3925
R1792	315-0302-00	B010135		RES.,FXD,COMP:3K OHM,5%,0.25W	01121	CB3025
R1794	311-1373-00			RES.,VAR,NONWIR:5K OHM,20%,1W		
R1802	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R1803	315-0302-00			RES.,FXD,COMP:3K OHM,5%,0.25W	01121	CB3025
R1812	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R1813	315-0204-00			RES.,FXD,COMP:200K OHM,5%,0.25W	01121	CB2045
R1814	315-0334-00			RES.,FXD,COMP:330K OHM,5%,0.25W	01121	CB3345
R1815[1]	311-1669-00			RES.,VAR,NONWIR:10K OHM,10%,1W		
R1816	315-0152-00			RES.,FXD,COMP:1.5K OHM,5%,0.25W	01121	CB1525
R1817	315-0124-00			RES.,FXD,COMP:120K OHM,5%,0.25W	01121	CB1245
R1818	315-0203-00			RES.,FXD,COMP:20K OHM,5%,0.25W	01121	CB2035
R1823	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1824	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1825	315-0161-00			RES.,FXD,COMP:160 OHM,5%,0.25W	01121	CB1615
R1826	315-0150-00			RES.,FXD,COMP:15 OHM,5%,0.25W	01121	CB1505
R1827	315-0132-00			RES.,FXD,COMP:1.3K OHM,5%,0.25W	01121	CB1325
R1831	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R1832	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1833	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R1834	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R1835	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R1836	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R1837	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1838	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R1842	315-0433-00			RES.,FXD,COMP:43K OHM,5%,0.25W	01121	CB4335
R1843	315-0182-00			RES.,FXD,COMP:1.8K OHM,5%,0.25W	01121	CB1825
R1844	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R1845	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1846	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1847	315-0203-00			RES.,FXD,COMP:20K OHM,5%,0.25W	01121	CB2035
R1848	315-0113-00			RES.,FXD,COMP:11K OHM,5%,0.25W	01121	CB1135
R1852	307-0106-00			RES.,FXD,COMP:4.7 OHM,5%,0.25W	01121	CB47G5
R1853	315-0241-00			RES.,FXD,COMP:240 OHM,5%,0.25W	01121	CB2415
R1855	315-0473-00			RES.,FXD,COMP:47K OHM,5%,0.25W	01121	CB4735
R1856	315-0204-00			RES.,FXD,COMP:200K OHM,5%,0.25W	01121	CB2045
R1858	311-1254-00			RES.,VAR,NONWIR:1M OHM,20%,0.50W		
R1862	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R1863	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R1864	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725

[1]Furnished as a unit with S1815A,B,C.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R1867	315-0272-00			RES.,FXD,COMP:2.7K OHM,5%,0.25W	01121	CB2725
R1869	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1872	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R1874	315-0911-00			RES.,FXD,COMP:910 OHM,5%,0.25W	01121	CB9115
R1875	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1922	315-0334-00			RES.,FXD,COMP:330K OHM,5%,0.25W	01121	CB3345
R1923A,B	311-1668-00			RES.,VAR,NONWIR:2 X 10K OHM,10%,0.50W		
R1924	315-0132-00			RES.,FXD,COMP:1.3K OHM,5%,0.25W	01121	CB1325
R1925	321-0411-00			RES.,FXD,FILM:187K OHM,1%,0.125W	75042	CEAT0-1873F
R1926	321-0414-00			RES.,FXD,FILM:200K OHM,1%,0.125W	75042	CEAT0-2003F
R1927	311-1229-00			RES.,VAR,NONWIR:15K OHM,20%,0.50W		
R1928	315-0332-00			RES.,FXD,COMP:3.3K OHM,5%,0.25W	01121	CB3325
R1932	315-0823-00			RES.,FXD,COMP:82K OHM,5%,0.25W	01121	CB8235
R1933	311-1252-00			RES.,VAR,NONWIR:500K OHM,20%,0.50W		
R1934	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	75042	CEAT0-7502F
R1935	311-1319-00			RES.,VAR,NONWIR:10K OHM,10%,0.75W		
R1941	321-0414-00			RES.,FXD,FILM:200K OHM,1%,0.125W	75042	CEAT0-2003F
R1942	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1943	315-0391-00			RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R1944	315-0163-00			RES.,FXD,COMP:16K OHM,5%,0.25W	01121	CB1635
R1945	315-0221-00			RES.,FXD,COMP:220 OHM,5%,0.25W	01121	CB2215
R1946	315-0154-00			RES.,FXD,COMP:150K OHM,5%,0.25W	01121	CB1545
R1947	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1952	315-0332-00			RES.,FXD,COMP:3.3K OHM,5%,0.25W	01121	CB3325
R1953	315-0303-00			RES.,FXD,COMP:30K OHM,5%,0.25W	01121	CB3035
R1954	315-0153-00			RES.,FXD,COMP:15K OHM,5%,0.25W	01121	CB1535
R1955	315-0202-00			RES.,FXD,COMP:2K OHM,5%,0.25W	01121	CB2025
R1956	315-0133-00			RES.,FXD,COMP:13K OHM,5%,0.25W	01121	CB1335
R1957	315-0124-00			RES.,FXD,COMP:120K OHM,5%,0.25W	01121	CB1245
R1962	315-0335-00			RES.,FXD,COMP:3.3M OHM,5%,0.25W	01121	CB3355
R1963	315-0753-00			RES.,FXD,COMP:75K OHM,5%,0.25W	01121	CB7535
R1964	315-0335-00			RES.,FXD,COMP:3.3M OHM,5%,0.25W	01121	CB3355
R1965	315-0334-00			RES.,FXD,COMP:330K OHM,5%,0.25W	01121	CB3345
R1966	315-0125-00			RES.,FXD,COMP:1.2M OHM,5%,0.25W	01121	CB1255
R1967	315-0155-00			RES.,FXD,COMP:1.5M OHM,5%,0.25W	01121	CB1555
R1968	315-0335-00			RES.,FXD,COMP:3.3M OHM,5%,0.25W	01121	CB3355
R1982	311-1339-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W		
R1983	321-0355-00			RES.,FXD,FILM:48.7K OHM,1%,0.125W	75042	CEAT0-4872F
R1984	321-0364-00			RES.,FXD,FILM:60.4K OHM,1%,0.125W	75042	CEAT0-6042F
R1985	321-0366-00			RES.,FXD,FILM:63.4K OHM,1%,0.125W	75042	CEAT0-6342F
R1986	321-0365-00			RES.,FXD,FILM:61.9K OHM,1%,0.125W	75042	CEAT0-6192F
R1987	311-1229-00			RES.,VAR,NONWIR:15K OHM,20%,0.50W		
R1988	321-0302-00			RES.,FXD,FILM:13.7K OHM,1%,0.125W	75042	CEAT0-1372F
R1989	311-1225-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	80294	3389F-P31-102
R1991	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	75042	CEAT0-1003F
R1992	315-0752-00			RES.,FXD,COMP:7.5K OHM,5%,0.25W	01121	CB7525
R1993	315-0391-00			RES.,FXD,COMP:390 OHM,5%,0.25W	01121	CB3915
R1994	315-0822-00			RES.,FXD,COMP:8.2K OHM,5%,0.25W	01121	CB8225
R1995	315-0201-00			RES.,FXD,COMP:200 OHM,5%,0.25W	01121	CB2015
R1996	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R1997	301-0203-00			RES.,FXD,COMP:20K OHM,5%,0.50W	01121	EB2035
R1998	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R1999	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R2012	321-0394-00			RES.,FXD,FILM:124K OHM,1%,0.125W	75042	CEAT0-1243F
R2013	321-0396-00			RES.,FXD,FILM:130K OHM,1%,0.125W	75042	CEAT0-1303F
R2015	321-0396-00			RES.,FXD,FILM:130K OHM,1%,0.125W	75042	CEAT0-1303F
R2022	321-0337-00			RES.,FXD,FILM:31.6K OHM,1%,0.125W	75042	CEAT0-3162F
R2023	321-0423-00			RES.,FXD,FILM:249K OHM,1%,0.125W	75042	CEAT0-2493F
R2024	315-0223-00			RES.,FXD,COMP:22K OHM,5%,0.25W	01121	CB2235
R2025	315-0753-00			RES.,FXD,COMP:75K OHM,5%,0.25W	01121	CB7535

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R2026	315-0471-00			RES.,FXD,COMP:470 OHM,5%,0.25W	01121	CB4715
R2031	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	75042	CEAT0-4993F
R2032	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	75042	CEAT0-4993F
R2033	321-0392-00			RES.,FXD,FILM:118K OHM,1%,0.125K	75042	CEAT0-1183F
R2034	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R2035	321-0433-00			RES.,FXD,FILM:316K OHM,1%,0.125W	75042	CEAT0-3163F
R2037	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R2038	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R2042	321-0411-00			RES.,FXD,FILM:187K OHM,1%,0.125W	75042	CEAT0-1873F
R2043	321-0414-00			RES.,FXD,FILM:200K OHM,1%,0.125W	75042	CEAT0-2003F
R2044	321-0395-00			RES.,FXD,FILM:127K OHM,1%,0.125W	75042	CEAT0-1273F
R2045	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R2046	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	75042	CEAT0-4993F
R2047	301-0473-00			RES.,FXD,COMP:47K OHM,5%,0.50W	01121	EB4735
R2048	315-0222-00			RES.,FXD,COMP:2.2K OHM,5%,0.25W	01121	CB2225
R2052	321-0449-00			RES.,FXD,FILM:464K OHM,1%,0.125W	75042	CEAT0-4643F
R2053	321-0400-00			RES.,FXD,FILM:143K OHM,1%,0.125W	75042	CEAT0-1433F
R2054	321-0422-00			RES.,FXD,FILM:243K OHM,1%,0.125W	75042	CEAT0-2433F
R2055	315-0104-00			RES.,FXD,COMP:100K OHM,5%,0.25W	01121	CB1045
R2056	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	75042	CEAT0-4993F
R2057	301-0473-00			RES.,FXD,COMP:47K OHM,5%,0.50W	01121	EB4735
R2058	315-0102-00			RES.,FXD,COMP:1K OHM,5%,0.25W	01121	CB1025
R2072	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R2073	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R2075	315-0204-00			RES.,FXD,COMP:200K OHM,5%,0.25W	01121	CB2045
R2076	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R2077	315-0303-00			RES.,FXD,COMP:30K OHM,5%,0.25W	01121	CB3035
R2078	315-0243-00			RES.,FXD,COMP:24K OHM,5%,0.25W	01121	CB2435
R2079	315-0393-00			RES.,FXD,COMP:39K OHM,5%,0.25W	01121	CB3935
R2092	321-0189-00			RES.,FXD,FILM:909 OHM,1%,0.125W	75042	CEAT0-9090F
R2093	321-0150-00			RES.,FXD,FILM:357 OHM,1%,0.125W	75042	CEAT0-3570F
R2094	315-0103-00			RES.,FXD,COMP:10K OHM,5%,0.25W	01121	CB1035
R2099	301-0220-00			RES.,FXD,COMP:22 OHM,5%,0.50W	01121	EB2205
RT119	307-0181-00			RES.,THERMAL:100K OHM,10%,4MW/DEG C	14193	2J05-104K
RT219	307-0181-00			RES.,THERMAL:100K OHM,10%,4MW/DEG C	14193	2J05-104K
RT415	307-0122-00	XB010300		RES.,THERMAL:50 OHM,10%		
RT421	307-0124-00	B010100	B010299X	RES.,THERMAL:5K OHM,10%		
RT458	307-0181-00	XB010300		RES.,THERMAL:100K OHM,10%,4MW/DEG C	14193	2J05-104K
RT487	308-0758-00	XB010300		RES.,FXD,WW:430 OHM,1%,7W		
RT557	307-0124-00			RES.,THERMAL:5K OHM,10%		
RT657	307-0124-00			RES.,THERMAL:5K OHM,10%		
RT1243	307-0122-00			RES.,THERMAL:50 OHM,10%		
RT1423	307-0181-00			RES.,THERMAL:100K OHM,10%,4MW/DEG C	14193	2J05-104K
RT1696	307-0124-00			RES.,THERMAL:5K OHM,10%		
S30A	105-0521-00			ACTUATOR,CAM SW:AC/GND/DC		
S30B	105-0282-01			ACTUATOR,CAM SW:VOLTS/DIV		
S96[1]						
S196[2]						
S225	260-1208-00			SWITCH,PUSH:DPDT	71590	2KAB010000-359
S338A	105-0423-00			ACTUATOR,SWITCH:BANDWIDTH LIMIT	80009	105-0423-00
S338B	105-0421-00			ACTUATOR,SWITCH:MOMENTARY	80009	105-0421-00
S350	260-1424-01			SWITCH,PUSH:	71590	2KBC050000-684
S400	260-1421-00			SWITCH,PUSH:	80009	260-1421-00
S510A,B	105-0572-01			ACTUATOR,SWITCH:B SOURCE		
S515	105-0570-01			ACTUATOR,SWITCH:B COUPLING		
S530[3]						
S610	105-0571-01			ACTUATOR,SWITCH:A SOURCE		
S615	105-0570-01			ACTUATOR,SWITCH:A COUPLING		
S630[4]				ACTUATOR,SWITCH:A SLOPE		

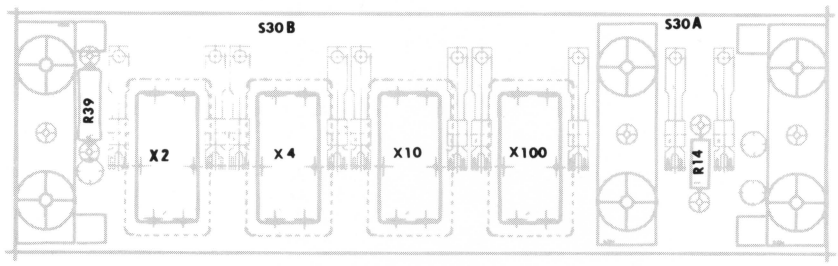
[1]Furnished as a unit with R96.
[2]Furnished as a unit with R196.
[3]Furnished as a unit with R530.
[4]Furnished as a unit with R630.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
S948[1]				ACTUATOR,SWITCH:B ENDS A		
S980	260-1422-00			SWITCH,PUSH:	71590	2KBC030000-594
S1120	260-1423-00			SWITCH,PUSH:	71590	2KBC040000-593
S1140[2]						
S1150	263-1066-00	B010100	B010299	ACTR ASSY,CAM S:A & B TIME/DIV DELAY TIME		
S1150	263-1092-00	B010300		ACTR ASSY,CAM S:	80009	263-1092-00
S1239	260-1208-00			SWITCH,PUSH:DPDT	71590	2KAB010000-359
S1403[3]				SWITCH,PUSH:REDUCED SCAN		
S1501	260-1304-00			SWITCH,MAG REED:		
S1601A,B[4]	260-0834-00			SWITCH,TOGGLE:DPDT,5A,125VAC,0.25-40 THD	09353	7201-SN
S1665[4]	105-0479-00			ACTUATOR,SWITCH:POWER MODE		
S1665A[4]	260-0760-00			SWITCH,SENS:		
S1665B[4]	260-0760-00			SWITCH,SENS:		
S1665C[4]	260-0760-00			SWITCH,SENS:		
S1665D[4]	260-0760-00			SWITCH,SENS:		
S1665E[4]	260-0760-00			SWITCH,SENS:		
S1665F[4]	260-0760-00			SWITCH,SENS:		
S1701	260-0834-00			SWITCH,TOGGLE:DPDT,5A,125VAC,0.25-40 THD	09353	7201-SN
S1702	260-0413-00			SW,THERMOSTATIC:OPEN 79.4DEG,CL 68.3DEG C		
S1703	260-1300-01			SWITCH,SLIDE:DPDT,3A,125V	82389	46206LFE
S1815A, S1815B,C	[5]					
S1921A,B S1921C,D	260-1603-00			SWITCH,PUSH:STORAGE		
T354	120-0366-00			XFMR,TOROID:2 WINDINGS	80009	120-0366-00
T1501	120-0909-00			XFMR,HV:	80009	120-0909-00
T1601[4]	120-0637-00			XFMR,TOROID:5 TURNS BIFILAR	80009	120-0637-00
T1631[4]	120-0852-00			XFMR,TOROID:2 WINDINGS	80009	120-0852-00
T1701	120-0908-00			XFMR,POWER:	80009	120-0908-00
U464	155-0077-01	B010100	B010299X	MICROCIRCUIT,LI:HYBRID	80009	155-0077-01
U540	155-0032-01			MICROCIRCUIT,LI:MONOLITHIC,INPUT PRE-AMPL	80009	155-0032-01
U640	155-0032-01			MICROCIRCUIT,LI:MONOLITHIC,INPUT PRE-AMPL	80009	155-0032-01
U980	155-0049-01			MICROCIRCUIT,DI:MONOLITHIC,SWEEP CONTROL	80009	155-0049-01
U1690	156-0281-00			MICROCIRCUIT,LI:4 TRANSISTOR ARRAY	04713	MPQ2221
U1724	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	S5558V
U1762	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	S5558V
U1844	156-0402-00			MICROCIRCUIT,DI:TIMER		
U1846	156-0172-00			MICROCIRCUIT,DI:DUAL MONOSTABLE MV	01295	SN74123N
U1866	156-0043-00			MICROCIRCUIT,DI:2-INPUT NOR GATE	01295	SN7402N
U1872	156-0371-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND ST		
U1874	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U1876	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U1878	156-0221-00			MICROCIRCUIT,DI:QUAD LATCH		
V1555	154-0708-00			ELECTRON TUBE:CRT	80009	154-0708-00
VR75	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR128	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR175	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR228	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR434	152-0127-00	B010100	B010299X	SEMICOND DEVICE:ZENER,0.4W,7.5V,5%	04713	1N755A
VR457	152-0422-00	XB010300		SEMICOND DEVICE:SILICON,VOLT.VAR CAP.,7PF,4V		
VR466	152-0395-00	XB010300		SEMICOND DEVICE:ZENER,0.4W,4.3V,5%	07910	1N749A
VR484	152-0279-00	XB010300		SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	07910	1N751A
VR494	152-0279-00	XB010300		SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	07910	1N751A
VR550	152-0175-00	XB010275		SEMICOND DEVICE:ZENER,0.4W,5.6V,5%	04713	1N752A
VR552	152-0175-00	XB010275		SEMICOND DEVICE:ZENER,0.4W,5.6V,5%	04713	1N752A
VR583	152-0227-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-6585
VR650	152-0175-00	XB010275		SEMICOND DEVICE:ZENER,0.4W,5.6V,5%	04713	1N752A
VR652	152-0175-00	XB010275		SEMICOND DEVICE:ZENER,0.4W,5.6V,5%	04713	1N752A
VR948	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,7.5V,5%	07910	1N4372A

