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WARNING

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

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

214 OSCILLOSCOPE

SERVICE

SN B300000 & ABOVE

INSTRUCTION MANUAL

MAGNETIC DATA CALIFORNIO Serial Number B304255 B304259

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

070-5055-00
Product Group 40

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INSTRUMENT SERIAL NUMBERS

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

B000000	Tektronix, Inc., Beaverton, Oregon, U.S.A.
HK00000	TEKTRONIX, INC., Hong Kong
G100000	Tektronix Guernsey, Ltd., Channel Islands
E200000	Tektronix United Kingdom, Ltd., Marlow
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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OPERATORS SAFETY SUMMARY

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

Terms In This Manual

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

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

Terms As Marked on Equipment

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

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

Symbols In This Manual

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

Symbols As Marked on Equipment

DANGER—High voltage.

Protective ground (earth) terminal.

ATTENTION—refer to manual.

Use the Proper Fuse

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

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

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

Do Not Operate Without Covers

To avoid personal injury, do not operate this product without covers installed.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

Use Care When Servicing With Power Applied

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

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

5054-01

Tektronix 214 Dual-Trace Storage Oscilloscope.

SPECIFICATION

INTRODUCTION

The TEKTRONIX 214 Storage Oscilloscope is a portable 500-kHz instrument that combines small size and light weight with the ability to make precision waveform measurements. It is designed for general-purpose applications where display storage is desired, along with conventional (NONSTORE) operation.

The dual-channel DC-to-500 kHz vertical system provides vertical deflection factors from 1 mV (at a reduced bandwidth) to 50 V per division at the tip of either of the integral high-impedance probes. Single trace operation is achieved by selecting either CH 1 or CH 2 with the VERT MODE switch and dual trace operation is achieved by selecting BOTH from the VERT MODE switch. Single Sweep operation is provided to display infrequently recurring events. The trigger circuit provides stable triggering over the full range of vertical frequency response.

The horizontal deflection system provides calibrated sweep rates from 500 mS to 5 μS per division. Uncalibrated sweep rates, via a variable sweep magnifier, are available to at least 5 times the indicated sweep rate for a maximum of at least 1 μS per division. Stored Automatic Enhance occurs (in Single Sweep mode) at sweep rates of 0.1 mS per division and faster.

X-Y operation is provided with Ch 1 supplying the horizontal deflection of the applied (X) signal, with a range from less than 1 mV to 50 V per division (at a reduced bandwidth of 50 kHz). Ch 2 suplies the vertical deflection of the applied (Y) signal.

The 214 is operated either from AC line voltage or from internal rechargeable batteries. The internal batteries are recharged from the AC power line by the integral battery charger (with the instrument OFF).

PERFORMANCE CONDITIONS

This instrument will meet the following electrical characteristics (Table 1-1) after complete calibration. These characteristics apply over an ambient temperature range of −15°C to +55°C (+5°F to +131°F) when operating from the internal batteries, and 0°C to +40°C (+32°F to +104°F) when operating from an AC line source, except as otherwise indicated. Warm-up time for given accuracies is at least 5 minutes.

Table 1-1
SPECIFICATIONS

Characteristics	Performance Requirements
VERTICAL DEFLECTION SYSTEM	
Deflection Factor	
Range	1 mV/DIV to 50 V/DIV in a 1-2-5 sequence of 15 steps.
Accuracy	Within ±5% with VAR VOLTS/DIV control in CAL position and gain correctly set at 5 mV/div.
Variable Range	Continuously variable between calibrated settings. Extends maximum deflection factor to at least 125 V/div.
Frequency Response	Six-division, 5-kHz reference signal, with VAR VOLTS/DIV control in calibrated detent.
AC Coupled Lower Bandwidth	Approximately 2 Hz.[a]
Input Resistance	1 MΩ ±5%.[a]
Input Capacitance	
1 mV/DIV to 50 mV/DIV	Approximately 160 pF.[a]
100 mV/DIV to 50 V/DIV	Approximately 140 pF.[a]
Maximum Input Voltage	
50 V/DIV to 0.1 V/DIV	600 V (DC + peak AC).[a] 600 V peak-to-peak AC (5 MHz or less).[a]
50 mV/DIV to 1 mV/DIV	600 V (DC + peak AC).[a] 600 V peak-to-peak AC (not over 2 kHz or a risetime ⩾100 nS).[a]
Chopped Mode	From 500 mS/DIV to 2 mS/DIV of time rate at approximately 50 kHz.[a]
Alternate Mode	From 1 mS/DIV to 5 μS/DIV of time rate.[a]
Input Impedance Matching	To within 10%.

VOLTS/DIV Setting	Frequency Response
1 mV/DIV	DC to 100kHz
2 mV/DIV	DC to 200kHz
5 mV/DIV	DC to 400kHz
10 mV/DIV to 50 V/DIV[b]	DC to 500kHz

[a] **Performance Requirement not checked in manual.**

[b] **Performance Requirement not checked in manual above 10 mV/DIV.**

Table 1-1 (cont)

Characteristics	Performance Requirements
TRIGGERING SYSTEM	
Trigger Sensitivity	
Internal	
COMP	0.2 division from DC to 500 kHz.
CH 2	0.2 division from 2 Hz to 500 kHz.
External	At least 1 V from DC to 500 kHz.
Preset Trigger Level	Triggered at preset level on positive slope of triggering signal. Sensitivity same as stated above
Display Jitter	0.5 μS or less at 500 kHz.[a]
External Trigger	
Input Resistance	Approximately 1 MΩ.[a]
Input Capacitance	Approximately 30 pF.[a]
Maximum Usable Input Voltage	8 V (DC + peak AC). 16 V peak-to-peak AC (500 kHz or less).[a]
HORIZONTAL DEFLECTION SYSTEM	
Sweep Rate	
Calibrated Range	500 mS/div to 5 μS/div in a 1-2-5 sequence of 16 steps
Accuracy	Within 5% with VAR HORIZ MAG control in CAL position measured over the center 8 divisions (disregard 1st 0.5 μS of sweep length).
Linearity	Within 5% over any 2 divisions within the center 8 divisions (disregard 1st 10% of total sweep length).
Variable Magnifier	Continuously variable between calibrated settings. Extends maximum sweep rate to at least 1 μS/div.

[a]**Performance Requirement not checked in manual.**

Table 1-1 (cont)

Characteristics	Performance Requirements
HORIZONTAL DEFLECTION SYSTEM (cont)	
CH 1 Horizontal Input	
Calibrated Deflection Factor	1 mV/div to 50 V/div.
Variable	At least 5 times magnification (using VAR HORIZ MAG).
Accuracy	Within 10% (with VAR HORIZ MAG in CAL).
X-Y Phasing	Less than 3° to 5 kHz.[a]
Maximum Input Voltage	Same as for CH 1 (vertical).[a]
DISPLAY	
Graticule	
Type	Internal Black line, non-illuminated.[a]
Area	6 divisions vertical by 10 divisions horizontal.[a] Each division equals 0.203 inch.
Phosphor	P31 standard.
Stored Writing Speed	80 div/mS.[a] 500 div/mS in Automatic Enhance (internal adjustment).[a]
ISOLATION	
Input Common to 214 Case Exterior	Maximum floating potential between input common and 214 case exterior is not to exceed 500 V RMS sinusoidal or 700 V (DC + peak AC). (When battery operated with AC power plug secured in the insulated cover.)[a]
Input Common to AC Line	Maximum floating voltage plus AC line voltage is not to exceed 250 V RMS sinusoidal, or 1.4 times the AC line voltage plus (DC + peak AC) not to exceed 350 V.[a]

[a]Performance Requirement not checked in manual.

Table 1-1 (cont)

Characteristics	Performance Requirements
AC OPERATION	
Line Voltage Range	
Stored Mode	110 V to 126 V AC. Batteries can not be charged during AC operation. Instrument can be operated between 104 V and 110 V with a resulting slow discharge of internal batteries.[a]
Line Frequency	58 to 62 Hz.
Maximum Power Comsumption	3 watts or less at 126 V, 60 Hz.[a]
INTERNAL BATTERIES	
Batteries	10 rechargeable A size, nickel-cadmium cells.[a]
Charge Time	
From AC Line	8 hours for full charge (instrument off during charge cycle).[a]
Power (Battery) Indicator	When extinguished indicates approximately 5 minutes of scope operating life left in the batteries.
Battery Excessive Discharge Protection	Instrument operation automatically interrupted when battery charge drops to 10 V, ±0.5 V.[a]
Typical Operating Time	At maximum trace instensity after full charge cycle at +20°C to +30°C.
Nonstore Mode	3.5 to 5 hours. Longest operating time provided at lower trace intensity.[a]
Store Mode	2.5 to 3.5 hours. Longest operating time provided at lower trace intensity.[a]
Typical Charge Capacity	In reference to charge/discharge at +20°C to +30°C (+68°F to +86°F). See chart below.[a]

[a]**Performance Requirement not checked in manual.**

Typical Charge Capacity

Charge Temperature	Operating Temperature		
	−15°C (+5°F)	+20°C to +30°C (+68°F to +86°F)	+55°C (+131°F)
0°C (+32°F)	40%	60%	50%
+20°C to +30°C (+68°F to +86°F)	65%	100%	85%
+40°C (+104°F)	40%	65%	55%

Table 1-1 (cont)

Characteristics	Performance Requirements
ENVIRONMENTAL	
Temperature	
Operating from Batteries	−15°C to +55°C (+5°F to +131°F)
Operating from AC Line	0°C to +40°C (+32°F to +104°F)
Non-Operating	−40°C to +60°C (−40°F to +140°F)
Altitude	
Operating	To 25,000 ft. Maximum operating temperature decreased by 1°C per 1,000 ft above 15,000 ft.
Non-Operating	To 50,000 ft.
Humidity	
Operating and Non-operating	5 cycles (120 hours) to 95% relative humidity in reference to MIL-E-16400F.
Shock	
Operating and Non-operating	Tested with 2 shocks at 150 g, one-half sine, 1 mS duration each direction along major axes.
PHYSICAL	
Weight (without accessories)	3.5 lb (1.6 kg).
Dimensions (measured at maximum points)	
Height	3.0 in (7.6 cm).
Width	5.25 in (13.2 cm).
Depth	9.5 in (24.1 cm).