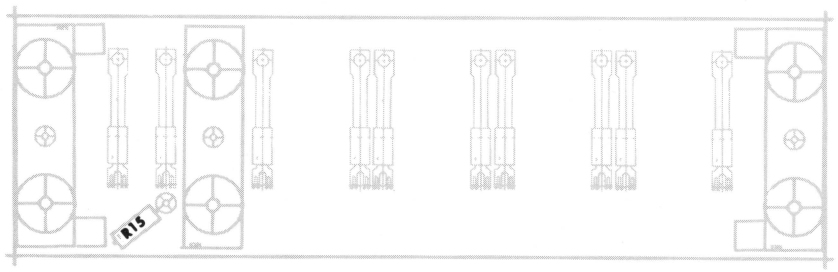
[1]Furnished as a unit with R948.
[2]Furnished as a unit with R1140.
[3]Furnished as a unit with R1403.
[4]Option 7 only.
[5]Furnished as a unit with R1815.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
VR987	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,7.5V,5%	07910	1N4372A
VR1145	152-0395-00			SEMICOND DEVICE:ZENER,0.4W,4.3V,5%	07910	1N749A
VR1146	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR1282	152-0168-00			SEMICOND DEVICE:ZENER,0.4W,12V,5%	04713	1N963B
VR1514	152-0280-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	1N753A
VR1527	152-0149-00			SEMICOND DEVICE:ZENER,0.4W,10V,5%	04713	1N916B
VR1532	152-0283-00			SEMICOND DEVICE:ZENER,0.4W,43V,5%	04713	1N976B
VR1533	152-0427-00			SEMICOND DEVICE:ZENER,0.4W,100V,5%	04713	1N985B
VR1604[1]	152-0306-00			SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	81483	1N960B
VR1605[1]	152-0306-00			SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	81483	1N960B
VR1622[1]	152-0241-00			SEMICOND DEVICE:ZENER,0.4W,33V,5%	04713	1N973B
VR1639[1]	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	07910	1N751A
VR1641[1]	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	07910	1N751A
VR1712	152-0304-00			SEMICOND DEVICE:ZENER,0.4W,20V,5%	04713	1N968B
VR1718	152-0580-00			SEMICOND DEVICE:ZENER,0.4W,75V,2%		
VR1722	152-0304-00			SEMICOND DEVICE:ZENER,0.4W,20V,5%	04713	1N968B
VR1724	152-0268-00			SEMICOND DEVICE:ZENER,0.4W,56V,5%	04713	1N979B
VR1725	152-0294-00	B010100	B010134	SEMICOND DEVICE:ZENER,1W,36V,5%	04713	1N3033B
VR1725	152-0281-00	B010135		SEMICOND DEVICE:ZENER,0.4W,22V,5%		
VR1726	152-0411-00			SEMICOND DEVICE:ZENER,0.25W,9V,5%	04713	1N937
VR1772	152-0279-00	XB010135		SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	07910	1N751A
VR1794	152-0127-00	XB010135		SEMICOND DEVICE:ZENER,0.4W,7.5V,5%	04713	1N755A
VR1945	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR1995	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035
VR2038	152-0304-00			SEMICOND DEVICE:ZENER,0.4W,20V,5%	04713	1N968B

[1]Option 7 only.



Attenuator Side



Cam Side

Figure 1. A1—Vertical Attenuator circuit boards.

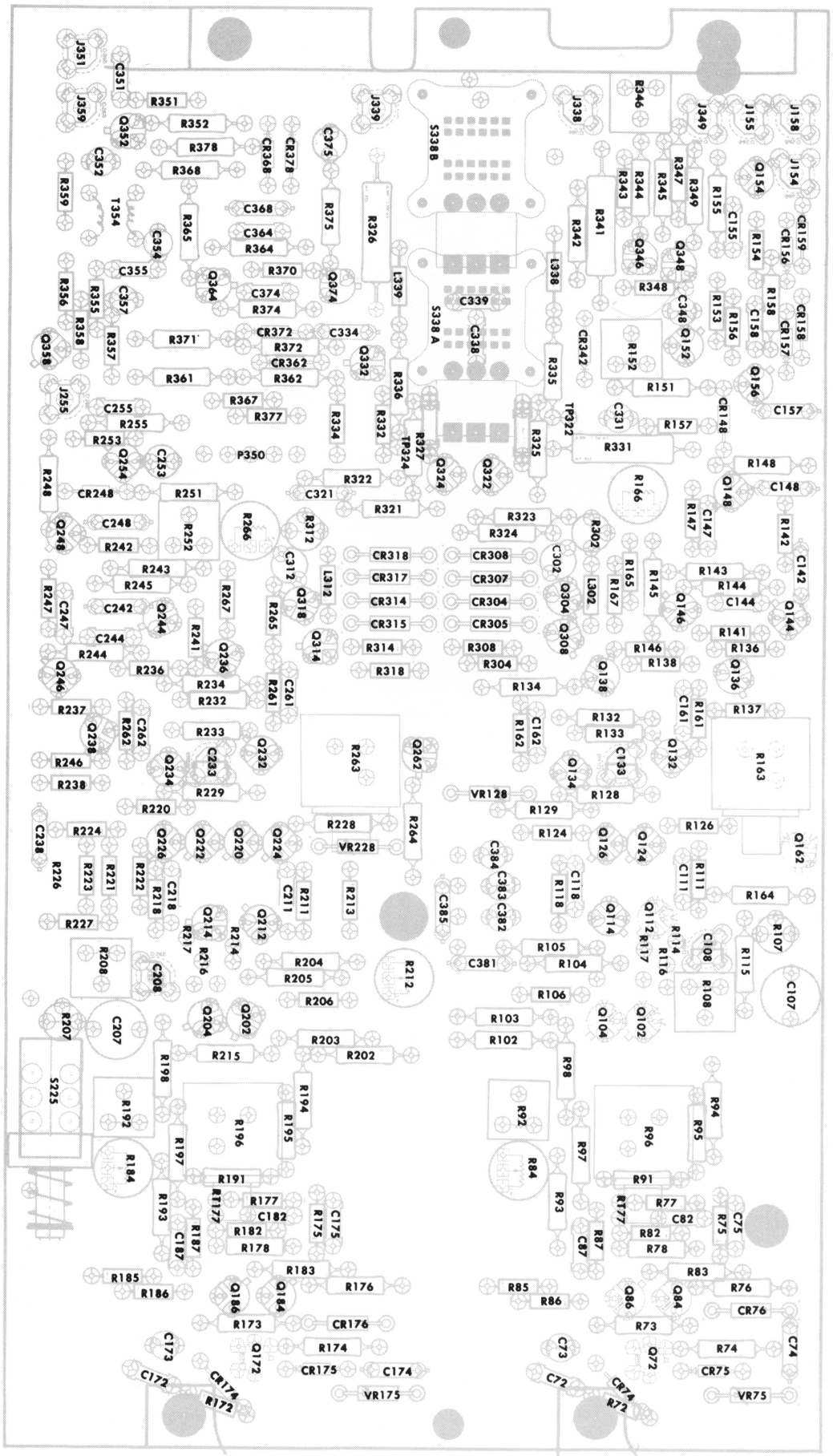


Figure 2. A2—Preamp circuit board.

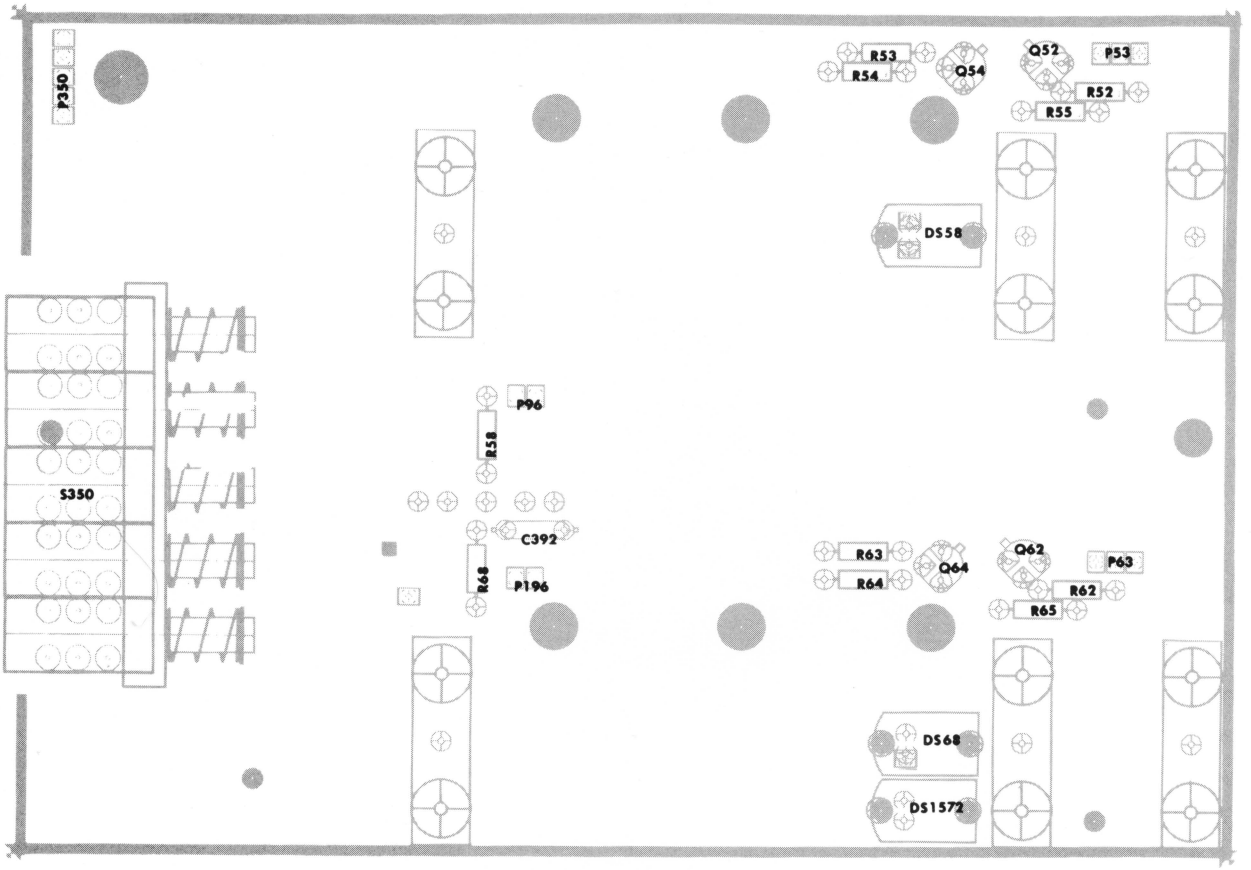


Figure 3. A3—Vertical Mode Switching circuit board.

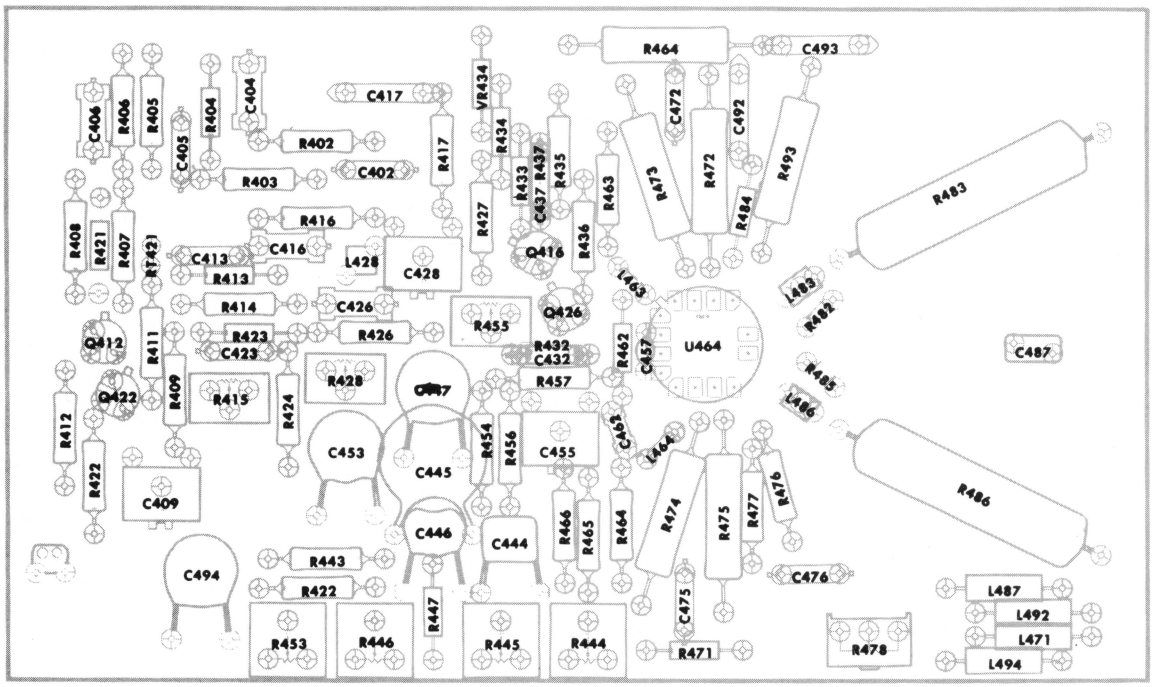


Figure 4. A4—Vertical Output circuit board.

Figure 5. A5—Trigger circuit board.

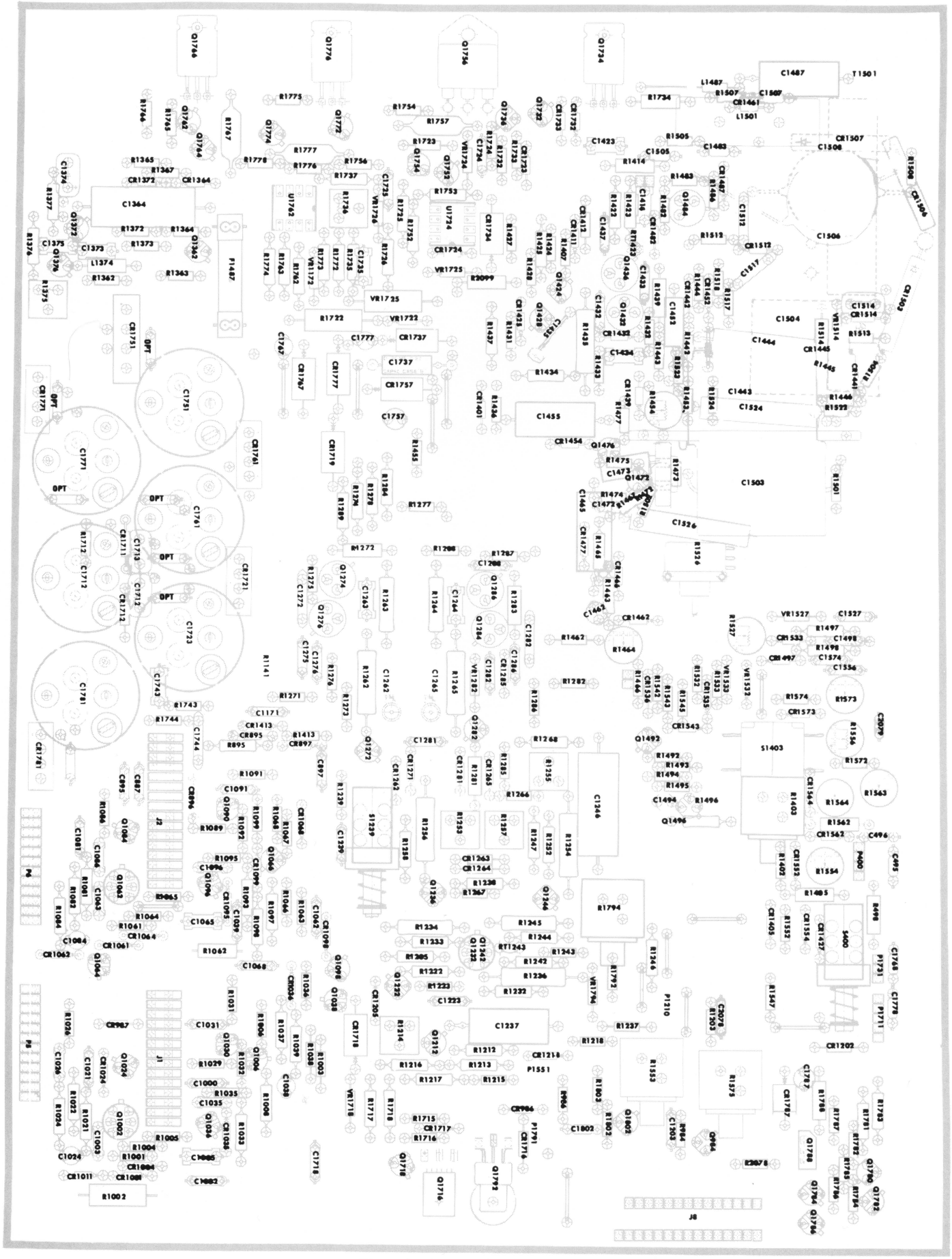


Figure 6. A6—Interface circuit board.

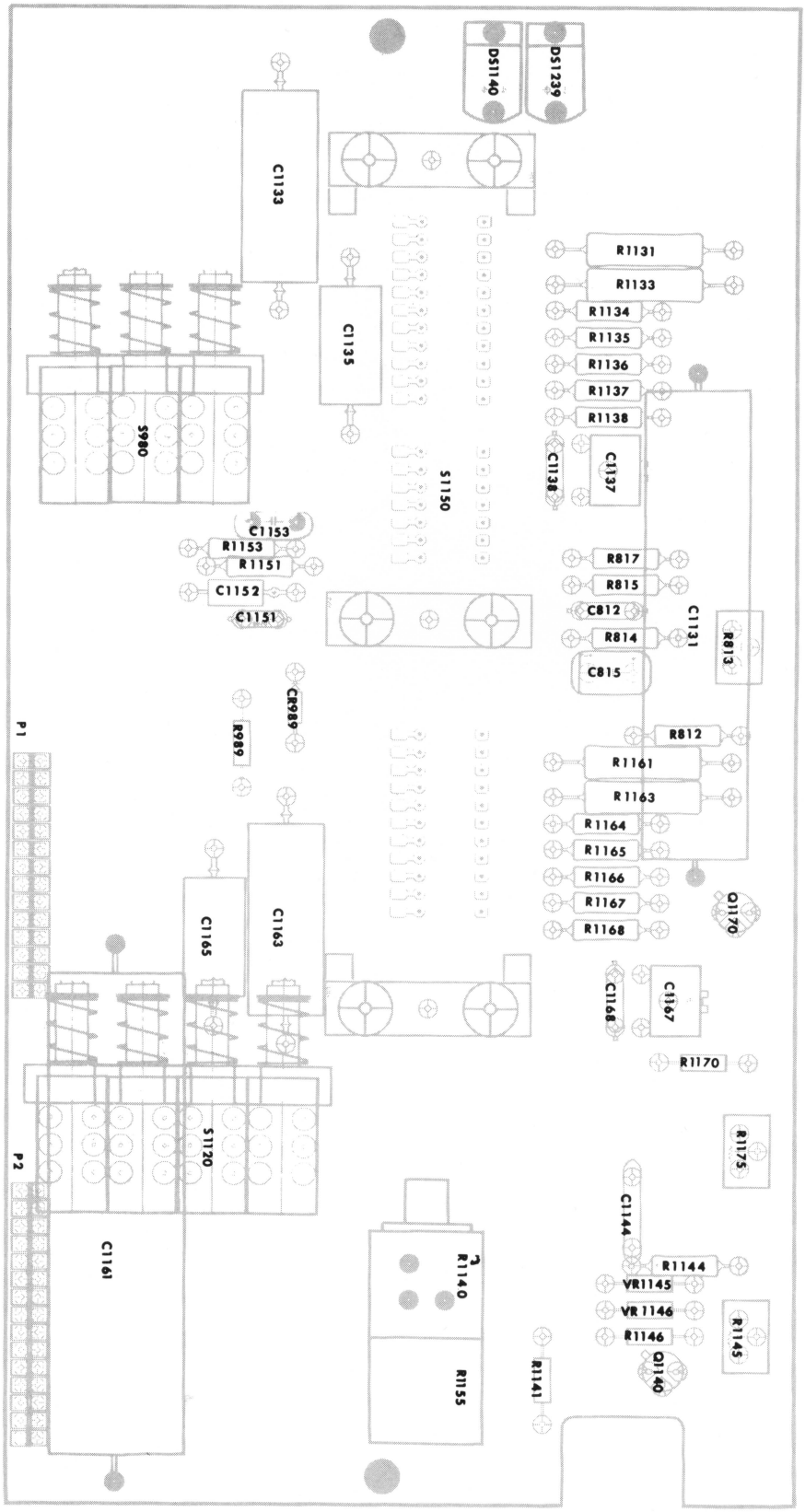


Figure 7. A7—Timing circuit board.

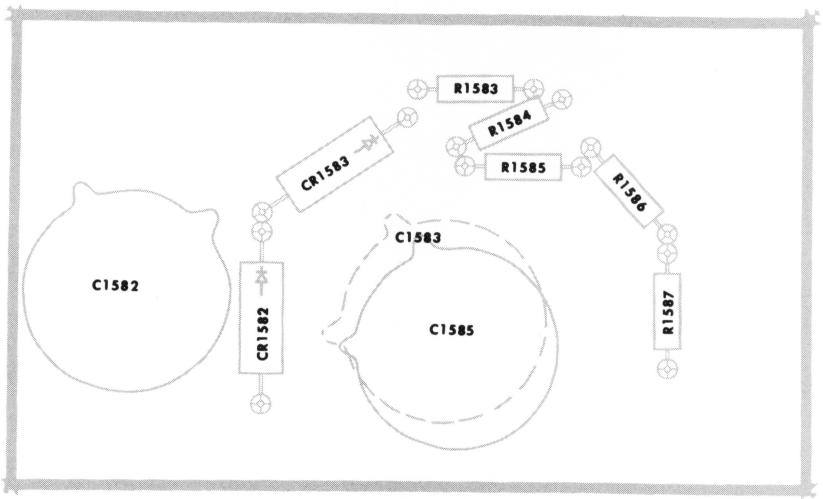


Figure 8. A8—High Voltage Multiplier circuit board.

Figure 9. A10—Storage circuit board.

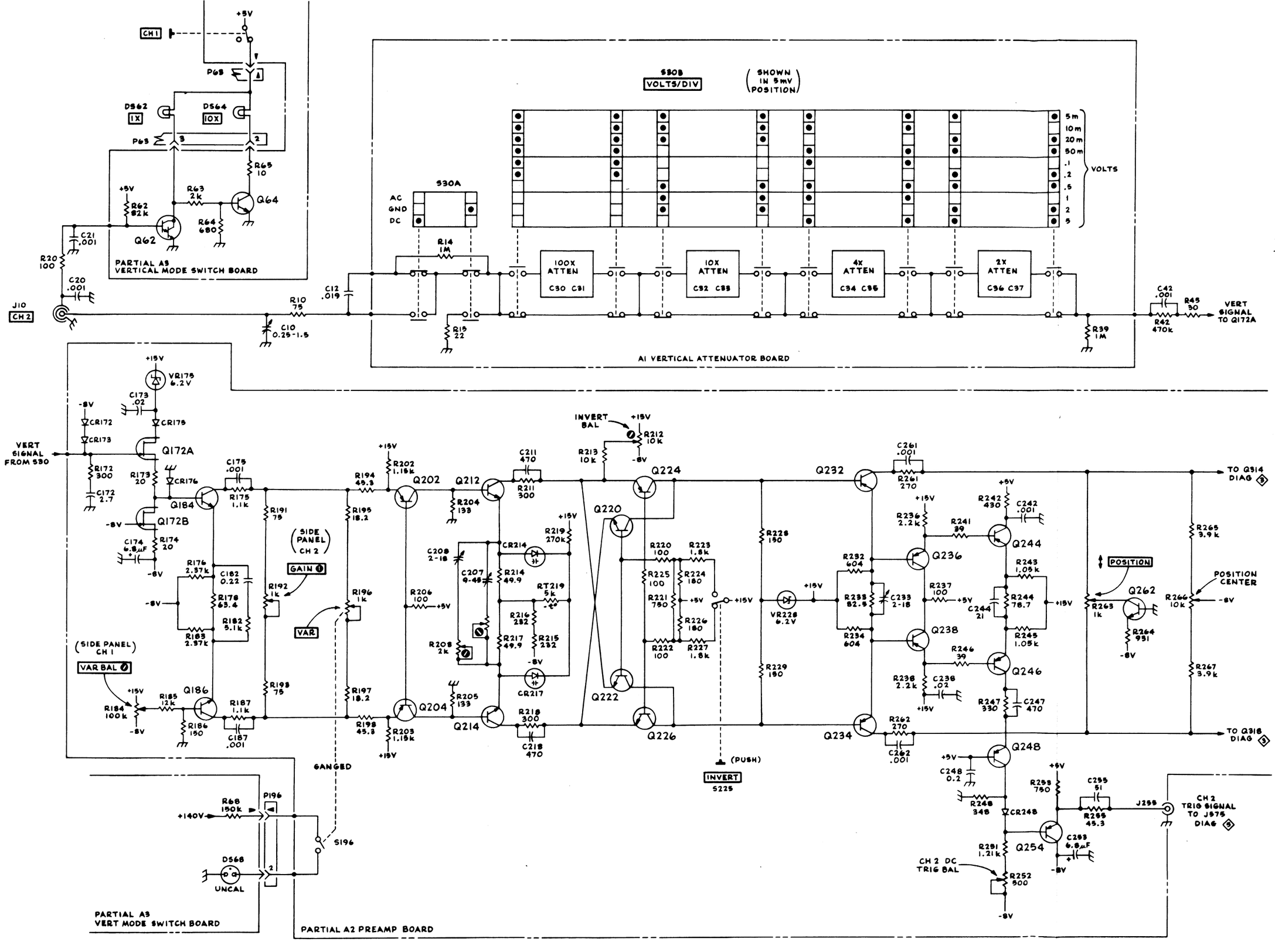
CH 1 VERTICAL PREAMP ◇1

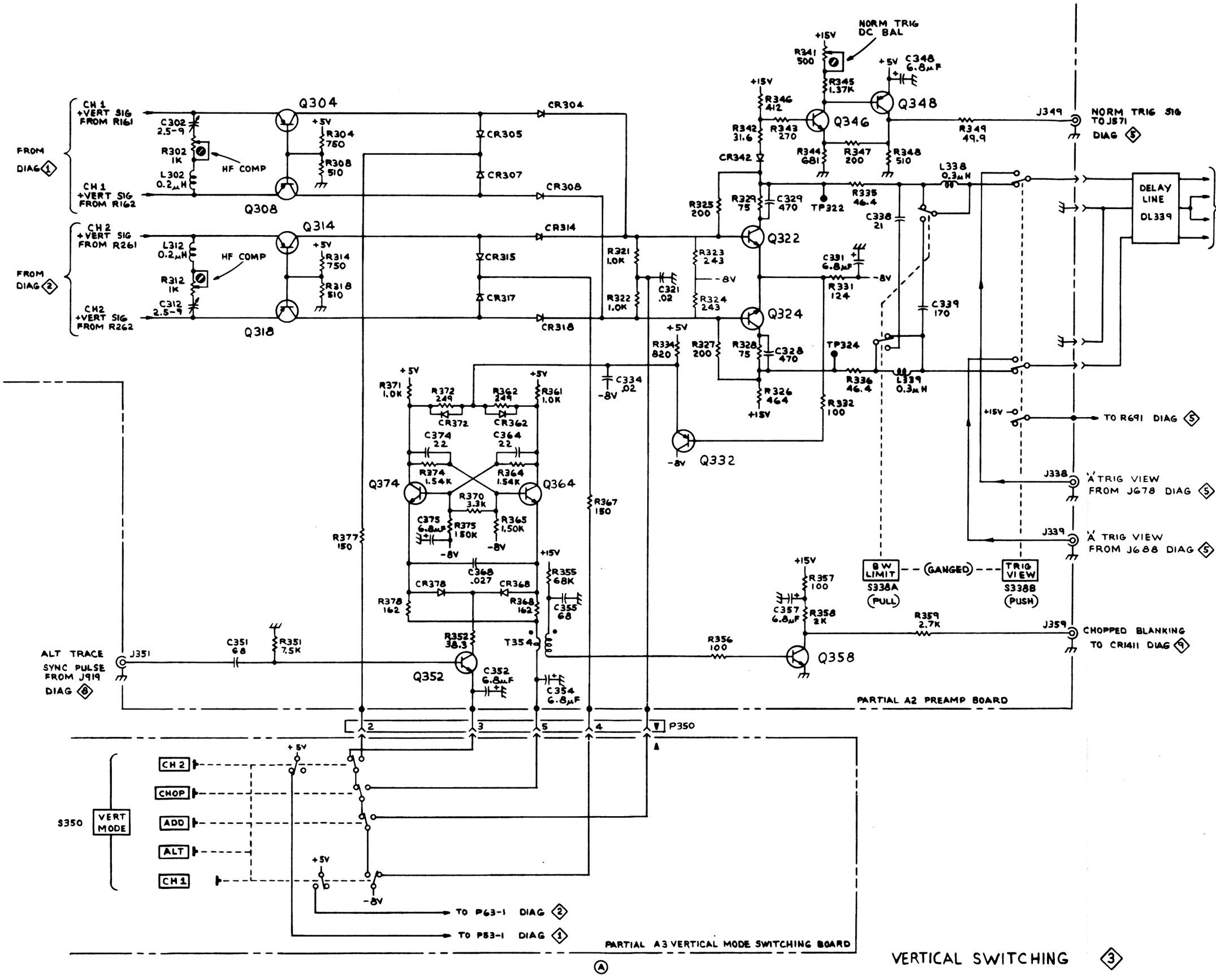
CH 2
+5V
TO CR1202 DIAG ◇9
P53 1
DS52 1X
DS54 10X
P53 3
2
R55 10
R53 2k
Q54
R54 680
+5V
R52 82k
Q52
C21 .001
R20 100
C20 .001
PARTIAL A3 VERT MODE SWITCH BOARD
J10 CH 1
R10 75
C10 0.25-1.5
C12 .019
S30B VOLTS/DIV (SHOWN IN AC POSITION)
S30A
AC
GND
DC
R14 1M
R15 22
100X ATTEN C30 C31
10X ATTEN C32 C33
4X ATTEN C34 C35
2X ATTEN C36 C37
5m
10m
20m
50m
.1
.2
.5
1
2
5
VOLTS
R39 1M
C42 .001
R42 470k
R45 30
TO Q72A
A1 VERTICAL ATTENUATOR BOARD