OPERATING INFORMATION

INTRODUCTION

This section of the manual provides information on instrument power requirements, and the functions of the controls and connectors. Operating considerations, intended to familiarize the operator with basic measurement techniques, and operator's checks and adjustments for the 214 are included. For additional operating information, refer to the 214 Operators Manual.

SAFETY CONSIDERATIONS

Refer to the Safety Summary at the front of this manual for safety considerations pertaining to the use of the instrument. Before connecting the oscilloscope to a power source, read entirely both this section and the Safety Summaries.

WARNING

When battery operated, store the AC plug in the insulated compartment in the rear of the instrument. The RFI circuitry connected between the instrument common and the AC power plug can cause small amounts of current from an elevated reference to be present on the AC power plug, imposing a possible shock hazard.

LINE FUSE

The Line Fuse for this instrument is located inside the cabinet. For fuse replacement, refer to the "Disassembly Instructions" in the Maintenance section to remove the cabinet and refer to the "Replaceable Electrical Parts" list for choosing the correct replacement fuse.

CONTROLS AND CONNECTORS

INTRODUCTION

Controls and connectors necessary for operation of the 214 are located on the front and right side panels of the instrument. The power on off switch is located on the lower left side of the instrument. Vertical controls are color-coded with the tip of the corresponding probe. To make full use of the capabilities of this instrument, the operator should be familiar with the function and use of each control and connector.

WARNING

COMMON and probe ground straps are electrically connected. Therefore, an elevated reference applied to any ground is present on the others-as indicated by the yellow warning bands under the probe retractable hook tips, and the ground strap protective coverings.

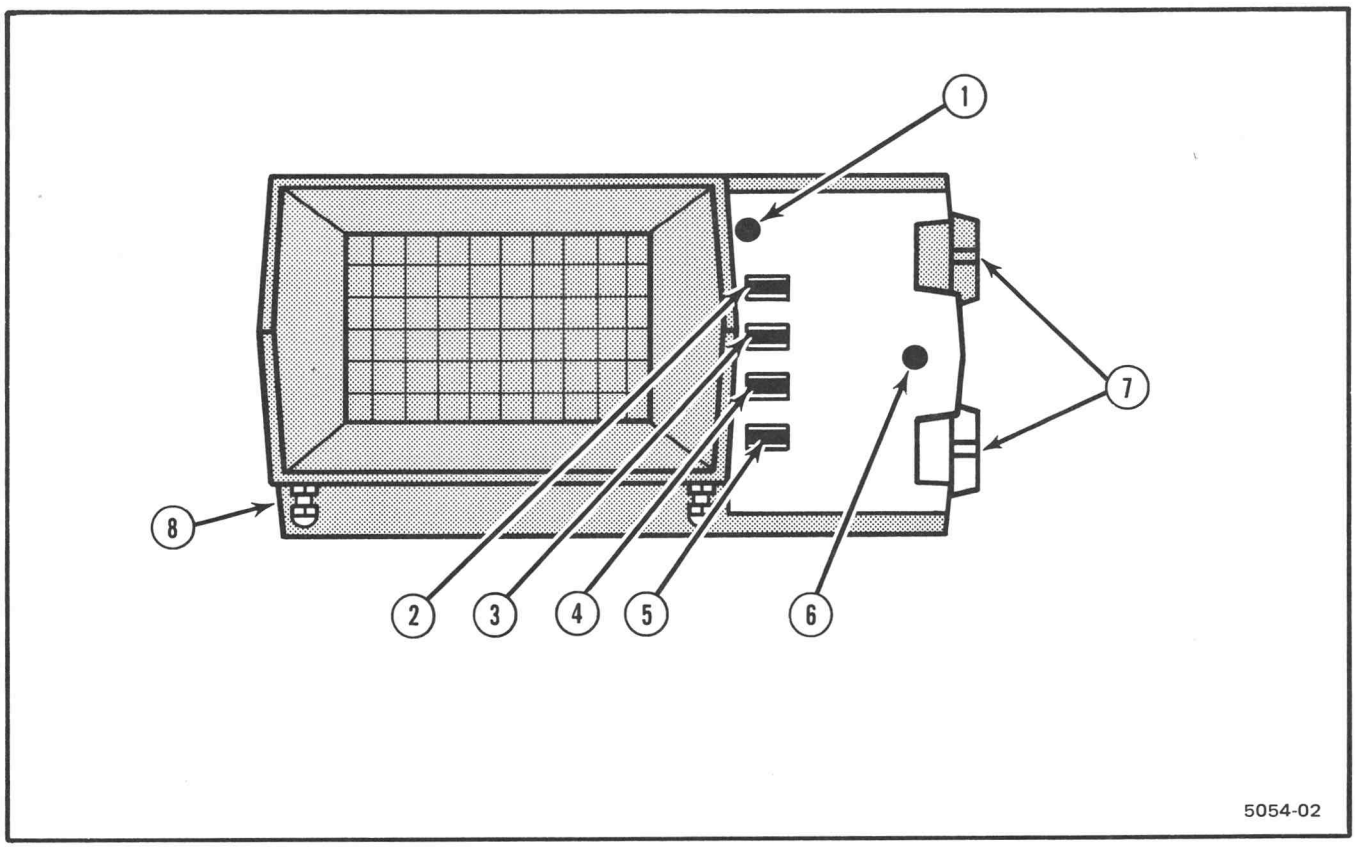


Figure 2-1. Front panel controls.

FRONT PANEL CONTROLS

(1) **READY LED**—Indicates sweep has been reset and a single display will be presented upon receipt of an adequate trigger signal.

(2) **SINGLE SWP**—When pushed, the sweep operates in the Single Sweep mode. After a sweep is displayed, further sweeps cannot be presented until the RESET button is pressed and released. Automatic Enhance occures in SINGLE SWP storage at sweep rates of 0.1 ms/div and above.

(3) **RESET**—When pressed and in the Single Sweep mode, a single display will be presented after correct triggering. Must be pressed again before another sweep can be displayed. When VERT MODE switch is set to BOTH, only one channel will be displayed for each RESET actuation.

(4) **STORE**—When pushed, the CRT operates in the Storage mode. With the button out, the CRT operates in the conventional, NONSTORE, mode. Automatic Enhance provides faster storage capabilities when in SINGLE SWP at sweep rates of 0.1 ms/div and faster.

(5) **ERASE**—Momentary contact switch that, when pushed and released, erases a stored display from the CRT.

(6) **POWER (BATTERY)**—Red LED to indicate when the instrument is on. When light extinguishes, battery charge is low and about five minutes of operating life remains.

(7) **VOLTS/DIV**—Selects vertical deflection factor (vertical VAR must be in the CAL position for indicated deflection).

LEFT SIDE PANEL CONTROLS

(8) **Power ON-OFF**—Turns the instrument on or off regardless of whether the internal battery source or an external AC source is being used. Does not interrupt charging current to the internal batteries when the instrument is connected to AC line voltage.

RIGHT SIDE PANEL CONTROLS AND CONNECTORS

(9) **INPUT COUPLING**—Selects method used to couple the channel input signal to the vertical amplifier system.

AC—Input signal is capacitively coupled to the vertical amplifier. The dc component of input signal is blocked. Low-frequency limit (−3 db point) is approximately 2 Hz.

GND—Vertical amplifier input circuit is grounded (does not ground the input signal). Allows precharging the input coupling capacitor.

DC—All frequency components of the input signal are coupled to the vertical amplifier system.

(10) **STEP ATTEN BAL**—Screwdriver adjustment to balance the vertical system for minimum trace shift when changing deflection factors.

(11) **Vertical POS**—Controls the vertical position of the appropriate trace.

(12) **VAR VOLTS/DIV**—Provides a continuously variable uncalibrated deflection factor between the calibrated settings of the VOLTS/DIV switch.

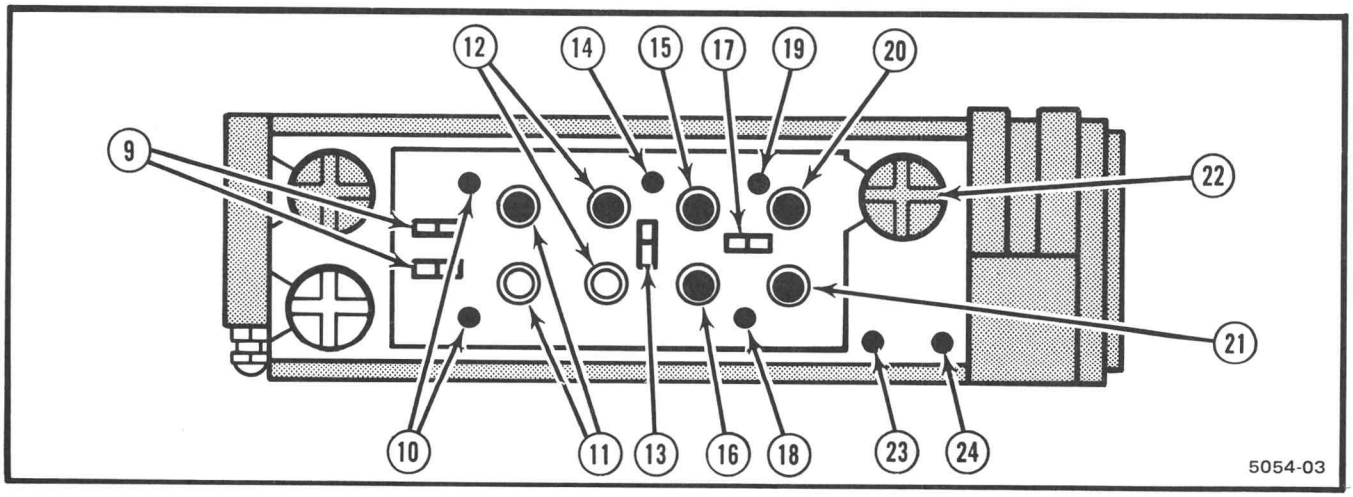


Figure 2-2. Right side panel controls.

(13) **VERT MODE**—Selects the mode of operation for the vertical amplifier system.