+15V
VR75 6.2V
C73 .02
-8V
CR72
CR73
CR75
VERT SIGNAL FROM R45
Q72A
R72 300
C72 2.7
R73 20
CR76
C75 .001
R75 1.1k
Q84
Q72B
-8V
R74 20
C74 6.8µF
R76 2.37k
C82 0.22
R78 63.4
R82 5.1k
R83 2.37k
R91 75
(SIDE PANEL) (CH 1) GAIN
R92 1k
VAR
R93 75
R95 18.2
R96 1k
R97 18.2
(SIDE PANEL) (CH 1) VAR BAL
R84 100k
R85 12k
Q86
R86 150
R87 1.1k
C87 .001
R94 45.3
+15V
R102 1.15k
Q102
R104 133
R106 100
+5V
C108 2-18
C107 9-45
R107 5k
R108 2k
Q104
R98 45.3
R103 1.15k
R105 133
Q112
C111 470
R111 300
+15V
R119 270k
CR114
R114 49.9
RT119 5k
R116 232
R115 232
-8V
R117 49.9
CR117
Q114
R118 300
C118 470
Q124
+15V
R124 1.8k
R126 150
+5V
Q126
R128 150
R129 150
+15V
VR128 6.2V
Q132
C161 .001
R161 270
R132 604
R133 82.5
C133 2-18
R134 604
Q134
R162 270
C162 .001
+15V
R136 2.2k
Q136
R138 2.2k
+15V
R141 39
Q138
R137 100
+5V
Q148
C148 348
R148 348
CR148
Q154
-8V
+5V
R142 430
C142 .001
Q144
R143 1.05k
C144 27
R144 78.7
R145 1.05k
+15V
R146 39
Q146
R147 330
C147 470
+5V
R153 330
C155 51
R155 45.3
R154 100
Q158
+5V
R156 750
CR156
CR157
C158 47
R158 49.3
Q156
C157 .02
R157 330
-8V
CR158
CR159
R151 1.21k
CH 1 DC TRIG BAL
R152 500
-8V
POSITION
Q162
R163 1k
R164 931
-8V
POSITION CENTER
R166 10k
-8V
R165 3.9k
R167 3.9k
TO Q304 DIAG ◇3
TO Q308 DIAG ◇3
J154
TO P1210 DIAG ◇4
J155
CH 1 TRIGGER SIGNAL TO J573 DIAG ◇5
J158
J159
CH 1 VERT SIGNAL OUT
PARTIAL A2 PREAMP BOARD

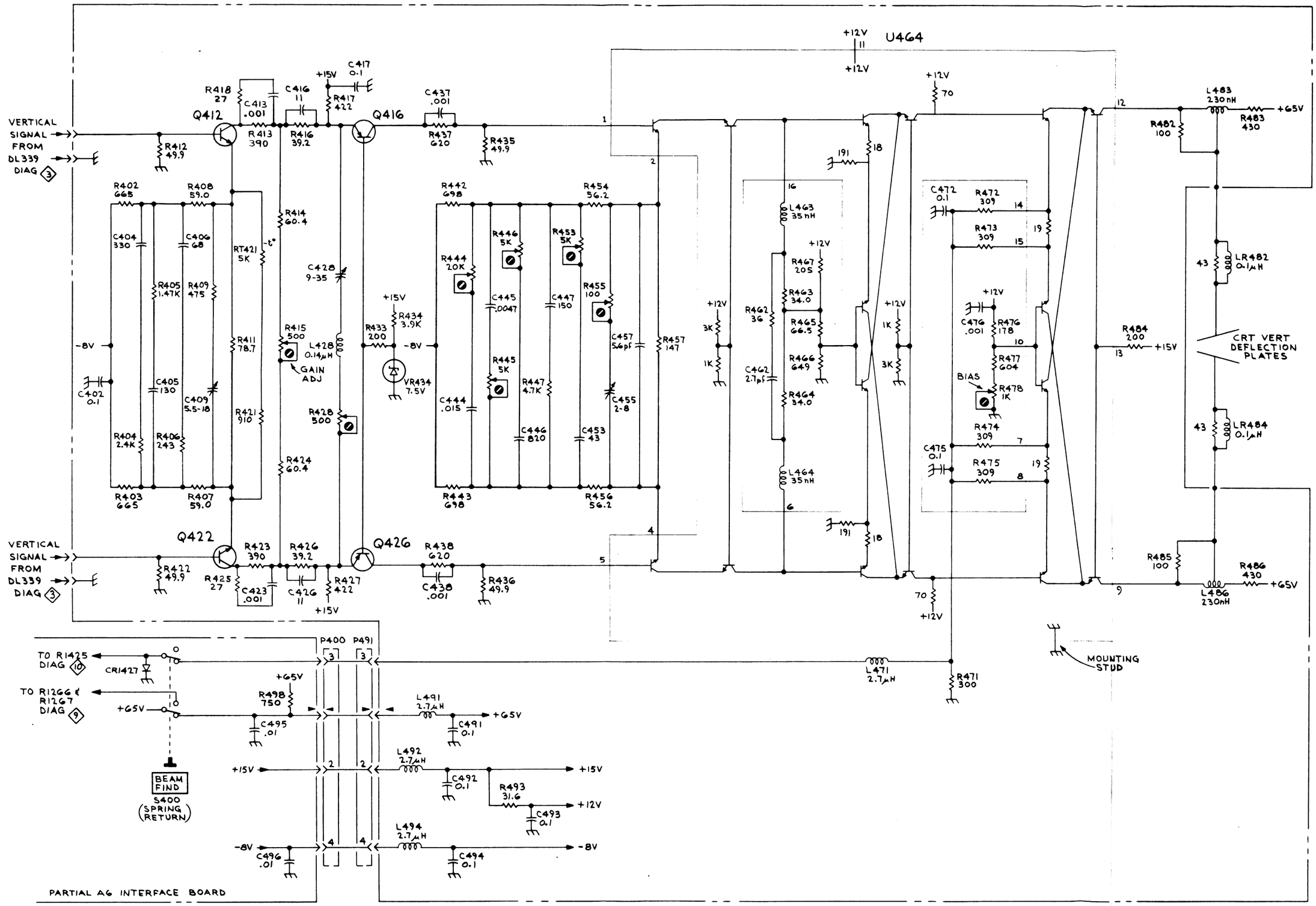
R58 150k
+140V
P96 2
S96
DS58 UNCAL
PARTIAL A3 MODE VERT SWITCH BOARD

Ⓐ
1-78


CH 1
+5V
P68
DS62
1X
DS64
10X
P63
R65
10
R63
2k
Q64
+5V
R62
82k
R64
680
Q62
C21
.001
R20
100
C20
.001
PARTIAL A3
VERTICAL MODE SWITCH BOARD
J10
CH 2
R10
75
C10
0.25-1.5
C12
.019
S30B
VOLTS/DIV
(SHOWN IN 5mV POSITION)
S30A
AC
GND
DC
R14
1M
R15
22
100X ATTEN
C30 C31
10X ATTEN
C32 C33
4X ATTEN
C34 C35
2X ATTEN
C36 C37
5m
10m
20m
50m
.1
.2
.5
1
2
5
VOLTS
R39
1M
C42
.001
R42
470k
R45
30
VERT SIGNAL TO Q172A
A1 VERTICAL ATTENUATOR BOARD
+15V
VR175
6.2V
C173
.02
-8V
CR172
CR173
CR175
VERT SIGNAL FROM S30
Q172A
R172
300
C172
2.7
R173
20
CR176
Q184
Q172B
C175
.001
R175
1.1k
-8V
C174
6.8μF
R174
20
R176
2.37k
C182
0.22
R178
63.4
R182
5.1k
R183
2.97k
(SIDE PANEL CH 1)
VAR BAL
R184
100k
R185
12k
Q186
R186
150
R187
1.1k
C187
.001
R191
75
R192
1k
R193
75
(SIDE PANEL CH 2)
GAIN
VAR
R194
49.3
R195
18.2
R196
1k
R197
18.2
R198
49.3
R202
1.15k
Q202
Q204
R203
1.15k
R204
133
R205
133
Q212
Q214
C211
470
R211
300
R206
100
+5V
C208
2-18
C207
9-48
R208
2k
R214
49.9
R216
232
R217
49.9
R215
232
CR214
CR217
R219
270k
RT219
5k
R218
300
C218
470
INVERT BAL
R212
10k
R213
10k
Q224
Q220
Q222
Q226
R220
100
R225
100
R221
750
R222
100
R223
1.8k
R224
180
R226
180
R227
1.8k
(PUSH)
INVERT
S225
R228
150
R229
150
VR228
6.2V
Q232
Q234
C261
.001
R261
270
R262
270
C262
.001
R236
2.2k
R241
39
Q236
R237
100
Q238
R238
2.2k
C238
.02
R232
604
R233
82.5
C233
2-18
R234
604
R242
430
C242
.001
Q244
R243
1.05k
C244
21
R244
78.7
R245
1.05k
R246
39
Q246
R247
330
C247
470
Q248
C248
0.2
R248
348
CR248
R251
1.21k
Q254
R252
500
C253
6.8μF
R253
750
C255
51
R255
45.3
J255
CH 2 TRIG SIGNAL TO J975 DIAG 5
CH 2 DC TRIG BAL
POSITION
Q262
R263
1k
R264
931
R265
3.9k
R266
10k
POSITION CENTER
R267
3.9k
TO Q314 DIAG 3
TO Q318 DIAG 3
GANGED
S196
R68
150k
+140V
P196
D568
UNCAL
PARTIAL A3
VERT MODE SWITCH BOARD
PARTIAL A2 PREAMP BOARD



VERTICAL SWITCHING 3



VERTICAL OUTPUT BOARD 4

MAR 1974 mgf

S510A 'B' SOURCE — START AFTER DELAY, NORM, CH 1, CH 2, EXT (SHOWN IN CH 1 POSITION)

S515 'B' COUPLING — AC, LF REJ, HF REJ, DC (SHOWN IN AC POSITION)

NORM TRIG FROM J349 DIAG 3 — J571

CH 1 TRIG FROM J155 DIAG 1 — J573

CH 2 TRIG FROM J255 DIAG 2 — J575

J500 'B' EXT TRIG

C512 .02, R512 56k, C515 22, C511 100, R511 100k, R516 1M

R502 750k, C502 21, R503 330k, C503 39

+8V, R522 100, C522 .01, Q522, R518 100, R523 15

R517 100, CR517, Q524, R524 15, R525 100, C525 .01, -8V

'B' TRIG LEVEL — R535 20k, R536 2k

R530 10k, R531 680, C531 .01, R537 56

B (DLY'D) TRIGGER LEVEL

'B' SLOPE S630

U540 MO55

+15V +5V R542 1.8k, R539 2.2k

R527 1.47k, C528 22, R528 39, R529 147k, 100, 2.7k 2.7k, 500, 50, 5.5k

R540 2.2k, R541 6.8k, R538 3.6k

B TRIG SLOPE CENTERING — R544 10k, R545 20k

L547 0.14μH, R547 100, R549 330, C549 .01, R546 100, L546 0.14μH

Q552, Q550

S510B 'B' SOURCE (SHOWN IN CH 1 POSITION) — START AFTER DELAY, NORM, CH 1, CH 2, EXT

R552 33, R558 4.75k, 'B' HOLD-OFF FROM CR846 DIAG 8

CR554, +65V, ARMING TD CR552

R553 18k, R557 100, RT557 5k t°, R554 100k, -8V

R551 17.8k, +65V

CR553, R550 33, FIRING TD CR550

'B' TRIGGER SENSITIVITY — R556 5.6k, R555 20k, -8V

'B' TRIGGER TO R862 DIAG 8

S610 'A' SOURCE — NORM, CH 1, CH 2, LINE, EXT, EXT÷10 (SHOWN IN CH 1 POSITION)

S615 'A' COUPLING — AC, LF REJ, HF REJ, DC (SHOWN IN AC POSITION)

LINE TRIG FROM R1774 DIAG 11 — J6-11

J600 'A' EXT TRIG

R507 49.9, R508 49.9, R509 49.9

C612 .02, R612 56k, C615 22, C611 100, R611 100k, R616 1M

R609 270k, C601 0.1, R602 47

R606 976k, C606 18, R607 487k, C607 21

R603 3.57M, C603 1.5, R604 100k, C604 100

+8V, R622 100, C622 .01, Q622, R618 100, R623 15

R617 100, CR617, Q624, R624 15, R625 100, C625 .01, -8V

'A' TRIG LEVEL — R635 20k, R636 2k

R630 10k, R631 680, C631 .01, R637 56

'A' TRIGGER LEVEL

'A' SLOPE S630

U640 MO55

+15V +5V R642 1.8k, R639 2.2k

R627 1.47k, C628 22, R628 39, R629 1.47k, 100, 2.7k 2.7k, 500, 50, 5.5k

R640 2.2k, R641 6.8k, R638 3.6k

A TRIG SLOPE CENTERING — R644 10k, R645 20k

L647 0.14μH, R647 100, R649 330, C649 .01, R646 100, L646 0.14μH

Q652, Q650

R652 33, R658 4.75k, 'A' HOLDOFF FROM CR957 DIAG 8

ARMING TD CR652

R651 17.8k, +65V

R657 100, RT657 5k t°

'A' TRIGGER SENSITIVITY — R656 5.6k, R655 20k, -8V

'A' TRIGGER TO R901 DIAG 8

R650 33, FIRING TD CR650

R687 820, J688, 'A' TRIG VIEW TO J339 DIAG 3

Q688, R688 43, R684 360, Q682, R683 3.6k, C676 27, R676 33, R675 200, R689 680, TRIG VIEW CENTERING, C691 6.8μF, R694 220, -8V

R682 10, R672 10, R679 3.6k, Q672, R679 680, R674 360, Q678, R678 43, J678, 'A' TRIG VIEW TO J338 DIAG 3, R677 820

S3388 3 TRIG VIEW (PUSH) — +15V, R691 3k, +15V

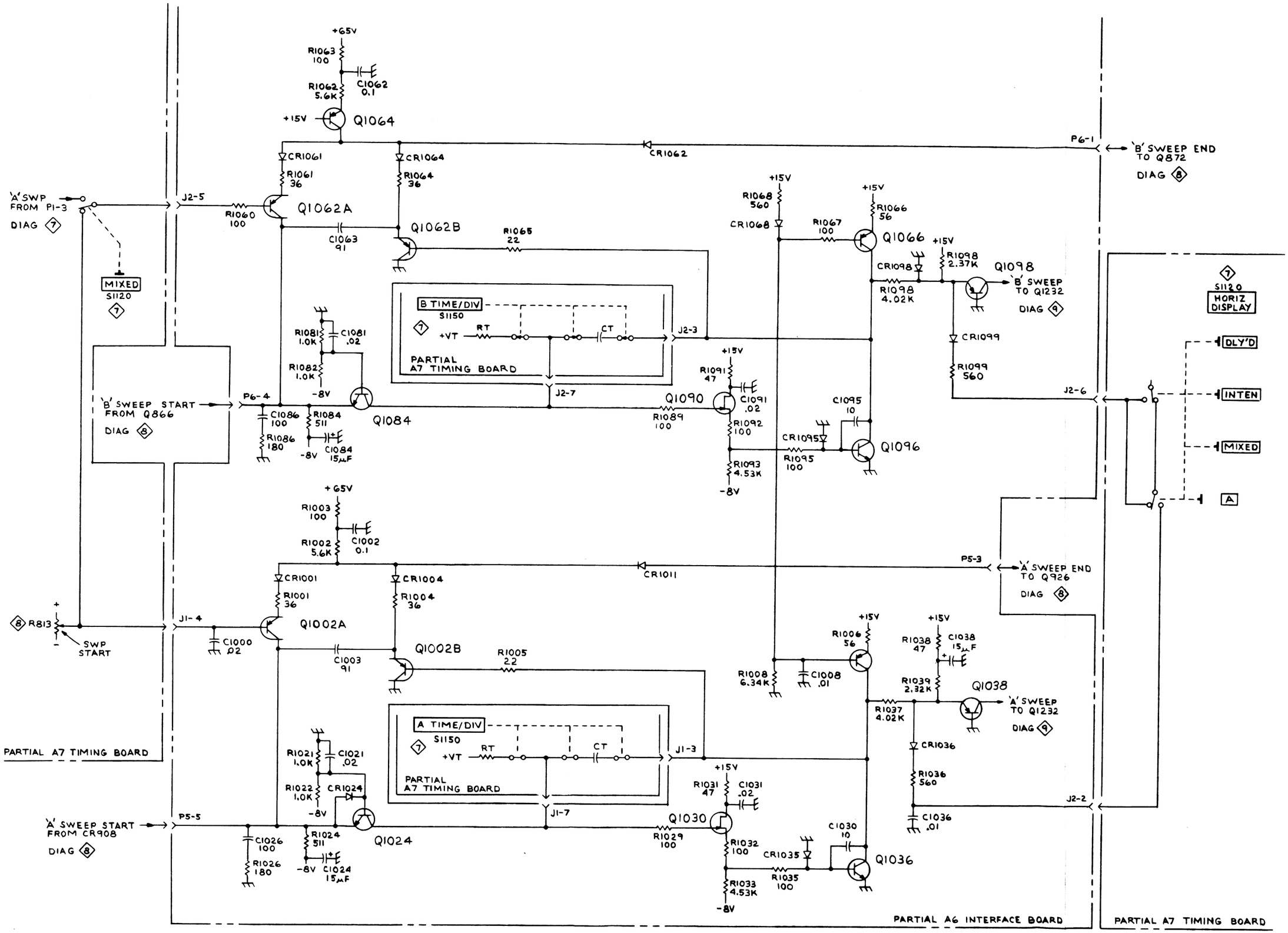
PARTIAL A5 TRIGGER BOARD

PARTIAL A2 PREAMP BOARD

A & B TRIGGER GENERATOR 5

A

1-74



A-B SWEEP GENERATORS 6

A7 TIMING BOARD

S1120 HORIZ DISPLAY

MIXED | A INTEN | B DLY'D | A

TO R1096 DIAG ◇6 — P2-2 — -8V
TO R1099 DIAG ◇6 — P2-6
TO CR1401 DIAG ◇10 — P2-15 — +5V
TO CR821 DIAG ◇6 — P2-11 — -8V
TO CR896 DIAG ◇8 — P2-8 — -8V
TO CR893 DIAG ◇8 — P2-9
TO Q1002A DIAG ◇6 — P1-4 — R813 ◇8 — SWP START
TO Q1062A DIAG ◇6 — P2-5
TO R827 DIAG ◇8
FROM Q1036 DIAG ◇6 — P1-9
TO CR867 DIAG ◇8 — P2-10 — -8V / -5V
TO R1029 DIAG ◇6 — P1-7

'A' SWP CAL — +65V — Q1140 — R1145 10k — R1144 1.98k — C1144 0.1 — +65V
'B' SWP CAL — +65V — Q1170 — R1175 10k — R1170 47k — +15V
VR1145 4.9V — VR1146 6.2V — R1146 4.75k — +15V

PARTIAL A6 INTERFACE BRD — +140V — R1141 150k — J2-14 — DS1140 — UNCAL
CLOSED IN DETENT FULL CW — VARIABLE — R1140 50k — +15V

R1133 1.0M — R1135 250k — R1137 100k — R1139 50k
R1131 1.5M — R1134 500k — R1136 200k
R1151 340k — R1153 38.3k — C1153 790
C1132 100 — R1132 100 — C1131 10µF
C1133 0.1 — C1135 .001
C1138 48 — C1137 2-8
C1152 1.5µF — C1151 0.5

P1-5 — TO R1217 DIAG ◇9 — CR897 DIAG ◇8
P1-8 — TO CR1209 DIAG ◇9
P1-12 — TO R945 DIAG ◇9

P1-18 — J5-10 — CR948 — R948 20k — A TRIG HOLDOFF — VR948 3V — +5V
S ENDS — CLOSED IN FULL CW POS OF R948 — +65V
PARTIAL A5 TRIGGER BOARD

S980 TRIG MODE — AUTO / NORM — PUSH TO RESET SINGL SWP (SPRING RETURN)
P1-10 — TO Q986 DIAG ◇8 — +5V
P1-9 — TO PIN 19, U980 DIAG ◇8
+5V — R989 6.8k — CR989 — P1-11 — TO CR987 DIAG ◇8

R1161 1.5M — R1163 1.0M — R1164 500k — R1165 250k — R1166 200k — R1167 100k — R1168 50k
C1162 100 — R1162 100 — C1161 1µF
C1163 .01 — C1165 .001
C1168 48 — C1167 2-8
P2-7 — TO R1089 DIAG ◇6
P2-3 — FROM Q1096 DIAG ◇8

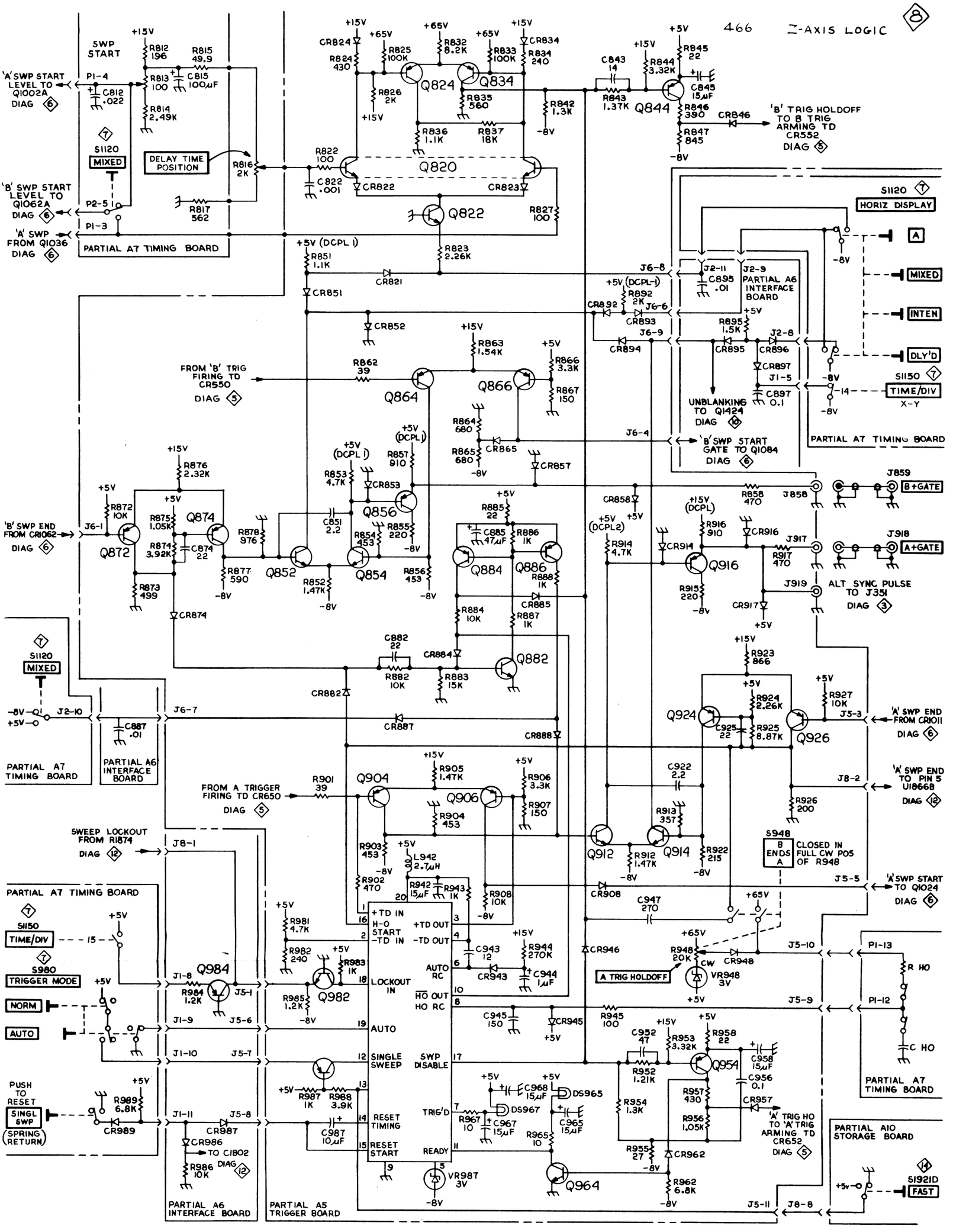
1	2	3	4	5	6	7	8	9	10	11	14	15	16	17	18	19	20	24	25	26	27	28	29	30	31	32	33	34
X-Y																												
s .5																												
s .2																												
s .1																												
ms 50																												
ms 20																												
ms 10																												
ms 5																												
ms 2																												
ms 1																												
ms .5																												
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µs .05																												

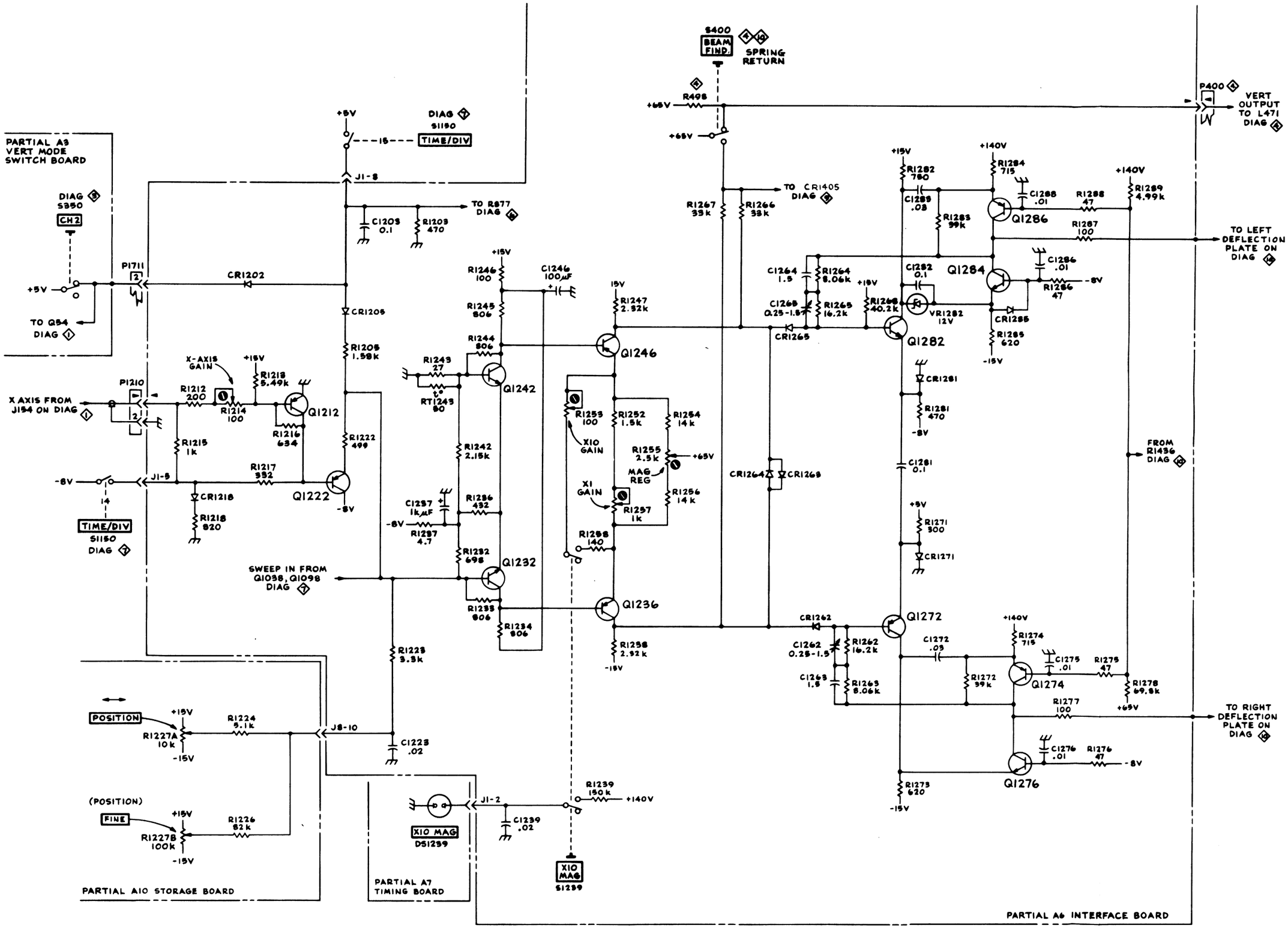
S1150 'A' AND 'B' TIME/DIV AND DELAY TIME

'A' (SWITCH SHOWN IN X-Y POSITION) — 'B'

Ⓐ

A & B TIMING SWITCH ◇7


SWP START
'A' SWP START LEVEL TO Q1002A DIAG 6
'B' SWP START LEVEL TO Q1062A DIAG 6
'A' SWP FROM Q1036 DIAG 6
PARTIAL A7 TIMING BOARD
S1120 MIXED
DELAY TIME POSITION
Q820
Q822
Q824
Q834
Q844
'B' TRIG HOLDOFF TO B TRIG ARMING TD CR552 DIAG 5
S1120 HORIZ DISPLAY
A
MIXED
INTEN
DLY'D
S1150 TIME/DIV X-Y
PARTIAL A6 INTERFACE BOARD
UNBLANKING TO Q1424 DIAG 10
'B' SWP START GATE TO Q1084 DIAG 6
FROM 'B' TRIG FIRING TD CR550 DIAG 5
Q864
Q866
Q872
Q874
Q852
Q854
Q856
Q884
Q886
Q882
Q916
J859 B+GATE
J918 A+GATE
ALT SYNC PULSE TO J351 DIAG 3
'B' SWP END FROM CR1062 DIAG 6
Q924
Q926
'A' SWP END FROM CR1011 DIAG 6
'A' SWP END TO PIN 5 U1866B DIAG 12
FROM A TRIGGER FIRING TD CR650 DIAG 5
Q904
Q906
Q912
Q914
S948 B ENDS A CLOSED IN FULL CW POS OF R948
'A' SWP START TO Q1024 DIAG 6
SWEEP LOCKOUT FROM R1874 DIAG 12
PARTIAL A7 TIMING BOARD
S1150 TIME/DIV
S980 TRIGGER MODE
NORM
AUTO
PUSH TO RESET SINGL SWP (SPRING RETURN)
Q984
Q982
Q964
Q954
+TD IN
H-O START
-TD IN
+TD OUT
-TD OUT
AUTO RC
LOCKOUT IN
HO OUT
HO RC
AUTO
SINGLE SWEEP
SWP DISABLE
RESET TIMING
RESET START
TRIG'D
READY
A TRIG HOLDOFF
VR948 3V
VR987 3V
DS965
DS967
CR989
CR987
CR986
TO C1802 DIAG 12
PARTIAL A6 INTERFACE BOARD
PARTIAL A5 TRIGGER BOARD
PARTIAL A10 STORAGE BOARD
S1921D FAST
'A' TRIG HO TO 'A' TRIG ARMING TD CR652 DIAG 5
R HO
C HO
PARTIAL A7 TIMING BOARD


PARTIAL A3 VERT MODE SWITCH BOARD
DIAG S350 CH2
+5V
TO Q54 DIAG 1
P1711
CR1202
+5V
DIAG S1150 TIME/DIV
J1-8
TO R877 DIAG 4
C1203 0.1
R1203 470
CR1205
R1205 1.58k
X-AXIS GAIN
+15V
R1218 5.49k
P1210
X AXIS FROM J154 ON DIAG 1
R1212 200
R1214 100
Q1212
R1216 634
R1222 499
R1215 1k
R1217 332
-8V
J1-5
CR1218
R1218 820
Q1222
-8V
14
TIME/DIV S1150 DIAG 7
SWEEP IN FROM Q1038, Q1098 DIAG 7
+15V
R1246 100
C1246 100µF
R1245 806
R1244 806
R1243 27
RT1243 80
Q1242
C1237 1kµF
-8V
R1237 4.7
R1242 2.15k
R1236 432
Q1232
R1232 698
R1233 806
R1234 806
R1223 3.3k
C1223 .02
15V
R1247 2.32k
Q1246
R1253 100
X10 GAIN
R1252 1.5k
R1254 14k
R1255 2.5k
+65V
MAG REG
X1 GAIN
R1257 1k
R1256 14k
R1258 140
Q1236
2.92k
-15V
$400 BEAM FIND. SPRING RETURN
R498
+65V
+65V
TO CR1405 DIAG 4
R1267 33k
R1266 33k
P400 VERT OUTPUT TO L471 DIAG 4
+15V
R1282 780
C1283 .03
R1283 99k
+140V
R1284 715
C1288 .01
Q1286
R1288 47
+140V
R1289 4.99k
R1287 100
TO LEFT DEFLECTION PLATE ON DIAG 14
C1264 1.5
R1264 8.06k
C1265 0.25-1.5
R1265 16.2k
+15V
R1268 40.2k
C1282 0.1
VR1282 12V
Q1284
C1286 .01
R1286 47
-8V
CR1285
R1285 620
-15V
Q1282
CR1265
CR1264
CR1269
CR1281
R1281 470
-8V
C1281 0.1
+5V
R1271 300
CR1271
FROM R1436 DIAG 12
CR1262
Q1272
C1262 0.25-1.5
R1262 16.2k
C1263 1.5
R1263 8.06k
C1272 .03
R1272 99k
+140V
R1274 715
C1275 .01
Q1274
R1275 47
R1278 69.9k
+69V
R1277 100
TO RIGHT DEFLECTION PLATE ON DIAG 14
C1276 .01
R1276 47
-8V
Q1276
R1273 620
-15V
POSITION
+15V
R1227A 10k
-15V
R1224 5.1k
J8-10
(POSITION)
FINE
+15V
R1227B 100k
-15V
R1226 82k
PARTIAL A10 STORAGE BOARD
X10 MAG DS1239
J1-2
C1239 .02
R1239 150k
+140V
X10 MAG S1239
PARTIAL A7 TIMING BOARD
PARTIAL A6 INTERFACE BOARD