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

BOTH—Selects both Channel 1 and Channel 2 input signals for display.

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

(14) **AUTO PRESET**—Screwdriver adjustment to set the PRESET trigger point for AUTO sweep operation.

(15) **LEVEL/SLOPE**—Selects the amplitude point and slope of the trigger signal on which the sweep is triggered. When the indicator dot is to the left of center, the sweep is triggered on the positive-going slope of the trigger signal; to the right of center, on the negative-going slope. When the LEVEL/SLOPE contol is set to the AUTO PRESET detent, the sweep is automatically triggered at a preset level on the positive-going slope.

(16) **INTENSITY**—Controls brightness of CRT display.

(17) **TRIG SOURCE**—Selects the source of the trigger signal.

COMP—Sweep is triggered from a DC-coupled sample of the vertical signal after the vertical switching.

CH 2—Sweep is triggered from an AC-coupled sample of the CH 2 vertical signal before the vertical switching.

EXT—Sweep is triggered from the DC-coupled signal applied to the EXT TRIG banana jack.

(18) **FOCUS**—Screwdriver adjustment to obtain a well-defined display.

(19) **SWP CAL**—Screwdriver adjustment to provide calibrated sweep timing.

(20) **VAR HORIZ MAG**—Provides continuously variable sweep magnification to a maximum of at least five times the sweep rate indicated by the SEC/DIV switch.

(21) **Horizontal POS**—Controls the horizontal position of the trace.

(22) **SEC/DIV**—Selects the sweep rate (VAR HORIZ MAG must be in CAL detent for indicated sweep rate). X-Y position allows for X-Y operation with CH 2 supplying the vertical deflection and CH 1 the horizontal deflection.

(23) **EXT TRIG**—Banana jack for input of an external trigger signal.

(24) **COMMON**—Input banana jack to establish common ground between the 214 and the external signal source or equipment under test. Electrically connected to the probe ground clips.

OPERATING CONSIDERATIONS

OPERATING POWER INFORMATION

CAUTION

Due to the capacitive line input circuit, sudden voltage changes may cause damaging input current transients. Avoid operating this instrument from square-wave inverter supplies, or other sources that produce large voltage transients.

INTERNAL BATTERY OPERATION

The 214 is designed primarily for operation from the internal rechargeable batteries. The operating time provided from the internal batteries depends upon trace intensity, STORE or NONSTORE mode, and battery charge and discharge temperature. Typical operating time from fully charged batteries at maximum trace intensity in the NONSTORE mode of operation, when charged and operated at +20°C to +30°C (+68°F to +86°F), is four hours. When operated in the STORE mode, typical operating time is three hours. Longest operating time occurs at lower trace intensity.

The POWER (BATTERY) LED provides an indication of the operating power of the 214. When the light extinguishes, battery charge is low and about five minutes of instrument operating power remains. The 214 has an automatic battery protection circuit to prevent excessive discharge and the resulting battery damage if the battery charge level drops below approximately 10 volts.

BATTERY CHARGING

The charging characteristics of the nickel-cadmium (NiCd) cells used in the 214 vary with the temperature at which they are charged. Batteries charged at about +20°C to +30°C (+68°F to +86°F) deliver more energy than when the same batteries are charged at a higher or lower temperature.

To charge the batteries, connect the instrument to an AC line and set the POWER switch to the OFF position. Allow at least eight hours for the batteries to reach full charge. For longest operating life of the batteries, increase the charge time to at least 16 hours once a month. This procedure balances the charge on all the cells in the battery and reduces the possibility of any individual cell becoming reverse charged.

The nickel-cadmium cells will self-discharge when the instrument is non-operational for extended periods of time. The rate at which this self-discharge occurs is dependent on the ambient temperature and humidity. If the 214 is to be stored for extended periods, particularly at either high ambient termperature or high humidity, it is recommended that the batteries be run through a full charge cycle (eight hours) about every two weeks.

AC OPERATION

If the internal batteries of the 214 become discharged to the minimum operating level, continued operation can be obtained by connecting the instrument to an AC power source. Due to the circuitry connected with the internal battery charger, the AC power line voltage must be at least 104 volts (110 volts in STORE mode) for operation in this manner. Operation below 110 volts in the STORE mode will result in a slow discharge of the internal batteries. The internal batteries cannot be recharged while the instrument is being operated from the AC line.

INTENSITY CONTROL

The INTENSITY control determines the brightness of the display presented on the CRT. Since the brightness of the CRT display affects the amount of current drained from the batteries, the INTENSITY control should be set to the minimum usable level. This will allow maximum operating time from the internal batteries.

The setting of the INTENSITY control will affect the focus of the display in the STORAGE mode of operation. Turn the INTENSITY off before selecting the STORE mode, then slowly increase the intensity level for the desired display brightness. Careful adjustment of the Focus adjustment at the desired brightness will give the maximum storage writing rate.

NOTE

A high intensity level in the STORE mode will cause the display to spread and may flood the CRT screen.

Slight re-adjustment of the FOCUS may be necessary when changing the intensity level in NONSTORE operation. To protect the CRT phosphor, do not turn the INTENSITY higher than necessary to provide a satisfactory display. Also, be careful that the INTENSITY control is not set too high when changing from a fast to a slow sweep rate, or when changing to the X-Y mode of operation.

GRATICULE

The graticule of the 214 is internally marked on the faceplate of the CRT to provide accurate, parallax-free measurements. The graticule is marked with six vertical and ten horizontal divisions. Each major division is divided into five minor divisions at the center vertical and horizontal lines. The vertical gain and the horizontal timing are calibrated to the graticule so that accurate measurements can be made directly from the CRT display.

CRT CARE

The following precautions will prolong the useful Storage life of the CRT screen in the 214:

1. Use the minimum beam intensity required to produce a clear, well-defined display. A too-high beam intensity may permanently damage the CRT screen, particularly if a bright spot is allowed to remain stationary on the display area.

2. Avoid the repeated use of the same area of the screen. If a particular display is being stored repeatedly, change the vertical position occasionally to use other portions of the display area.

3. Do not leave a Stored display on the screen when it is no longer needed.

4. Operate the instrument in the NONSTORE mode unless Storage is required.

SIGNAL CONNECTIONS

Two high-impedance signal probes are internally connected to the 214. These probes provide a 1 MΩ input impedance and a shielded input cable to prevent pickup of electrostatic interference. The vertical deflection factors can be read directly from the appropriate VOLTS/DIV switch (VAR in CAL detent).

Signals can be connected to the EXT TRIG banana jack with short unshielded leads under most conditions. Be sure to establish a common ground between the 214 and the equipment under test. Attempt to position the unshielded leads away from any source of interference ot avoid errors in triggering. If interference is excessive with unshielded leads, use a coaxial cable with a suitable adapter.

GROUNDING

Reliable signal measurements cannot be made unless both the oscilloscope and the unit under test are connected together by a common reference (ground) lead in addition to the signal probe. The ground clips on the attached probes provide the best ground. Also, a ground lead can be connected to the 214 chassis COMMON banana jack to establish a common ground with the signal source.

CAUTION

The 214 probe ground clips and the chassis COMMON input jack are electrically connected. Do not apply dissimilar voltage potentials to them. See Elevated Reference information in Operators Manual.

INPUT COUPLING

The INPUT COUPLING switches allow a choice of the coupling method for the applied signals. The type of display desired and the applied signal will determine the coupling method to use.

DC coupling can be used for most applications. This positon allows measurement of the DC component of a signal, and must be used to display signals of 10 Hz and below, as they will be attenuated in the AC position.

With AC coupling, the DC component of the signal is blocked by a capacitor in the input circuit. The low-frequency response in the AC position is about 2 Hz (−3 dB point). Therefore, some low-frequency attenuation can be expected near this frequency limit. Attenuation in the form of waveform tilt will also appear in square waves that have low-frequency components. The AC coupling position provides the best display of signals with a DC component that is much larger than the AC component.

The GND positon provides a ground reference at the input of the appropriate vertical channel without the need to externally ground the probe. The signal applied to the probe is internally disconnected, but not grounded, and the 214 input circuit is held at ground potential. This also allows precharging the input coupling capacitor to the average voltage level of the signal applied to the probe.

The GND position is used to precharge the input coupling capacitor. The following procedure should be used whenever one of the probe tips is connected to a signal source having a different DC level than that which was previously applied.

1. Before connecting the probe to a signal source with a large DC component, set the INPUT COUPLING switch to GND.

2. Connect the probe tip to ground for several seconds to allow the input coupling capacitor to fully discharge. Then, connect the probe to the signal source.

3. Wait several seconds for the input coupling capacitor to charge.

4. Set the INPUT COUPLING switch to AC. The display will remain on the screen so the AC component of the signal can be measured in the normal manner.

OPERATOR'S ADJUSTMENTS

INTRODUCTION

To verify the operation and accuracy of your instrument, perform the following check and adjustment procedures before making a measurement. Move the power switch to the (ON) position and allow the instrument to warm-up before performing any of the following checks. Warm-up time required is at least five minutes to meet all the instruments' specifications.

If adjustments are required beyond the scope of these operator's checks and adjustments, see the "Calibration Procedure" in Section 4 of this manual.

EQUIPMENT REQUIRED

The equipment listed in Table 2-1, or the equivalent is required to complete these checks and adjustments.

Table 2-1
Test Equipment

Description	Minimum Specification
Calibration Generator	Standard-amplitude signal levels: 20 mV to 100 V. Accurcy ±0.3%. Fast-rise signal level, 100 mV to 50 V; Repetition rate, 1 kHz. Rise-time, 100 ns or less; Aberration, ±0.5%.
Leveled Sine-Wave Generator	Frequency, 50 kHz to at least 500 kHz. Output amplitude, variable from 5 mV to 0.2 V p-p. Output impedance, 50 Ω. Amplitude accuracy, constant within 1% of reference frequency as output frequency changes.
Adapter	Connector, probe tip to BNC.