PARTIAL A6 INTERFACE BOARD

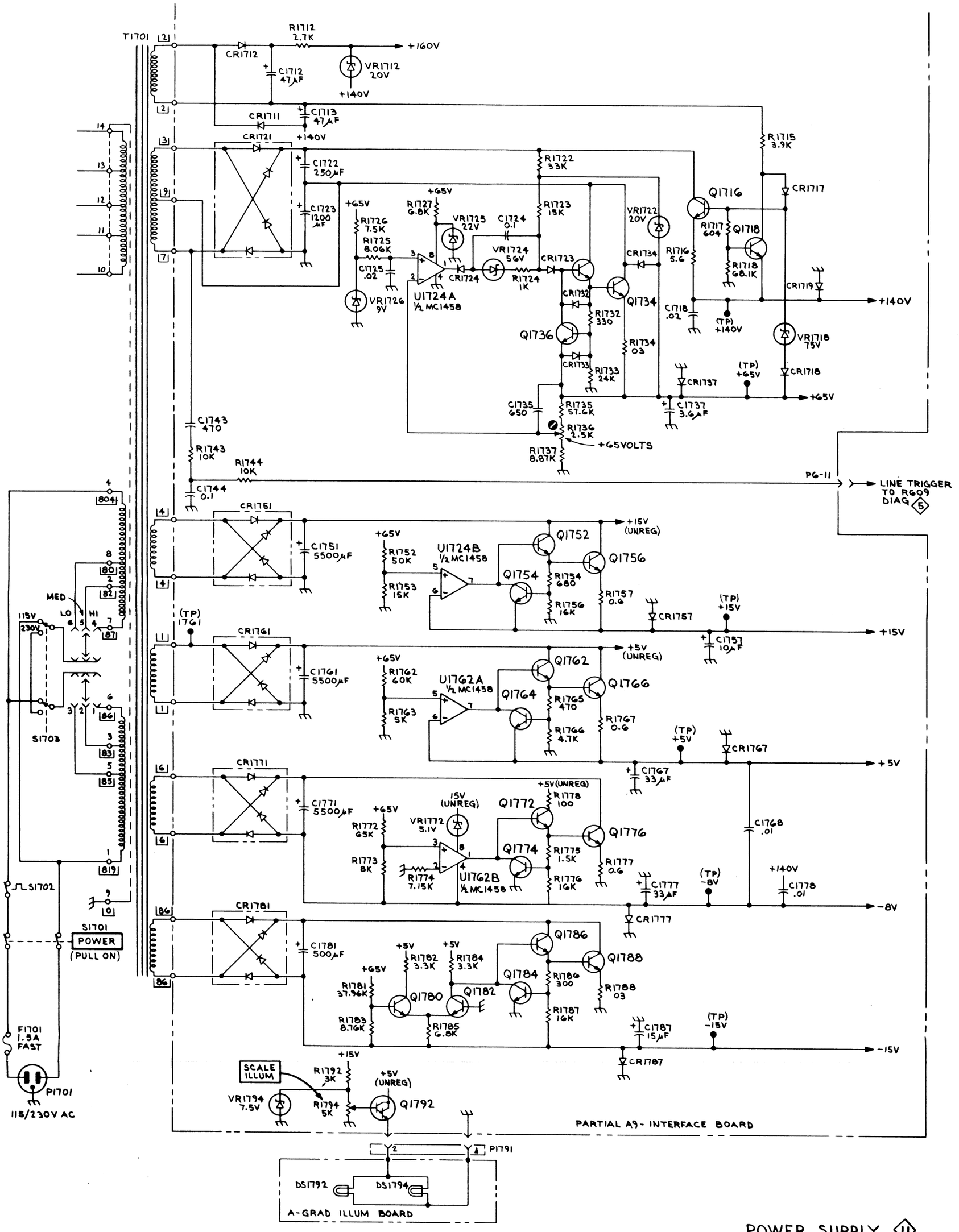
A8 HIGH VOLTAGE MULTIPLIER BRD

A10 PARTIAL STORAGE BOARD

PARTIAL A3 VERT MODE SWITCH BRD

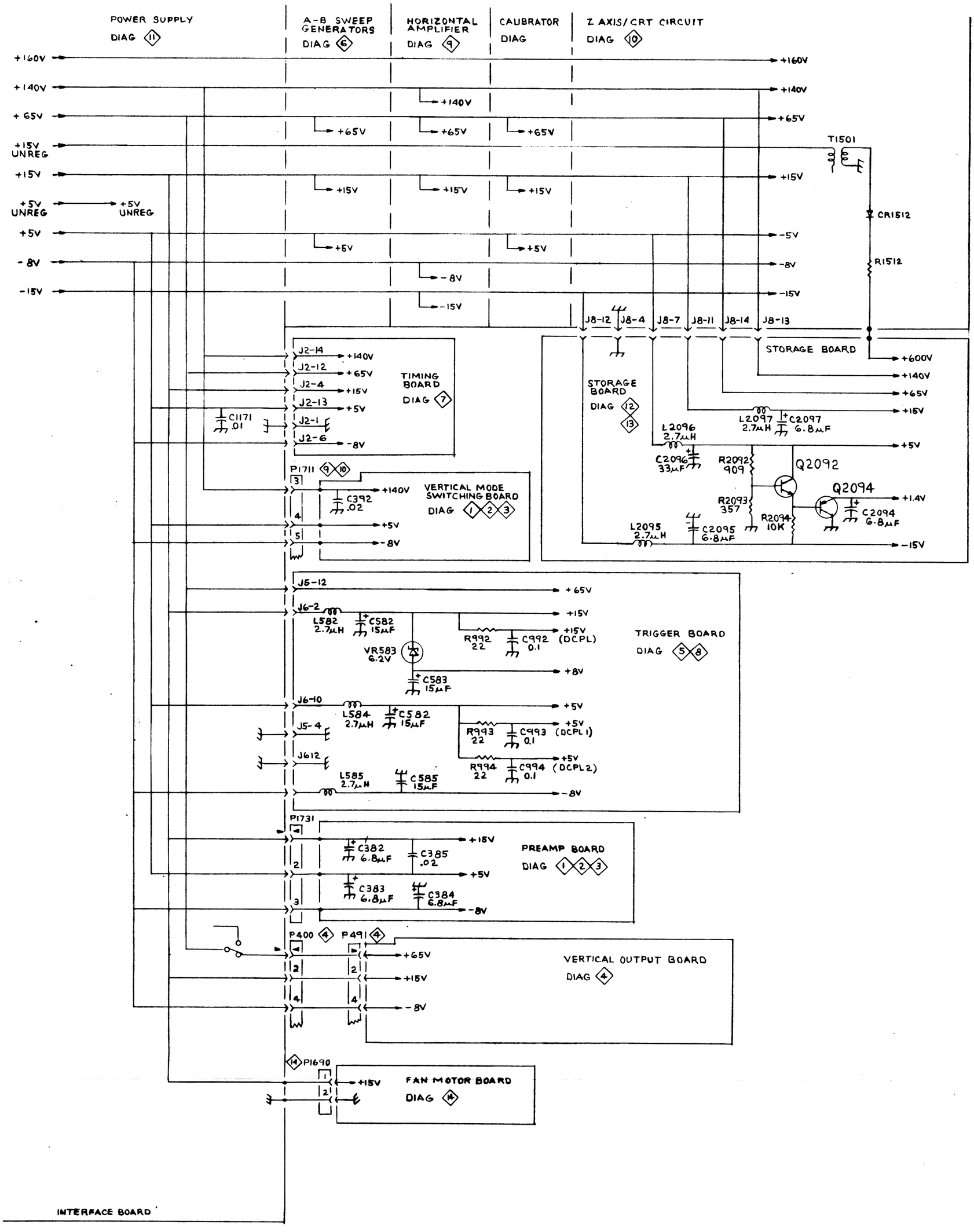
Z AXIS/CRT CIRCUIT ⑩

12-73



POWER SUPPLY 11

MAR 1974 mgf


POWER SUPPLY
DIAG 11
A-B SWEEP GENERATORS
DIAG 6
HORIZONTAL AMPLIFIER
DIAG 9
CALIBRATOR
DIAG
Z AXIS/CRT CIRCUIT
DIAG 10
+160V
+140V
+65V
+15V UNREG
+15V
+5V UNREG
+5V
-8V
-15V
T1501
CR1512
R1512
J8-12
J8-4
J8-7
J8-11
J8-14
J8-13
STORAGE BOARD
+600V
-5V
TIMING BOARD
DIAG 7
J2-14
J2-12
J2-4
J2-13
J2-1
J2-6
C1171 .01
STORAGE BOARD
DIAG 12 13
L2096 2.7µH
L2097 2.7µH
C2097 6.8µF
C2096 33µF
R2092 909
Q2092
Q2094
R2093 357
R2094 10K
C2094 6.8µF
L2095 2.7µH
C2095 6.8µF
+1.4V
P1711 9 10
C392 .02
VERTICAL MODE SWITCHING BOARD
DIAG 1 2 3
J5-12
J6-2
L582 2.7µH
C582 15µF
R992 22
C992 0.1 (DCPL)
VR583 6.2V
C583 15µF
TRIGGER BOARD
DIAG 5 8
J6-10
J5-4
J612
L584 2.7µH
C582 15µF
R993 22
C993 0.1 (DCPL1)
R994 22
C994 0.1 (DCPL2)
L585 2.7µH
C585 15µF
P1731
C382 6.8µF
C385 .02
C383 6.8µF
C384 6.8µF
PREAMP BOARD
DIAG 1 2 3
P400 4
P491 4
VERTICAL OUTPUT BOARD
DIAG 4
14 P1690
FAN MOTOR BOARD
DIAG 14
INTERFACE BOARD

FROM CR986 DIAG 8

C1802 .01 · R1802 2.0K · +5V · J8-3 · R1803 3.0K · Q1802

CR1825 · R1825 160

VIEWTIME

R1812 100K · R1814 · CR1814 · R1813 200K · Q1812

CR1815 · R1815 10K · CW · R1816 1.5K · R1817 120K · R1818 20K

S1815A CLOSED IN DETENT FULL CW

S1815 B OPEN IN DETENT FULL CW

FAST S1921D (14) · +5

Q1816 · Q1822 · Q1832 · Q1834 · Q1836

R1823 10K · R1824 10K · R1826 15 · R1827 1.3K · R1831 8.2K · R1832 1.5K · R1833 220 · R1834 2.2K · R1835 2.3K · R1836 8.2K · R1837 15K · R1838 220

C1826 33μF · C1831 47μF · C1834 4.7μF · C1835 1μF

CR1822 · CR1835

SAVE S1921A (14) · ERASE S1815C (14) (SPRING RETURN)

CR1845 · R1845 10K · CR1866

VAR PERS S1921C (14)

TP1836

R1872 220

U1866B 1/4 7402

'A' SWP END FROM Q926 DIAG 8 · J8-2

SWP LOCKOUT TO Q984 DIAG 8 · J8-1

CR1877 · CR1876 · CR1875

R1874 910 · R1875 10K · Q1872

U1874A 1/2 7474

R1862 150K · C1862 3.3μF · Q1864 · R1864 2.7K · R1867 2.7K

U1866A 1/4 7402

C1869 100μF · R1869 10K · CR1869

U1872C 1/4 74132

U1866D 1/4 7402 · U1866C 1/4 7402

U1874B 1/2 7474

NON STORE S1921B (14) · TO CR1934 DIAG 13

R1853 240 · R1855 47K · R1856 200K · R1853 1M · FRONT MODULATION

M TO CR1933 DIAG 13

Q1852 · R1842 43K · R1843 1.8K · R1844 2.7K · R1852 4.7 · C1842 0.22 · Q1842

L TO C2074 DIAG 12

U1846A 1/2 74123 · C1848 650 · R1848 11K · CR1848 · C1845 150

U1876D 1/4 7400

I TO CR1982 DIAG 13

R1846 10K · C1846 15μF · U1844 555

U1872D 1/4 74132

K TO CR2035 DIAG 13

VAR PERS TO CR1985 DIAG 13

U1876C 1/4 7400

A TO R2073 DIAG 13

Ā TO CR1932 DIAG 13

U1872A 1/4 74132 · U1876A 1/4 7400 · U1876B 1/4 7400 · U1872B 1/4 74132

J TO CR1926 DIAG 13

H TO CR2042 DIAG 13

C1847 15μF · R1847 20K · U1846B 1/2 74123

G TO R1952 DIAG 13

B TO CR2043 DIAG 13

U1878 74175

E TO CR1928 DIAG 13

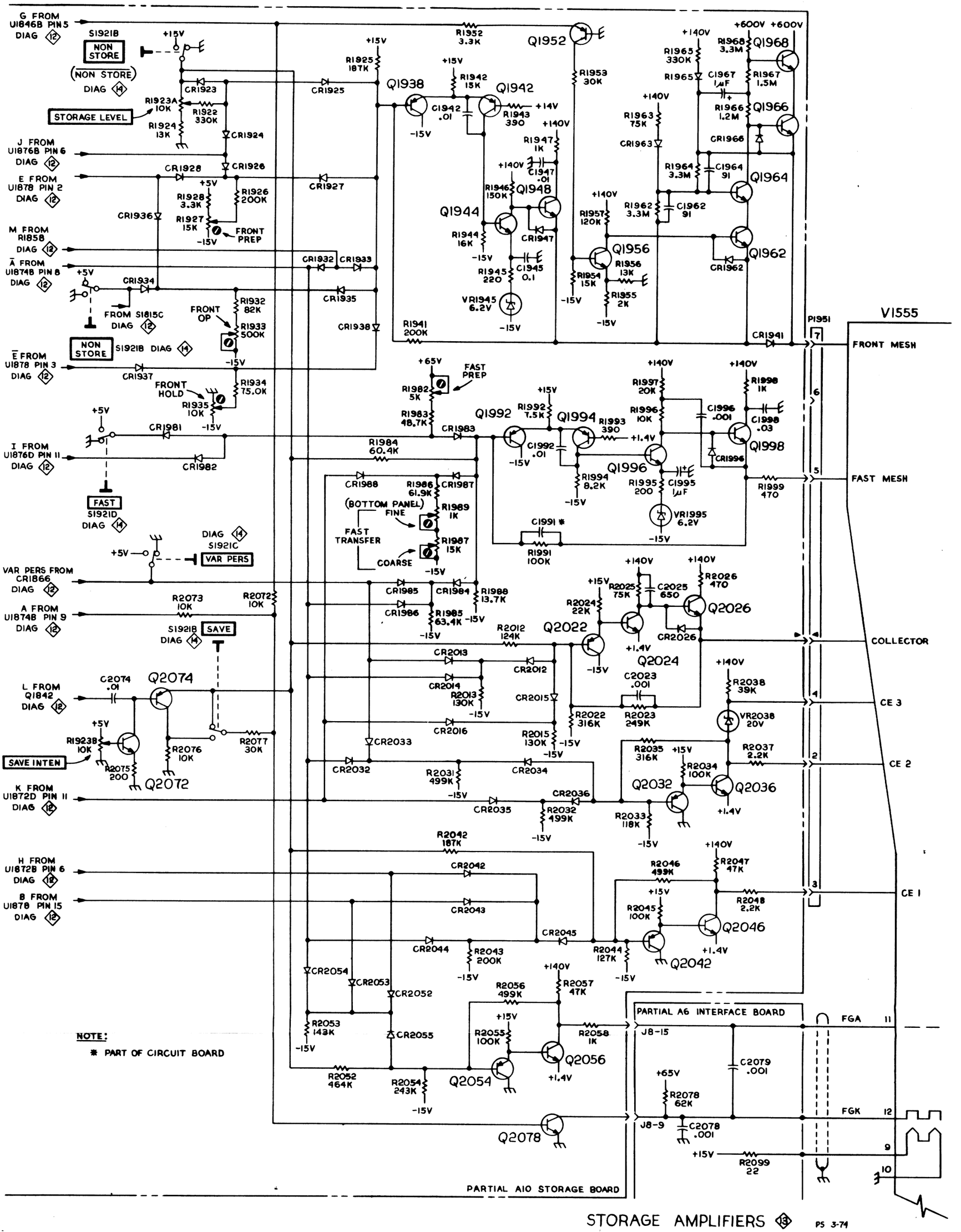
Ē TO CR1937 DIAG 13

	+5V	GND
U1846	PIN 14	PIN 8
U1866	PIN 14	PIN 7
U1872	PIN 14	PIN 7
U1874	PIN 14	PIN 7
U1876	PIN 14	PIN 7

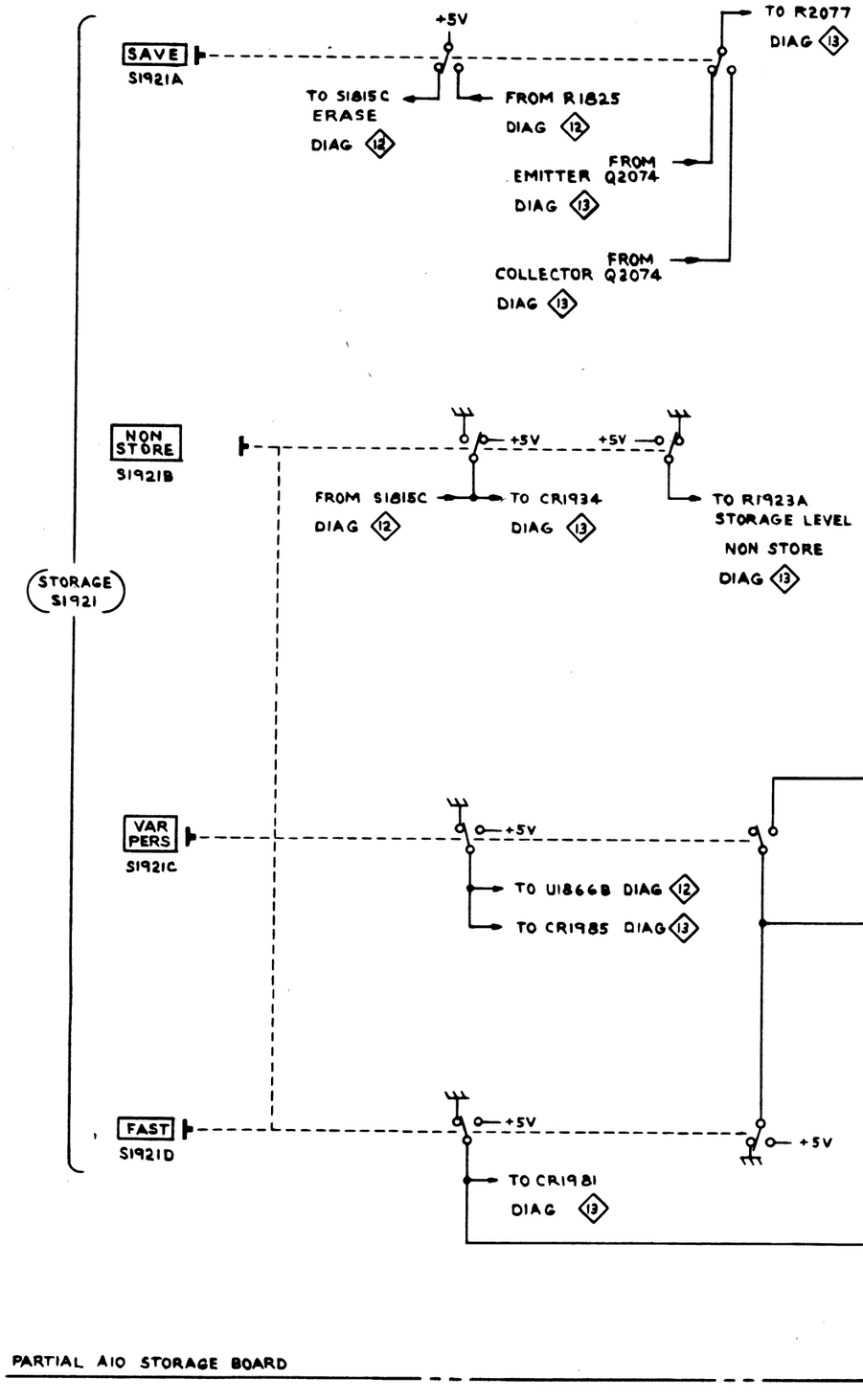
PARTIAL AG INTERFACE BOARD

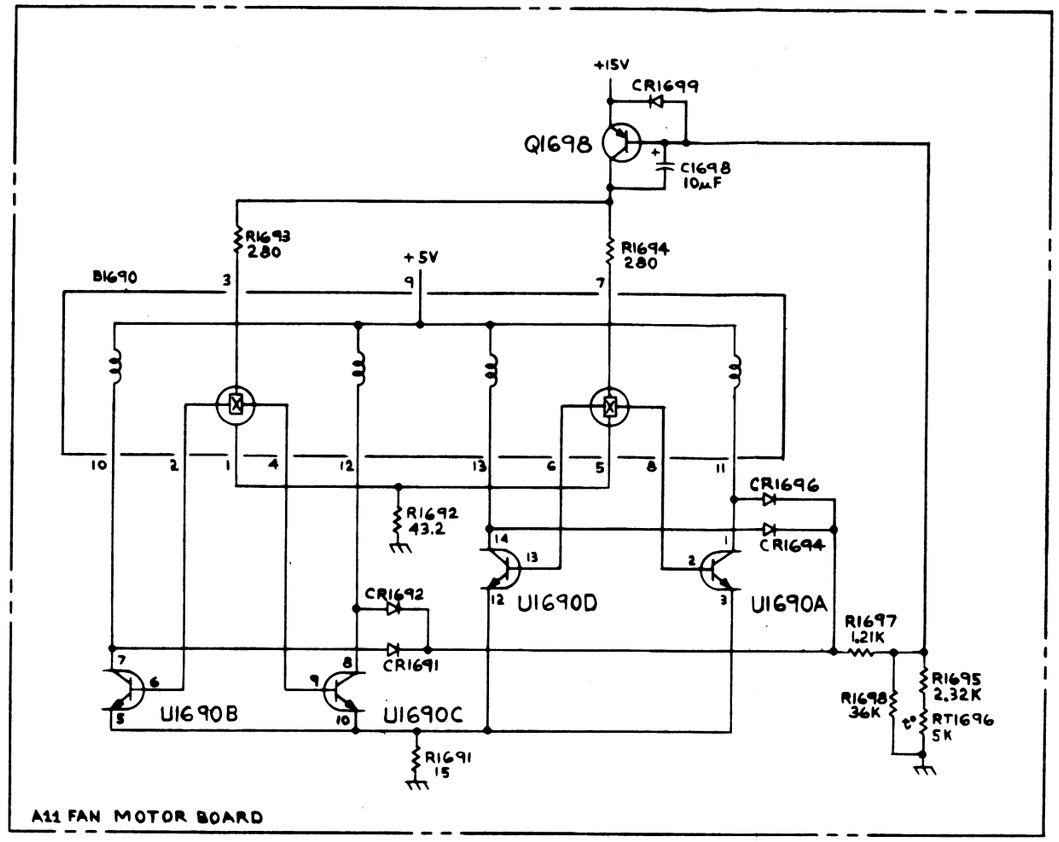
PARTIAL A10 STORAGE BOARD