VERT GAIN CHECK

1. Set the VERT MODE switch to CH 1.

2. Set the CH 1 VOLTS/DIV and CH 2 VOLTS/DIV switches to 5 mV (VAR VOLTS/DIV to CAL)

3. Connect the CH 1 probe tip to an accurate 20 mV generator.

4. Set the Trigger controls for a stable display.

5. Check for four divisions of deflection.

6. Set the VERT MODE switch to CH 2 and repeat steps 3 through 5.

7. Disconnect the probe from the generator.

STEP ATTENUATOR BALANCE

1. Set the VERT MODE switch to CH 1.

2. Set the TRIGGER/SLOPE to Auto Preset.

3. While switching the CH 1 VOLTS/DIV switch between the 50 mV and 1 mV positions, adjust the CH 1 STEP ATTEN BAL for minimum trace shift between adjacent positions.

4. Set the VERT MODE switch to CH 2.

5. While switching the CH 2 VOLTS/DIV switch between the 50 mV and 1 mV positions, adjust the CH 2 STEP ATTEN BAL for minimum trace shift between adjacent positions.

HORIZONTAL GAIN CHECK

1. Set the SEC/DIV switch to X-Y.

2. Connect the CH 1 probe tip to an accurate 0.2V generator.

3. Set the CH 1 VOLTS/DIV switch to 50 mV (VAR VOLTS/DIV to CAL).

4. Set the CH 2 POS control to midrange to display two dots.

5. Check for four divisions of deflection between dots.

HORIZONTAL TIMING CHECK

1. Set the VERT MODE switch to CH 1.

2. Connect the CH 1 probe tip to an accurate time-mark generator.

3. Set the SEC/DIV switch to 1 ms (VAR HORIZ MAG in CAL).

4. Set the Time-mark generator to 1 ms time markers.

5. Adjust the CH 1 VOLTS/DIV switch to obtain aproximately 6 divisions of display.

5. Check for eight divisions of deflection between the second and tenth time markers (one time marker/division). Adjust the SWP CAL adjustment if necessary.

6. Disconnect the probe from the generator.

FOCUS

1. Set the SEC/DIV switch to X-Y.

2. Set the INPUT COUPLING switches to GND.

3. Adjust the FOCUS for optimum focus of the CRT display (a single dot). To obtain the maximum storage writing rate the Focus Adjustment must be adjusted for the desired intensity setting.

AUTO PRESET

1. Set the VERT MODE switch to CH 2.

2. Connect the CH 2 probe tip to a 1 kHz sine-wave signal generator.

3. Set the LEVEL/SLOPE control to the AUTO PRESET detent.

4. Adjust the CH 2 VOLTS/DIV switch and the SEC/DIV switch for a display approximately four divisions in amplitude, with one cycle of signal displayed every two or three divisons.

5. Vertically center the display about the center horizontal line, using the CH 2 POS control.

6. Adjust the AUTO PRESET adjustment so that the CRT display starts on the center horizontal graticule line.

7. Disconnect the probe from the generator.

THEORY OF OPERATION

INTRODUCTION

The following circuit description begins with a discussion of the instrument, using the block diagram located in the Diagram section at the rear of this manual. Each circuit is then described in detail, using detailed diagrams where necessary to show the interconnections between the stages in each major circuit and the relationship of the external controls to the individual stages. In addition to the block diagram, complete schematics are given in the Diagram section.

GENERAL DESCRIPTION

Signals to be displayed on the CRT are applied to the tips of the signal probes. The signals are then amplified by the appropriate channel Input Amplifier circuit, consisting of a two-section source-follower stage and two feedback amplifiers. The Input Amplifier circuits also contain the vertical deflection factor, position, input coupling, variable attenuation, and balance controls.

The Trigger Generator circuit initiates the sweep signal produced by the Sweep Generator. The input signal to the Trigger Generator can be selected internally either from the capacitively coupled CH 2 Input Amplifier signal, or from the directly coupled COMP signal of the Feedback Amplifier. The Trigger Generator input signal can also be selected from the external signal applied to the EXT TRIG banana jack. The Trigger Generator circuit contains coupling and source controls in addition to a combination LEVEL/SLOPE control.

The Sweep Generator circuit produces a linear sawtooth output signal when initiated by the Trigger Generator circuit. The slope of the sawtooth produced by the Sweep Generator circuit is controlled by the SEC/DIV switch. The operating mode of the Sweep Generator circuit is determined by the Trigger LEVEL/SLOPE control and the SINGLE SWP pushbutton. In AUTO PRESET, at full counter-clockwise rotation, the absence of an adequate trigger signal causes the sweep to free run. When the LEVEL/SLOPE control is out of AUTO PRESET, a horizontal sweep is presented only when correctly triggered by an adequate trigger signal. The Single Sweep mode of operation allows one triggered sweep to be initiated after the circuit is reset with the RESET button. The Sweep Generator also produces an unblanking gate signal coincident with the sawtooth waveform. This gate signal unblanks the crt to permit display presentation.

The output of the Sweep Generator circuit is amplified by the Horizontal Amplifier circuit to produce the correct horizontal deflection for the crt for all positions of the SEC/DIV switch. The Horizontal Amplifier contains a variable magnifier to increase the sweep rate up to at least a maximum of five times in any position of the SEC/DIV switch.

The CRT circuit contains the controls necessary for operation of the cathode-ray tube. Trace storage is accomplished by the Storage circuit. The Power Supply and CRT circuits provide all the voltages necessary for operation of this instrument.

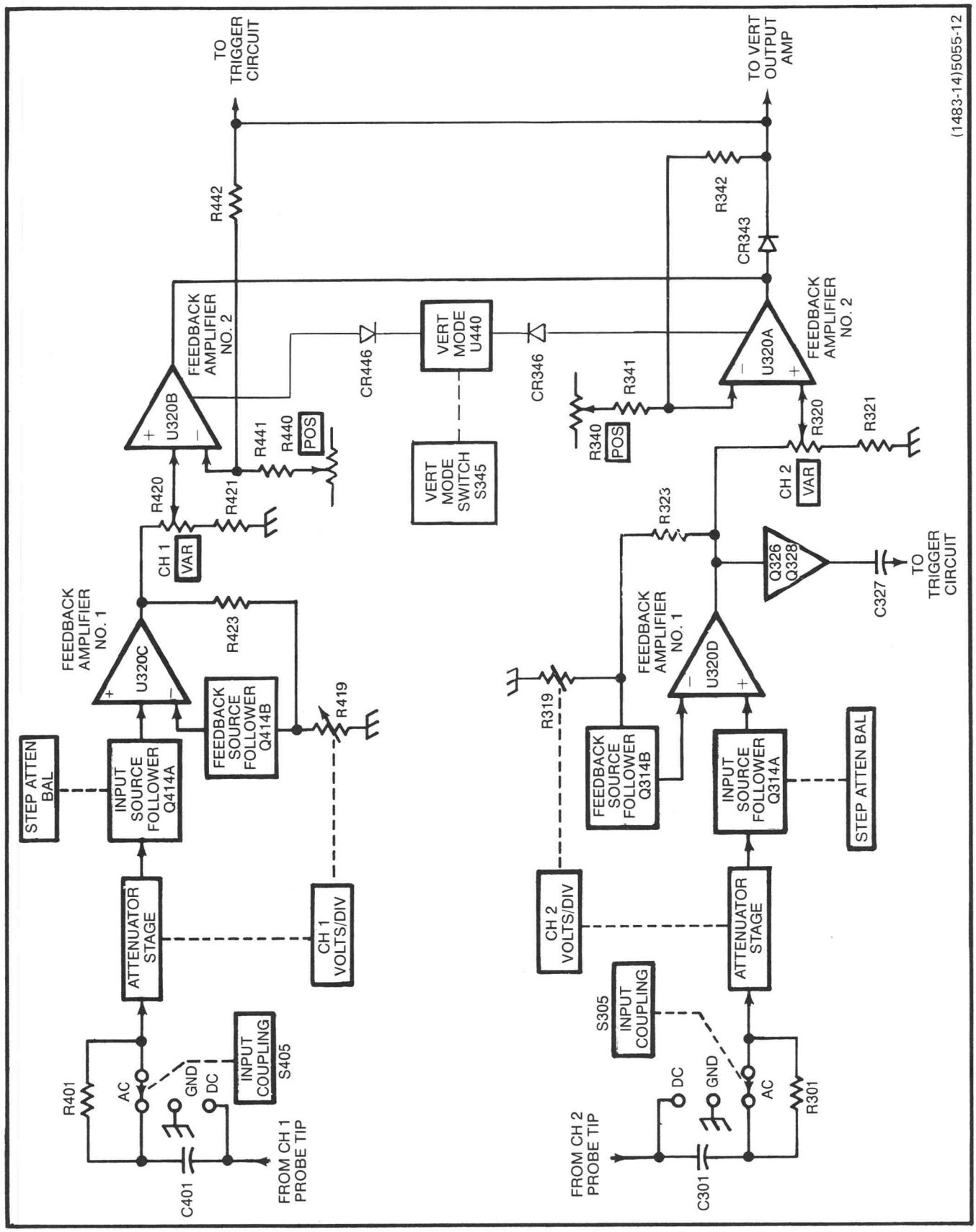


Figure 3-1. Vertical input amplifiers detailed block diagram.

DETAILED CIRCUIT DESCRIPTIONS

Vertical Input Amplifiers

Input signals for vertical deflection of the display are applied to the tips of the attached probes. Each Input Amplifier provides control of input coupling, variable attenuation, vertical deflection factor, balance, and vertical position for the appropriate channel. Figure 3-1 shows a detailed block diagram of the Vertical Input Amplifier circuit. A schematic of this circuit is shown on diagram 1.

Input signals applied to the tips of the probes are connected to the appropriate Attenuation Stage through the INPUT COUPLING switches (S305 and S405). The deflection factor in each channel is determined by the VOLTS/DIV switch (S310 or S410). In all positions of the VOLTS/DIV switches below 0.1 V/DIV, the correct deflection factor is achieved by changing the gain of Feedback Amplifiers U320D and U320C. In switch positions 0.1 V/DIV and up, precision attenuators are used (in addition to changing the gain of U320D and U320C) to achieve the correct deflection factors. When the VAR VOLTS/DIV control is rotated, the signal is attenuated across R320 and R420. This offers variable (uncalibrated) deflection factors between the calibrated settings of the VOLTS/DIV switch. The STEP ATTEN BAL adjustments (R315 and R417) control the trace shift when switching between deflection factors.

Chop Oscillator

The active element of the chop oscillator is U388B. The oscillator operates when +5.6 V is applied to the junction of R389 and R398, and this occurs only when the VERT MODE switch S345 is set to BOTH and the SEC/DIV switch S360 is set at sweep speeds slower than 1ms/div.

When the chop oscillator is first enabled, the voltage at pin 6 of U388 is lower than at pin 5, forcing U388B to an open circuit state, and the output, pin 7, goes high. A reference voltage is established at pin 5 of U388 by the devider action or R386 and R387. Current flowing through R389 and R385 begins to charge C385, and when the voltage across C385 exceeds the reference voltage, the output of U388B goes low. This establishes a new reference voltage and provides a discharge path for C385 through R385. When the voltage across C385 drops below the new reference voltage, the output of U388B goes high, and the cycle repeats itself.

Every negative transition of the voltage at pin 7 of U388 causes Q388 to momentarily turn on while C389 charges. This in turn sends a positive voltage pulse to U440 pin 4 causing the channel switch to toggle, and at the same time turns on Q392, blanking the screen.

Vert Mode Switch

The Vertical Mode Selection system consists of S345, U440, Q454 and associated circuitry.

NOTE

U440 is operated between −5.6 V source and ground. Ground (0 V) is HI and −5.6 V is LO.

With the VERT MODE switch S345 set to CH 1, U440B pin 8 is HI. U440B pin 10 is LO. This combination sets the state of U440 pin 13 HI and U440 pin 12 LO. With U440 pin 13 HI, CR446 is turned off and current flows through R446 to U320 pin 7, turning on U320B, CH 1 vertical preamplifier. U440 pin 12 is LO, turning on CR346 and shunting current away from U320 pin 16. This shuts off U320A, CH 2 vertical preamplifier. In VERT MODE CH 1 and CH 2 positions, U440B does not respond to inputs from U440A.

With the VERT MODE switch S345 set to CH 2, U440B pin 10 is HI. U440B pin 8 is LO. This condition sets U440 pin 13 LO and U440 pin 12 HI, reversing the action described for CH 1. This turns U320A on and U320B off.

With the VERT MODE switch S345 set to BOTH, U440B pin 8 and 10 are both LO. U440B is now set to function as a flip-flop, changing output states each time Chop or Alt information is received from Q388 through buffer U440A. U440A is wired such that pin 2 goes HI only when Pin 4 goes HI. U440A also provides a small amount of time delay, allowing the crt blanking pulse to start before U440B switches output states.

The voltage from S360 enabling the chop oscillator (at sweep speeds slower than 1ms/div) is coupled through S345 in this mode.

When switch S360 is set to X-Y, U440B is forced to a state identical to that described for when the VERT MODE is set to CH2 regardless of the present state of the VERT MODE switch. This is ensured by Q454 turning on and forcing U440 pin 10 high, and the lack of a pull-up voltage for U440 pin 8. At this time U370 functions an an amplifier rather than a sweep generator and any signal applied to the CH 1 input connector becomes the X signal or horizontal signal.

Vertical and Horizontal Output Amplifiers

The Vertical and Horizontal Output Amplifiers provide the final amplification for the deflection signals. Figure 3-2 shows a detailed block diagram of these Output Amplifiers. A schematic of these circuits is on diagram 2.

Both amplifiers contain the same basic circuitry. The single-ended input signals are applied to paraphase amplifiers, U105A and U105B, to convert the signal into push-pull output signals. The Vertical Paraphase Amplifier stage contains the VERT GAIN adjustment (R170) which sets the overall gain of the vertical system, and a Vertical Centering adjustment (R101) to set DC centering. The Horizontal Paraphase Amplifier stage contains the HORIZ GAIN adjustment (R175), the VAR HORIZ MAG control (R476), and the Horizontal POS control (R480). The output signals from the Paraphase Amplifiers receive final amplification in the common base Output Amplifier stages.

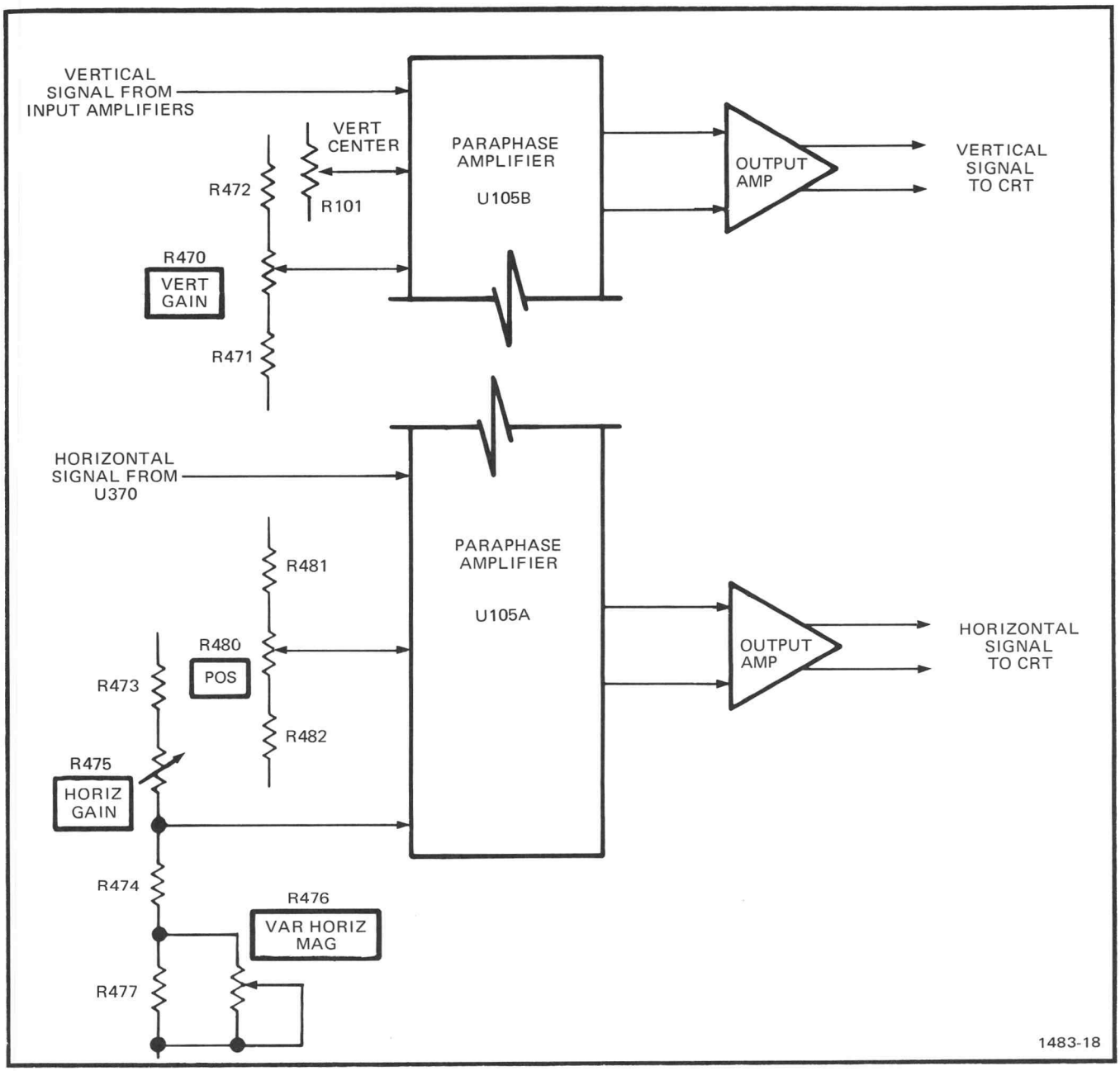


Figure 3-2. Vertical and Horizontal output amplifiers detailed block diagram.

Trigger Generator

Integrated circuit U370 is a combination Trigger/Sweep Generator. The Trigger portion derives trigger signals internally, either from the capacitively coupled CH 2 Vertical Input Amplifier, or from the directly coupled COMP signal, which drives the Vertical Output Amplifier. The Trigger Generator can also select signals from an external signal applied to the EXT TRIG input banana jack. Controls are provided in this circuit to select trigger level, slope, and source. Figure 3-3 shows a detailed block diagram of the Trigger/Sweep Generator circuits. A schematic of this circuit is on diagram 2.

Auto Preset

Comparator U388A senses the position of the Trigger LEVEL/SLOPE control R375 and drives the Auto Preset circuitry. When the wiper of the Trigger LEVEL/SLOPE control is not at the counter-clockwise end of rotation, the voltage at pin 3 of U388 is more positive than at pin 2 and the output of U388A is in an open circuit state (U388 has open collector outputs). Under this condition Q367 is on, disabling the AUTO function, and Q363 is also on, providing the full voltage range for the Trigger LEVEL/SLOPE control. When the Trigger LEVEL/SLOPE control is in AUTO PRESET, fully counter-clockwise, the output of U388A shunts the current from R379, and both Q367 and Q363 are turned off. The AUTO function is enabled and the trigger level is determined by the setting of the AUTO PRESET adjustment R374.

Sweep Generator

The Sweep Generator portion of U370 serves a multiple purpose. In all positions of the SEC/DIV switch except X-Y, the Sweep Generator is an integrator, which generates a linear sawtooth voltage waveform. The output signal is produced on command (trigger pulse) from the Trigger Generator circuit. The slope of the sawtooth voltage is controlled by the setting of the SEC/DIV (S360) switch.

The Sweep Generator also produces an unblanking gate signal coincident with the sawtooth waveform. This gate signal is amplified by Unblanking Amplifier Q134 and applied to the crt to unblank the crt during sweep presentation. In addition, the Sweep Generator supplies the clock pulses to the Vertical Mode Multivibrator (U440) for alternate switching between channels. In the X-Y position of the SEC/DIV switch, the Sweep Generator becomes a feedback amplifier to amplify the signal applied to the CH 1 probe tip. Figure 3-3 shows a detailed block diagram of the Trigger/Sweep Generator circuits. A schematic of this circuit is on diagram 2.