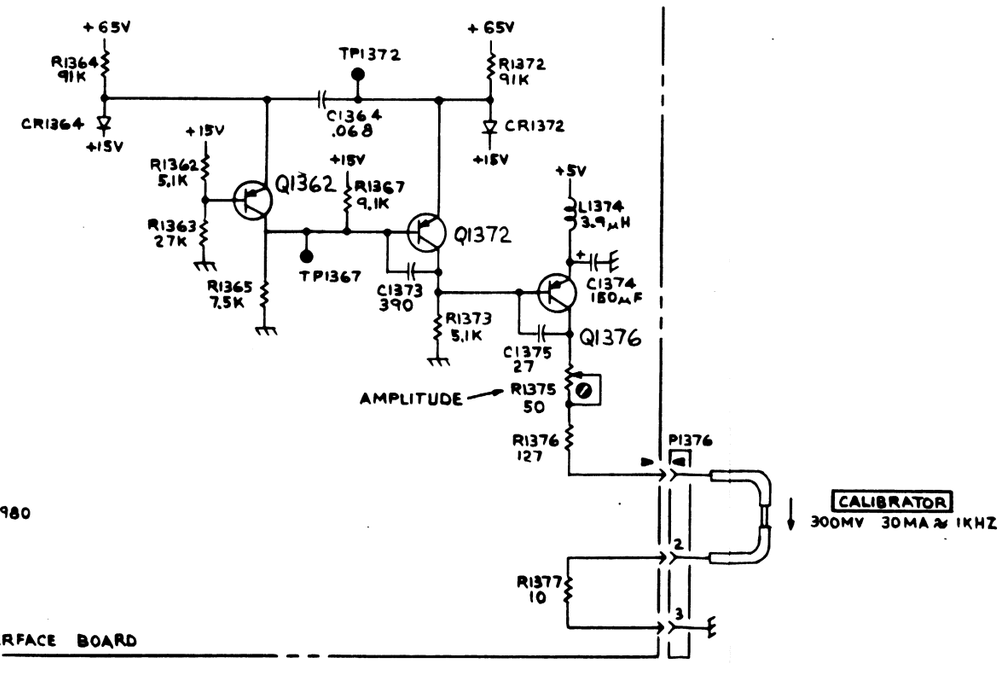
STORAGE LOGIC 12



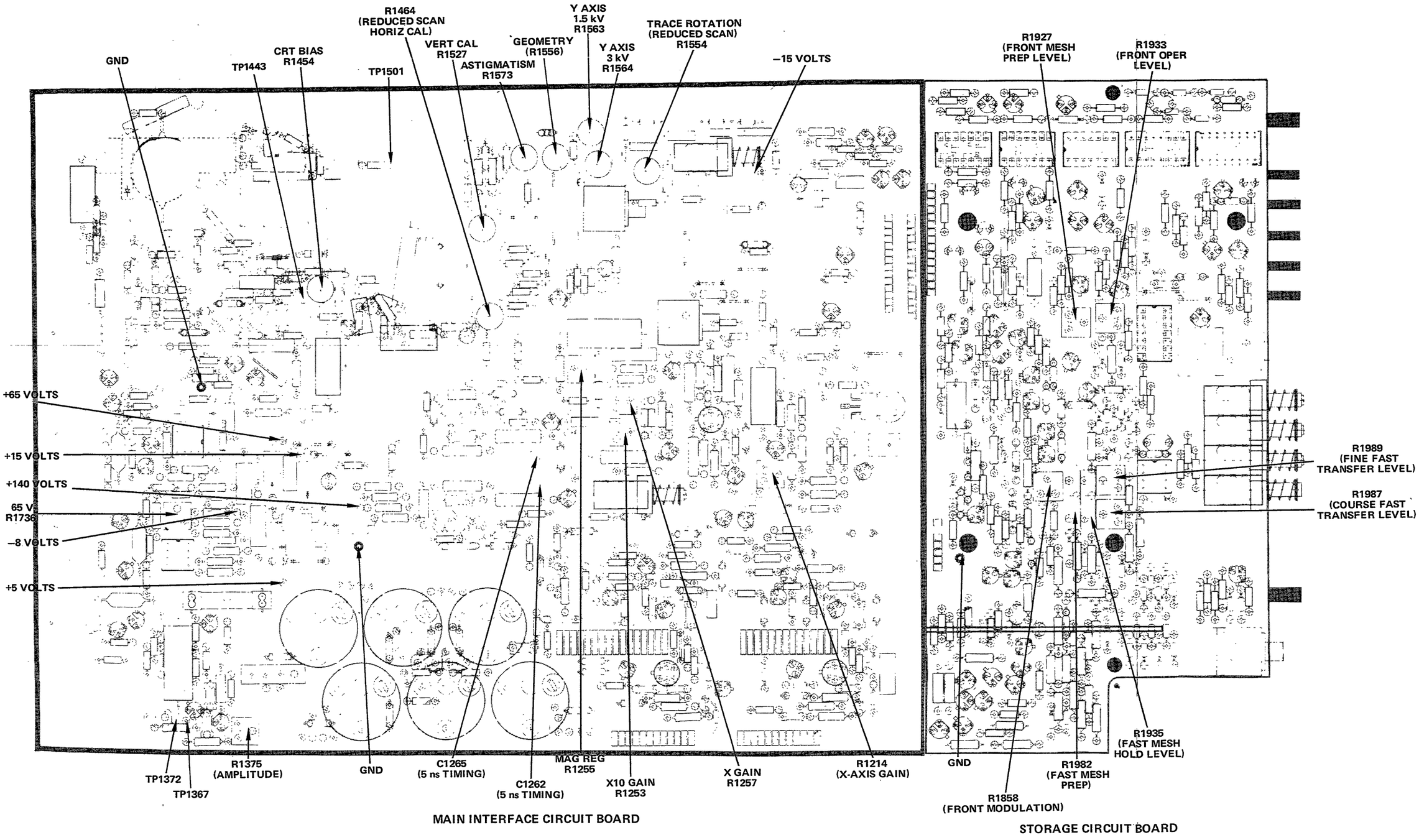
STORAGE AMPLIFIERS 13 PS 3-74

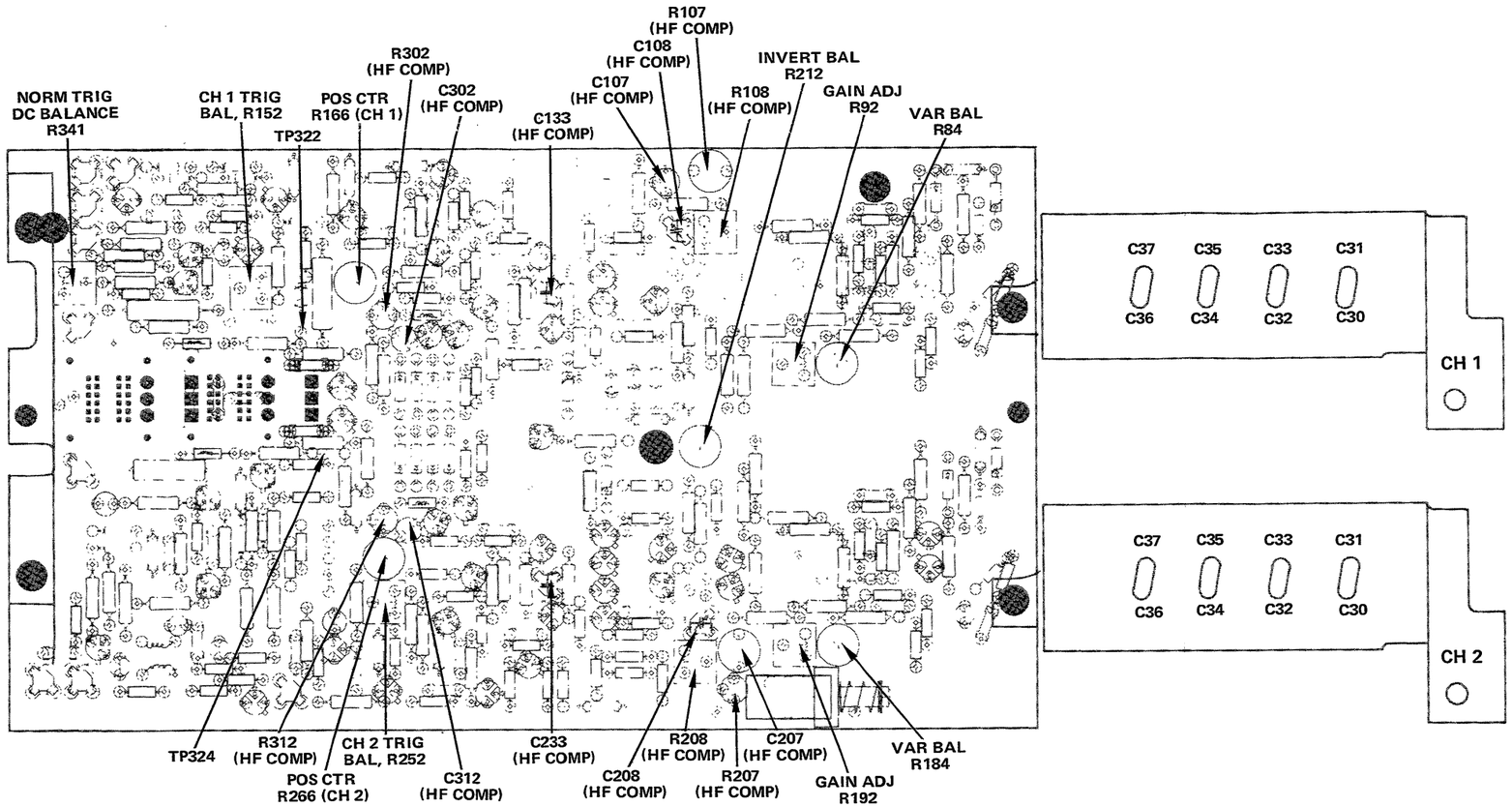




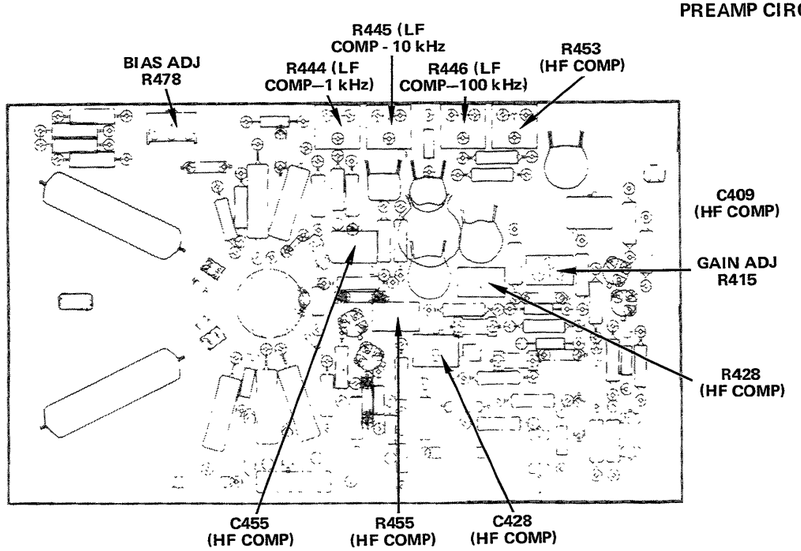


STORAGE SWITCH & CALIBRATOR 14

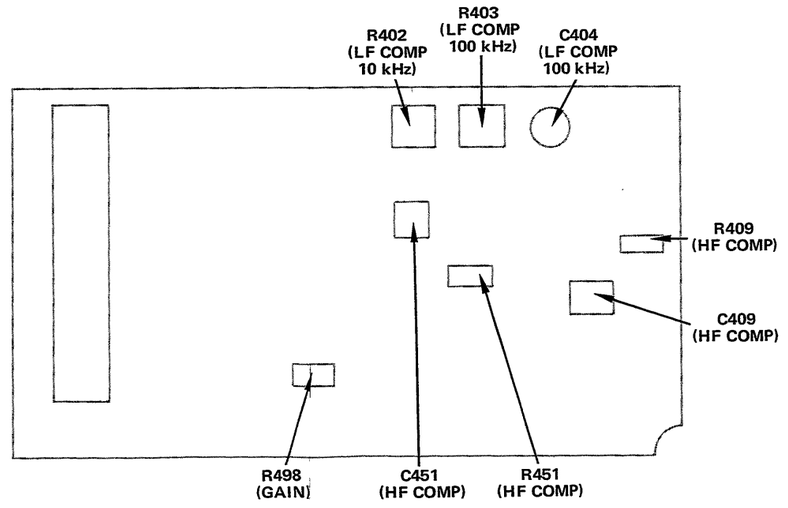

GND
TP1443
CRT BIAS R1454
TP1501
R1464 (REDUCED SCAN HORIZ CAL)
VERT CAL R1527
ASTIGMATISM R1573
GEOMETRY (R1556)
Y AXIS 1.5 kV R1563
Y AXIS 3 kV R1564
TRACE ROTATION (REDUCED SCAN) R1554
–15 VOLTS
+65 VOLTS
+15 VOLTS
+140 VOLTS
65 V R1736
–8 VOLTS
+5 VOLTS
TP1372
TP1367
R1375 (AMPLITUDE)
GND
C1265 (5 ns TIMING)
C1262 (5 ns TIMING)
MAG REG R1255
X10 GAIN R1253
X GAIN R1257
R1214 (X-AXIS GAIN)
MAIN INTERFACE CIRCUIT BOARD
R1927 (FRONT MESH PREP LEVEL)
R1933 (FRONT OPER LEVEL)
R1989 (FINE FAST TRANSFER LEVEL)
R1987 (COURSE FAST TRANSFER LEVEL)
GND
R1935 (FAST MESH HOLD LEVEL)
R1982 (FAST MESH PREP)
R1858 (FRONT MODULATION)
STORAGE CIRCUIT BOARD



PREAMP CIRCUIT BOARD

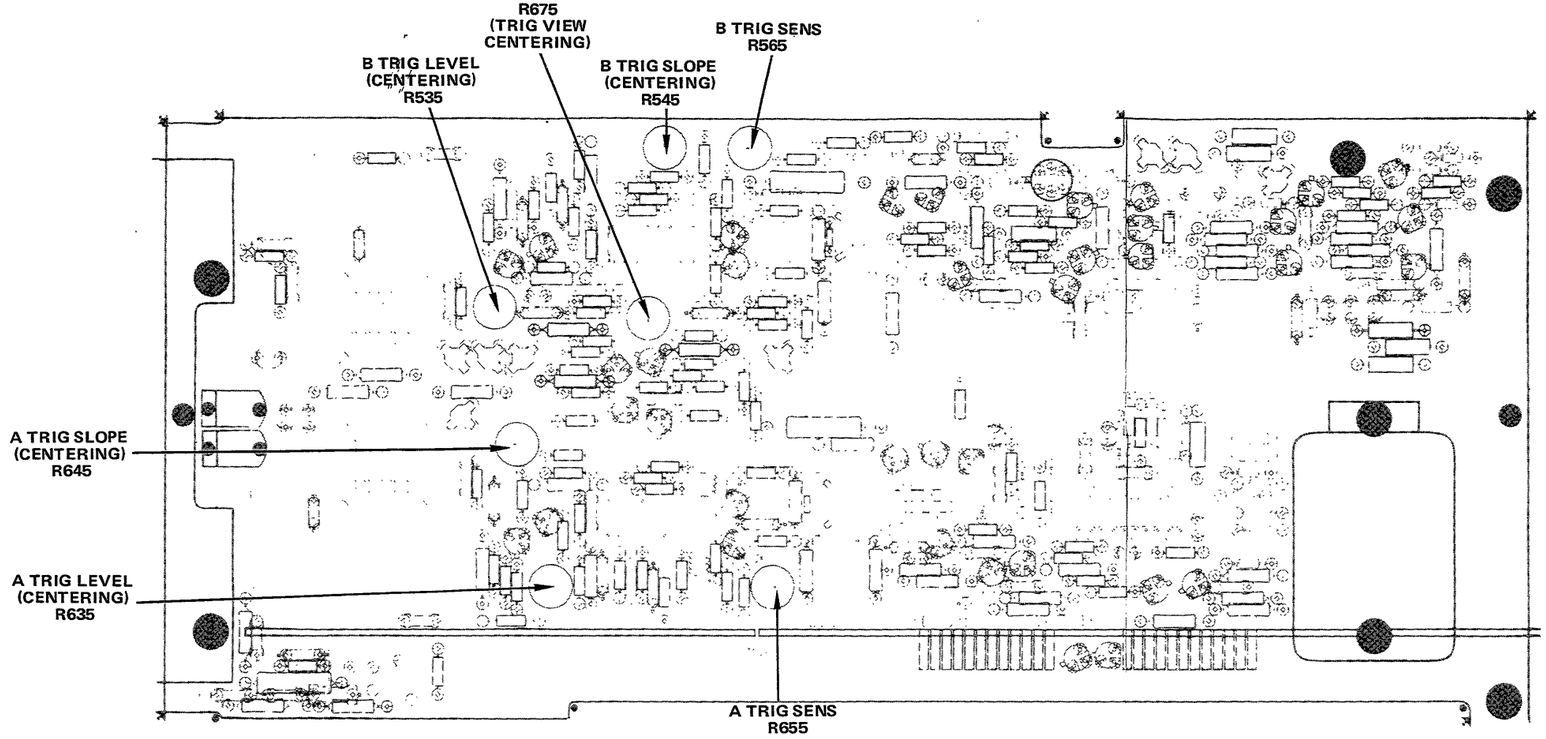


IC VERTICAL OUTPUT CIRCUIT BOARD

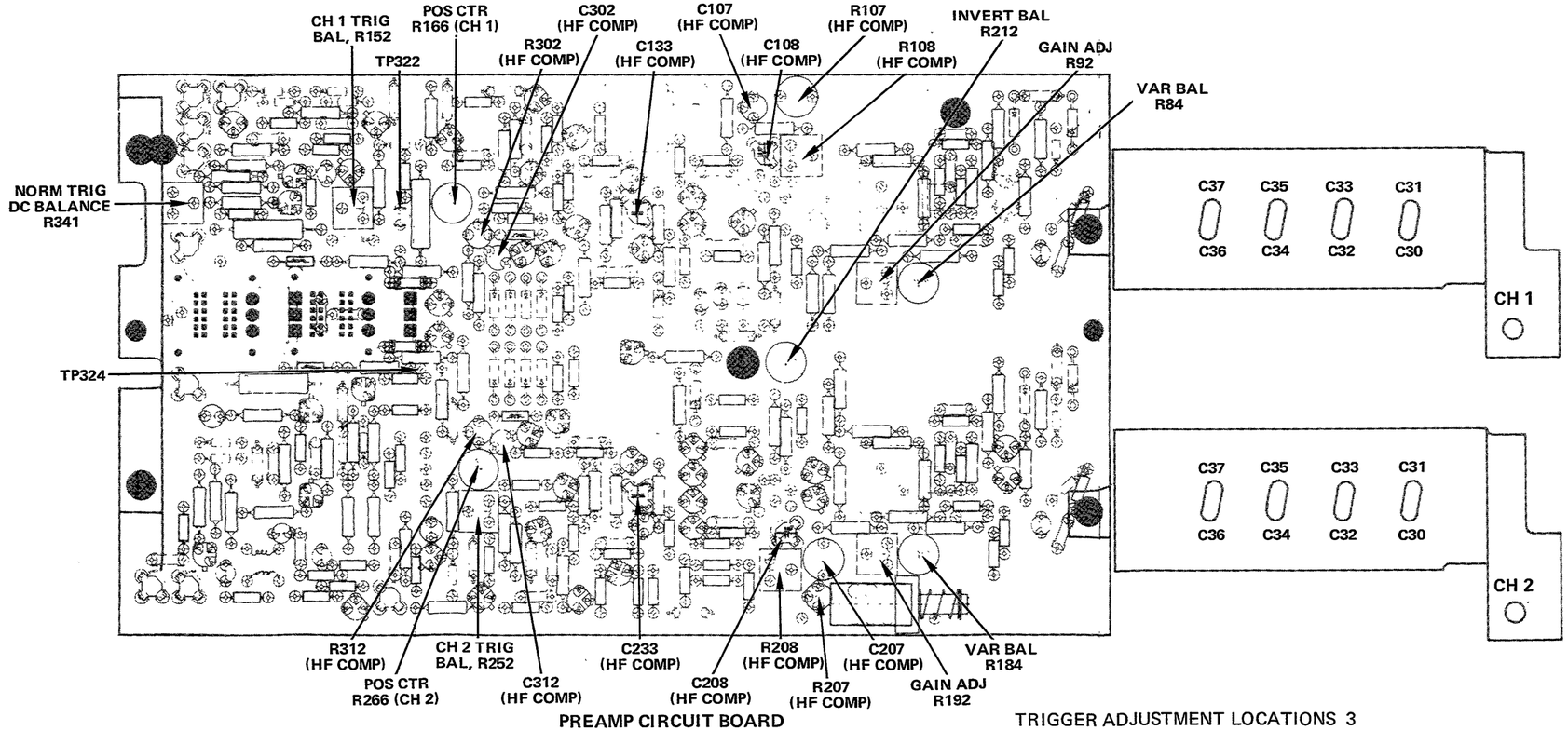


DISCREET VERTICAL OUTPUT CIRCUIT BOARD

VERTICAL ADJUSTMENT LOCATIONS 2

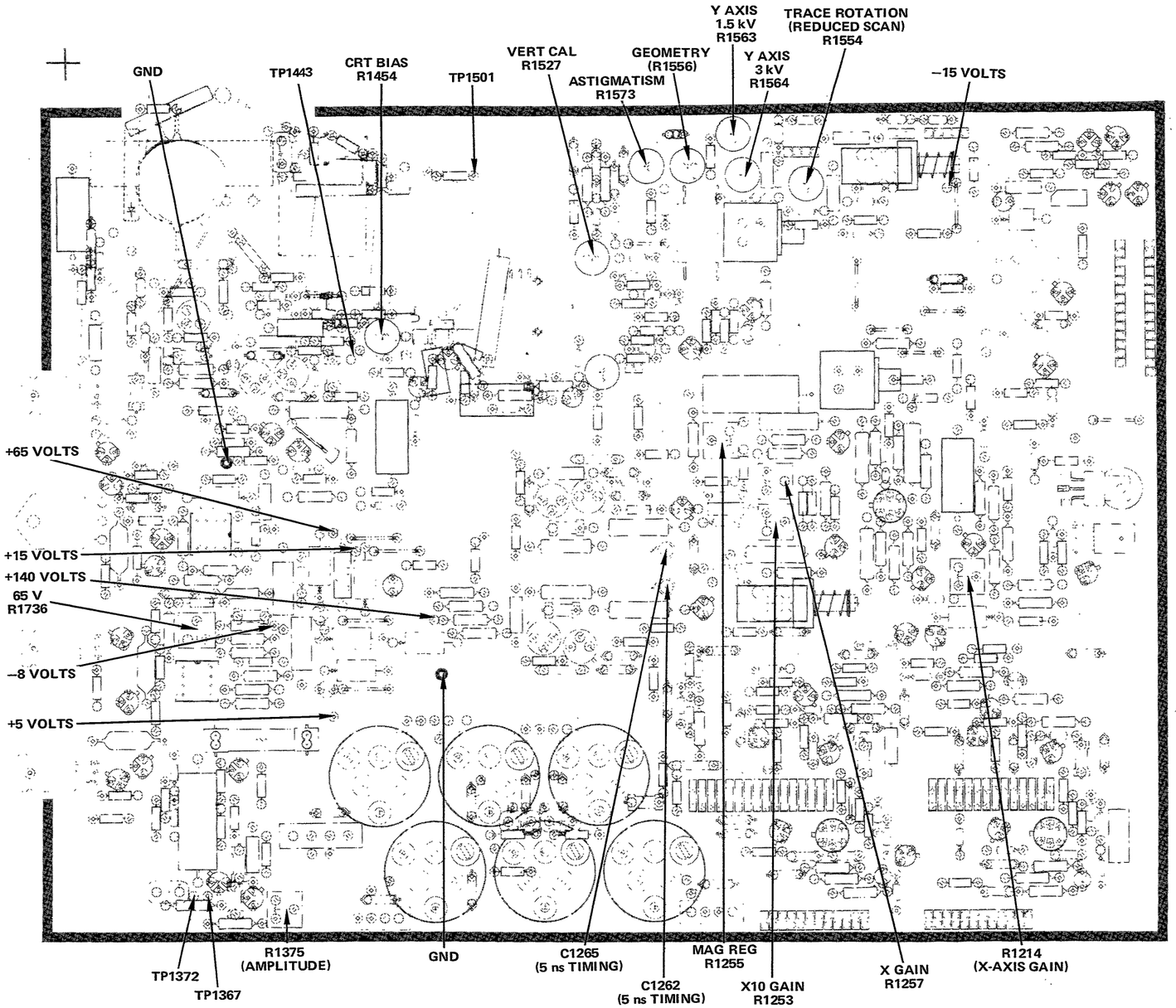


TRIGGER CIRCUIT BOARD

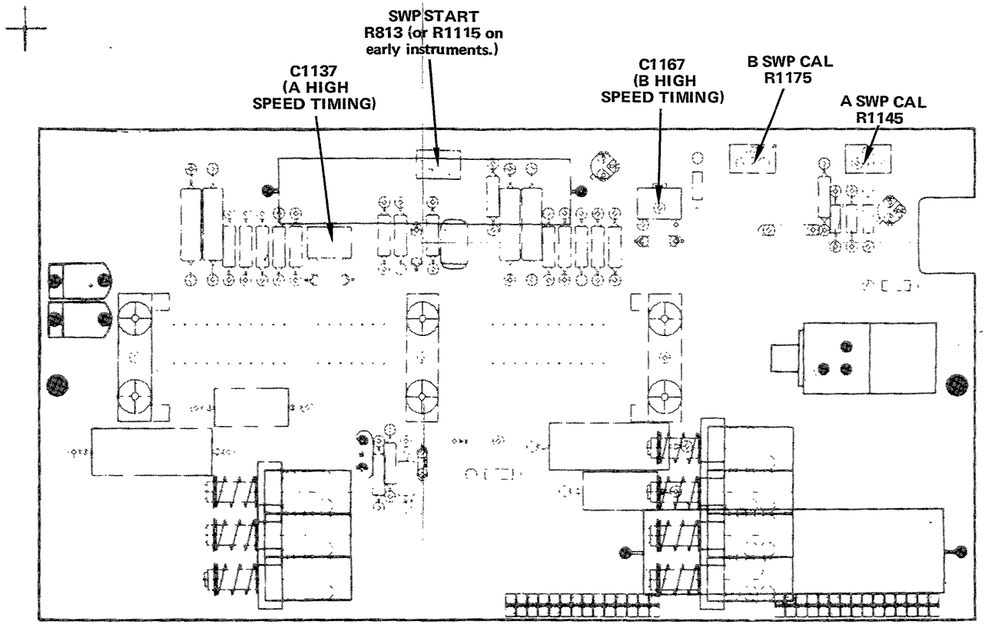


PREAMP CIRCUIT BOARD

TRIGGER ADJUSTMENT LOCATIONS 3



MAIN INTERFACE CIRCUIT BOARD



TIMING CIRCUIT BOARD