Single Sweep

In the Single Sweep mode of operation, the Auto Trigger is disabled and sweep initiation is controlled by the Single Sweep Reset circuit. Also, Sweep Start Holdoff is controlled by latch circuit Q532 and Q535, instead of the Sweep Generator. A schematic of the Single Sweep circuit is on diagram 3.

The Sweep Start Holdoff waveform (see Figure 3-4) from the Sweep Generator is applied to the Single Sweep circuit. The positive-going step of this waveform (Sweep Start) is coupled through C530 to turn on Q530. When Q530 turns on, the latch circuit (Q532 and Q535) is disabled. The emitter of Q532 is held positive, preventing the Sweep Start Holdoff from returning to the Sweep Ready state.

When the RESET button is pressed, the latch circuit is again enabled and Q530 is turned off. At this time the READY indicator light, DS535, turns on. The next Trigger Pulse received by the Sweep Generator ends the Sweep Start Holdoff and initiates a sweep.

Storage

The Storage circuit provides the voltage levels necessary to operate the flood gun, wall band, and target. Additional circuitry included is the Enhance Amplifier, which permits fast Single Sweep displays to be Stored. Figure 3-5 shows a detailed block diagram of the Storage circuit; a schematic is on diagram 3.

The crt used in the 214 is a direct-view bistable storage cathode ray tube containing special storage elements in addition to the conventional writing gun elements. The operating mode of the tube depends primarily on the voltages applied to these storage electrodes. With one condition of applied potentials, the Storage screen (target) operates in the ready-to-write state; then, when it is bombarded with high-energy writing beam current, the bombarded portion shifts to the STORED mode to store a written display. With a different set of applied voltages, the target operates in the conventional, NONSTORE, mode.

The wall band serves as a lens to distribute the flood gun electrons uniformly over the storage target, and has no effect on the bombarding energy of the electrons. The voltage level of the wall band is determined by R506 through Q505. The ready-to-write potential of the target is set by Operational Level control R510 in the Target Control Amplifier (Q510, Q512).

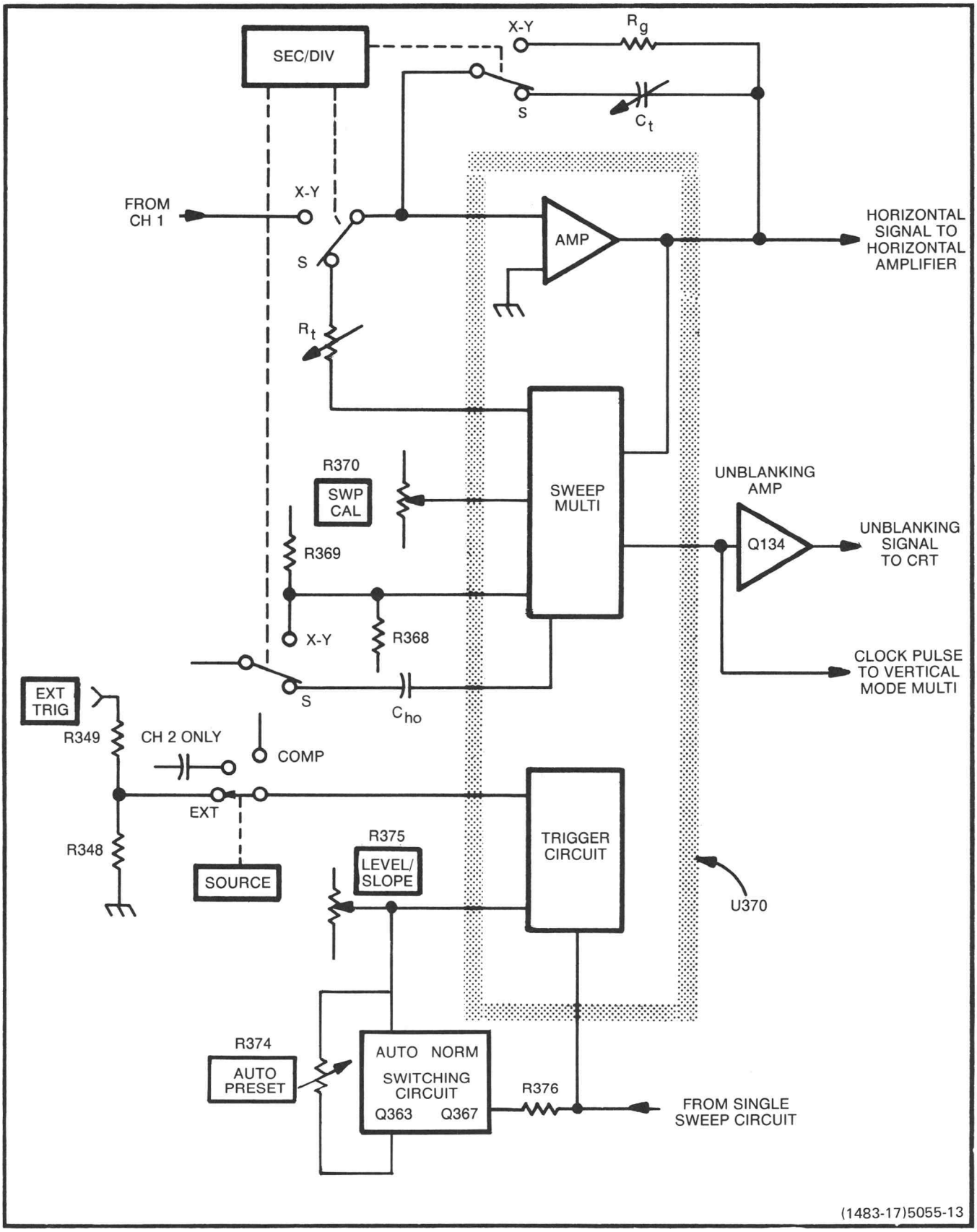


Figure 3-3. Trigger/Sweep Generator detailed block diagram.

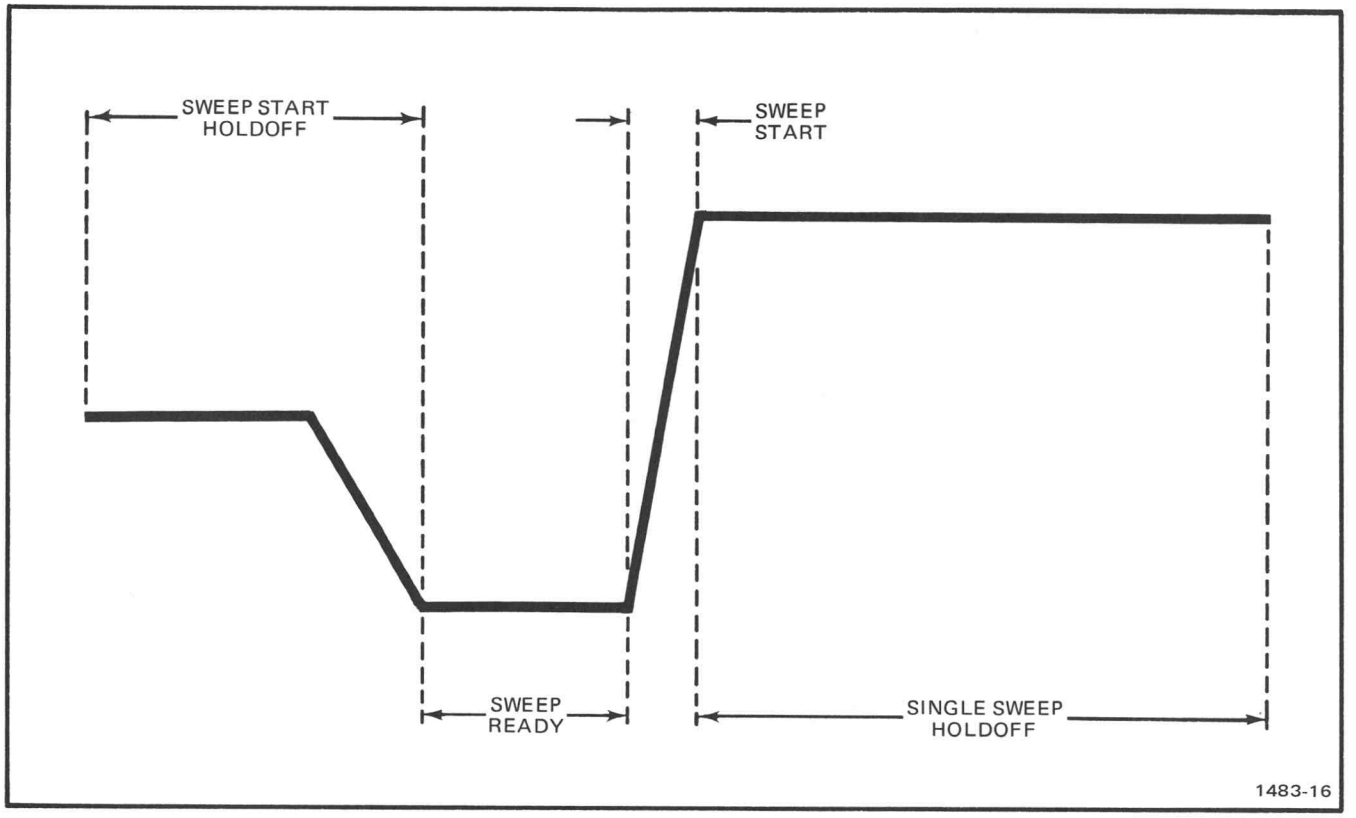


Figure 3-4. Identification of portion of the Sweep Start Holdoff waveform at Pin 5 of the Single Sweep Board.

Storage Erase. Erase of a Stored display is achieved by pressing and releasing the ERASE button. As the switch makes contact, a positive-going pulse (about +155 V) is applied to the target and wall band through the Target Control and Wall Board Amplifiers. This pulse raises the target voltage above the writing threshold and writes the entire target with flood gun electrons.

When the ERASE button is released, a negative-going pulse (about −155 V) is applied to the target and wall band, pulling the target voltage below the ready-to-write potential. Then the target and wall band are gradually returned to the ready-to-write state.

Enhance Amplifier. Automatic Enhance occurs only in the Store, Single Sweep Mode of operation and at sweep rates of 0.1 ms/div and above. The Enhance Amplifier (Q520 and Q521) receives a negative pulse from the Single Sweep Reset circuit when the READY light is extinguished. With power applied to the Enhance Amplifier from the SEC/DIV switch, the Enhance Amplifier produces a positive pulse to the Target Control Amplifier and wall band circuits. The amplitude of this Enhance pulse is determined by the Enhance Level control, R526. This Enhance pulse conditions the target so that less writing-gun current is required to shift the written section to the STORED state.

Power Supply

The Power Supply provides the power necessary to operate this instrument or, if the instrument is turned off and connected to an ac line, to recharge the batteries. Figure 3-6 shows a detailed block diagram of this circuit. A schematic of this circuit is on diagram 4. Differences in the CRT sensitivity between STORE and NONSTORE modes are compensated for by the Store Gain control, R275.

When the instrument is connected to a power line, the ac power is capacitively coupled to the Power Rectifier. The rectified dc is used to either run the instrument or to recharge the internal batteries. The batteries act as a large filter capacitor for the Input Rectifier in the ac line mode of operation. When the instrument is not connected to a power line, operating power is provided by the batteries. The POWER (BATTERY) indicator, light-emitting diode DS310, is illuminated when the 214 is operating from line voltage or

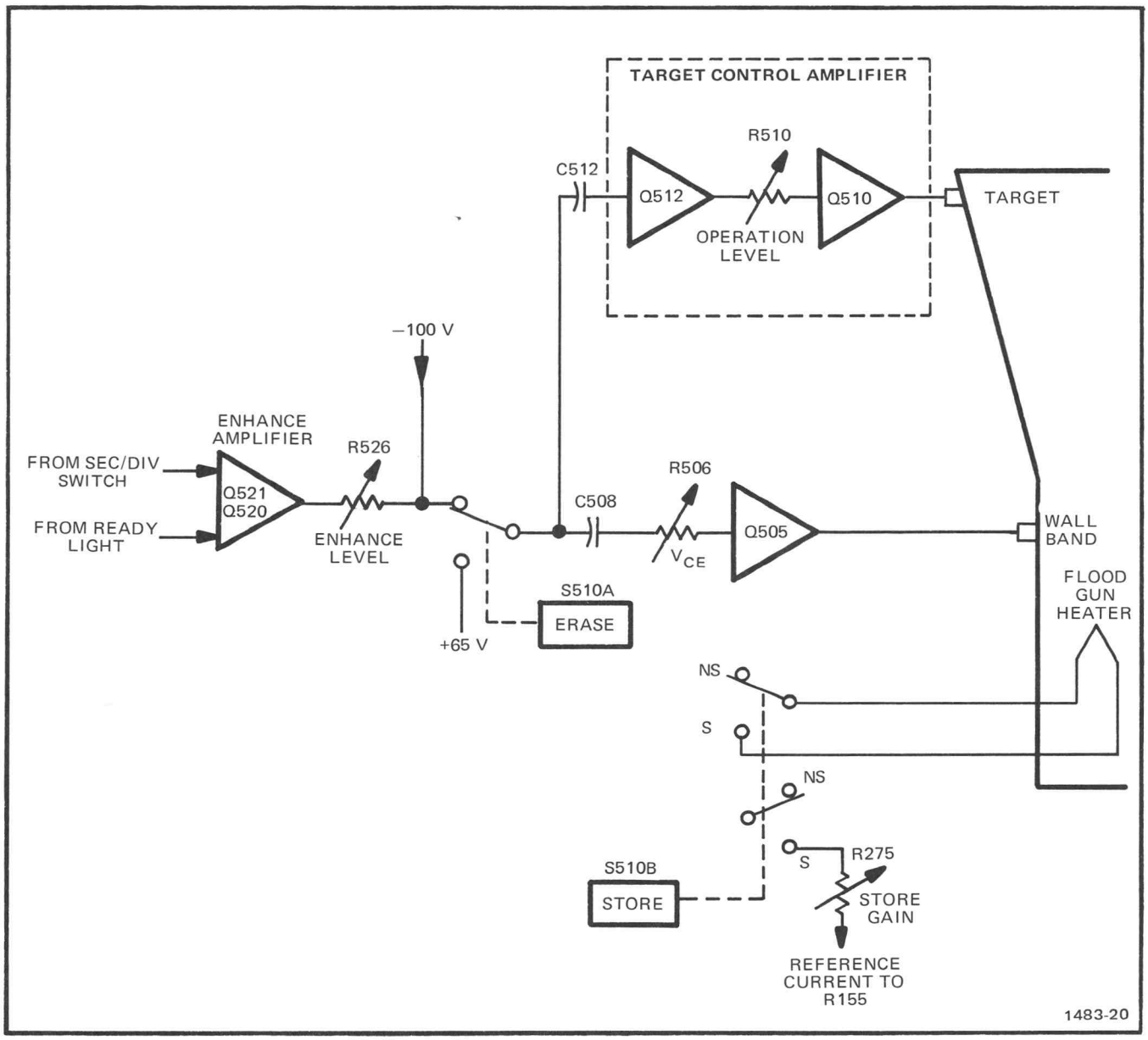


Figure 3-5. Storage circuit detailed block diagram.

adequately charged batteries. When about five minutes of operating time remains, the battery voltage drops to a point where DS310 will extinguish. When the voltage of the batteries falls below about +10 volts, the Discharge Protection circuit (Q231 and Q235) prevents the Converter Multivibrator (Q242 and Q249) from functioning. The Converter Multivibrator changes dc into ac, which is applied across T250 and then rectified into the appropriate dc voltages in the Rectifier circuit. Q242 and Q249, together with VR238, also act as a Regulator in the Primary of T250. Error Amp Q235, VR238, CR240, and CR241 controls the voltage changes to the Converter Multivibrator.

Power is applied to T280 to activate the −100 volt supplies, storage circuits, and the flood gun of the CRT only in the STORE mode of operation. This reduces the power drain from the batteries when operating in the NONSTORE mode.

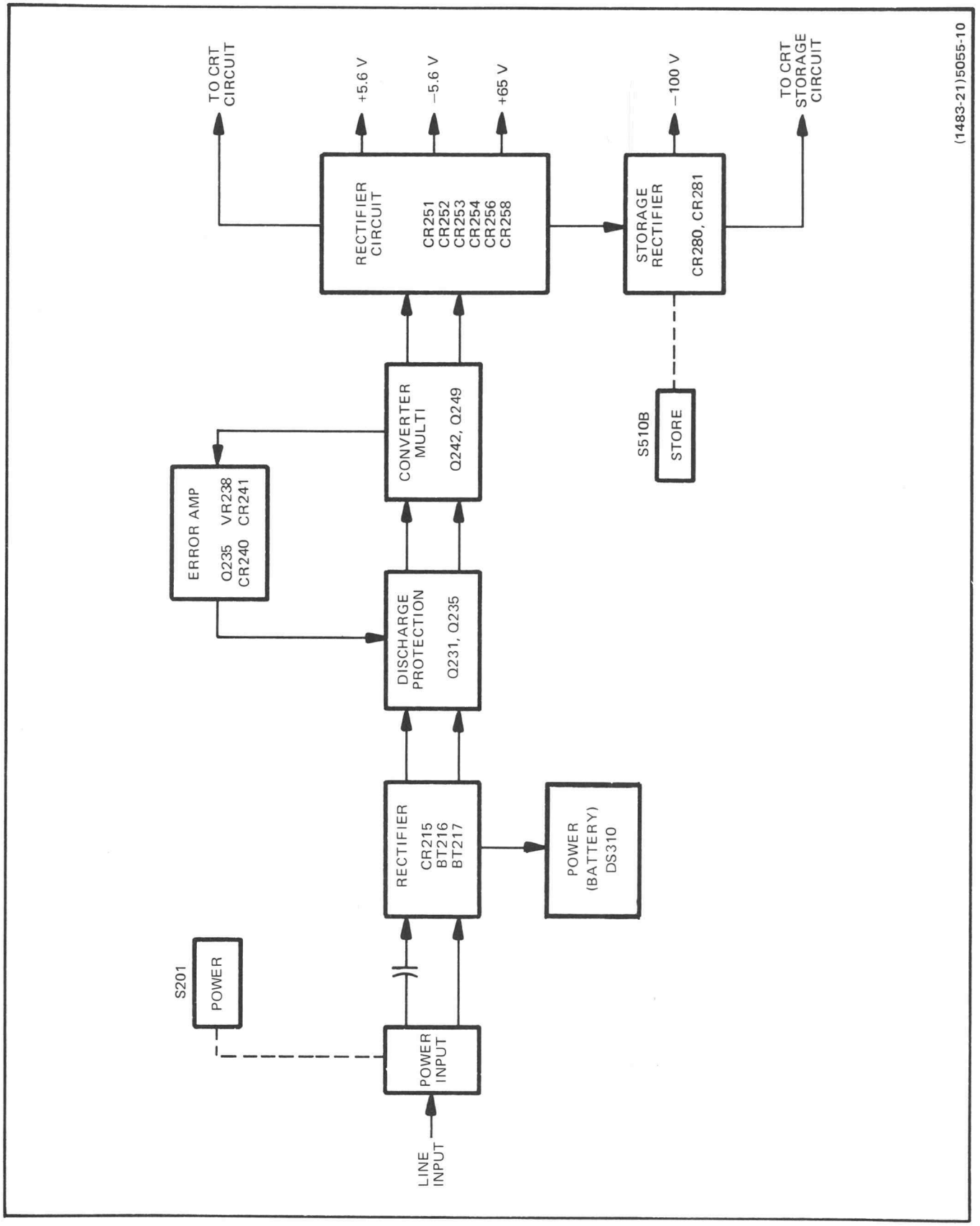


Figure 3-6. Power Supply circuit block diagram.

Overvoltage Protection

In the event that fuse F216 or F217 should blow, the regulating ability of the batteries is lost. When connected to the ac line, protection circuitry consisting of Q215, VR216, and CR216 prevents the voltage across the Converter Multivibrator from reaching a damaging level. When the voltage rises to about 18 volts at the beginning of a line cycle, VR216 conducts and turns on SCR Q215. Charge current is shunted through R215, limiting the voltage. At the end of the line cycle the charge current drops to zero and Q215 turns off. Unintentional discharge of batteries with good fuses, should Q215 misfire, is prevented by CR216.

CRT Circuit

The CRT circuit provides the high voltage and control circuits necessary for operation of the cathode ray tube (CRT). Figure 3-7 shows a detailed block diagram of the CRT circuit. A schematic of this circuit is on diagram 3.

NOTE

See the Storage Circuit description for operation of the CRT in the STORE mode.

Rectifiers CR261 through CR268 provide the negative accelerating potential for the CRT. Voltage output is approximately −1000 volts at the CRT cathode. Filament voltage for the CRT is provided by a separate winding of T250. Display intensity and focus are controlled by R395 and R294 respectively. The Trace Rotation adjustment controls the current through L300 and affects both the vertical and horizontal alignment of the CRT beam.

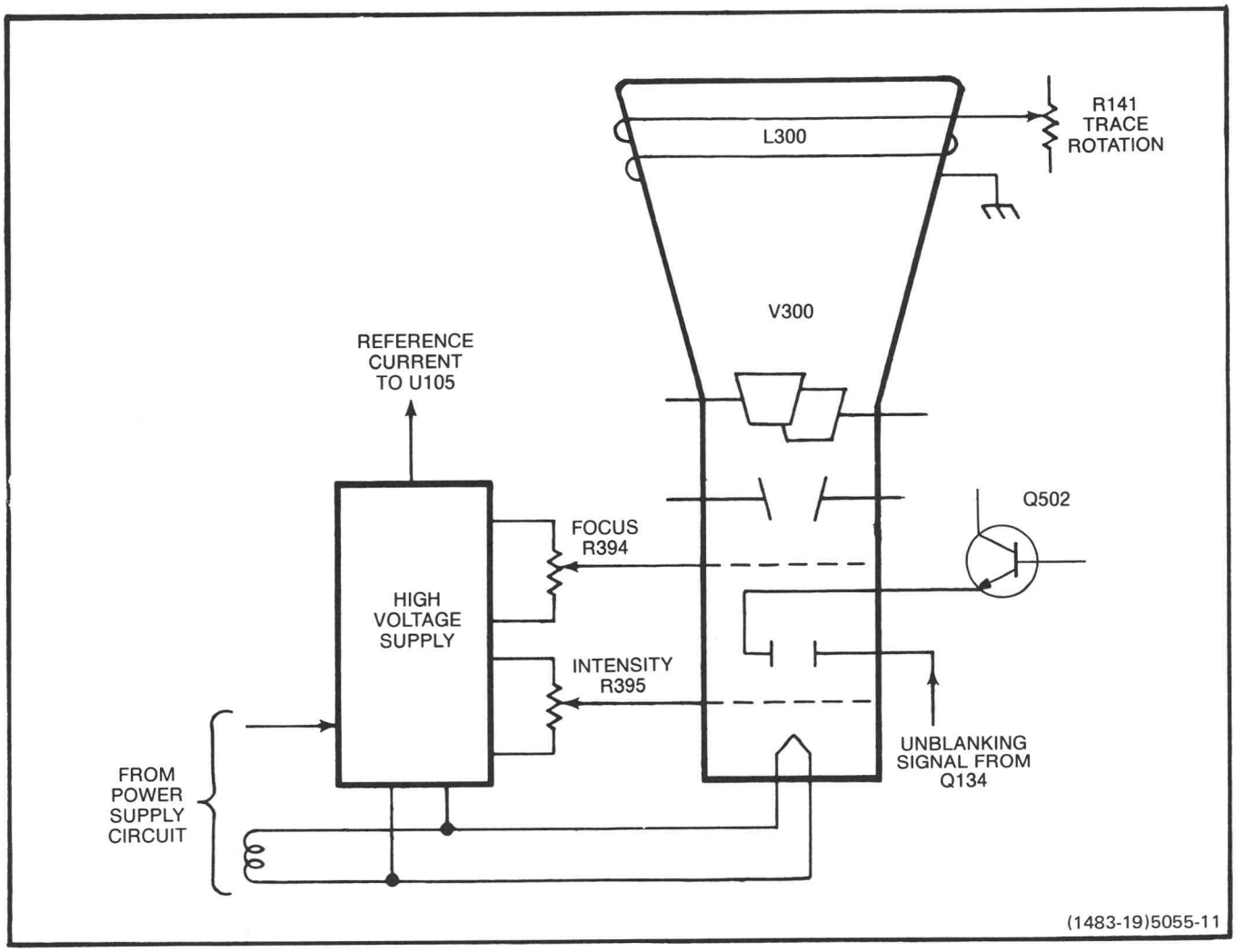


Figure 3-7. CRT Circuit detailed block diagram.

CALIBRATION

INTRODUCTION

PURPOSE

This section contains information necessary to allow a complete instrument calibration. To maintain instrument accuracy, the performance of the instrument should be checked every 1000 hours of operation, or every six months if used infrequently. If your instrument is subjected to harsh environments or severe usage, a more frequent interval may be necessary.

The completion of the Calibration Procedure ensures that this instrument meets the electrical specifications given in Section 1. Where possible, instrument performance is checked before an adjustment is made.

Selected procedures may also be used as preliminary troubleshooting aids or to verify instrument performance after repair or component replacement.

STRUCTURE

This procedure is structured into four major subsections, each of which can be performed independently to permit checking individual portions of the instrument. For example, if only the Vertical section fails to meet the Performance Requirements or has had repairs made, it can be calibrated with little or no effect on other sections of the instrument. At the beginning of each subsection there is an equipment-required list showing only the test equipment necessary for performing the steps in that subsection. In this list, the item number that follows each piece of equipment corresponds to the item number listed in Table 4-1.

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

TEST EQUIPMENT

The test equipment listed in Table 4-1 is a complete list of the equipment required to calibrate the 214. To assure accurate measurements, it is important that test equipment used for making these checks meet or exceed the specifications described in Table 4-1. When considering use of equipment other than that recommended, utilize the "Minimum Specification" column to determine whether available test equipment will suffice.

Each procedure in this section is written using the control and connector nomenclature imprinted on the "recommended" test equipment. When substitute equipment is used control settings stated in the test setup and in the procedure itself may need to be altered.

Detailed operating instructions for test equipment are not given in this procedure. If more operating information is required, refer to the appropriate test-equipment instruction manual.

LIMITS AND TOLERANCES

The limits and tolerances stated in this procedure are instrument specifications only if they are listed in the Specifications Part of Section 1. Tolerances given are applicable only to the instrument undergoing calibration and do not include test equipment error. Calibration of the instrument must be performed at an ambient temperature between +20°C and +30°C, and the instrument must have had a warm-up period of at least 5 minutes.

STEP TITLES

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

PREPARATION FOR CALIBRATION

The instrument cabinet must be removed to perform the Calibration Procedure. See the "Disassembly Instructions" in the "Maintenance" section of this manual.

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

Before performing any procedure in this section, ensure that the batteries are fully charged. Set the POWER switch to ON and allow a 5-minute warm-up period.

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

Table 4-1
Test Equipment Required

Item No.and Description	Minimum Specification	Purpose	Examples of Suitable Test Equipment
1. Calibration Generator	Standard-amplitude signal levels: 20 mV to 100 V. Accuracy ±0.3%. Fast-rise signal level: 100 mV + 50 V. Repetition rate 1 kHz. Rise time: 100 ns or less. Flatness: ±0.5%.	Vertical and horizontal checks.	TEKTRONIX PG 506 Calibration Genererator.
2. Leveled Sine-Wave Generator	Frequency: 50 kHz to above 500 kHz. Output amplitude variable from 5 mV to 0.2 V p-p. Output impedance: 50 Ω. Reference frequency: 1 kHz. Amplitude accuracy: constant within 1% of reference frequency as output frequency changes.	Vertical and horizontal amplifier checks.	Krohn-Hite 4200A Oscillator.
3. Time-Mark Generator	Marker outputs: 5 μs to 0.1 s. Marker accuracy: ±0.1%. Trigger output: 1 ms to 0.1 μs, time-coincident with markers.	Horizontal checks and adjustments. Display adjustment.	TEKTRONIX TG 501 Time-Mark Generator.[a]
4. Ramp Generator	Frequency: 100 ms to 10 s. Output amplitude: variable from 50 mV to 6 V. External triggering: both auto and normal.	Hum balance adjustment.	TEKTRONIX RG 501 Ramp Generator.[a]

[a]Requires a TM 500-series power-module mainframe.

Table 4-1 (cont)

Item No.and Description	Minimum Specification	Purpose	Examples of Suitable Test Equipment
5. Cable	Impedance: 50 Ω. Length: 42 in. Connectors: BNC.	Signal interconnection.	Tektronix Part Number 012-0057-01.
6. Adapter	Connectors: GR to BNC female.	Signal interconnection.	Tektronix Part Number 017-0063-00.
7. Adapter	Connectors: BNC-male-to-probe tip.	Signal interconnection.	Tektronix Part Number 013-0084-01.
8. Adapter	Connectors: BNC-female-to-dual male banana plug.	Signal interconnection.	Tektronix Part Number 103-0090-00.
9. 10X Attenuator	Ratio: 10X. Impedance: 50 Ω. Connectors: BNC.	Signal attenuation.	Tektronix Part Number 011-0059-02.
10. Termination	Impedance: 50 Ω. Connectors: BNC.	Signal termination.	Tektronix Part Number 011-0049-01.
11. T-Connector	Connectors: BNC.	Signal interconnection.	Tektronix Part Number 103-0030-00.
12. Digital Voltmeter	Range: 0 to 100 V. Dc voltage accuracy: ±0.15%. 4 1/2-digit display.	Power supply, CRT, and vertical checks and adjustments.	TEKTRONIX DM 501A Digital Multimeter.[a]
13. DC Voltmeter	Range: 0 to 1500 V. Calibrated to 1% accuracy at −1000 V. Input resistance: 10 MΩ to 12 MΩ.	High-voltage power supply check.	Triplett Model 630-NA.
14. Screwdriver	Length: 3-inch. Bit size: 3/32 in.	Adjust variable resistors.	Xcelite R-3323.
15. Low-Capacitance Alignment Tool	Length: 1-in shaft. Bit size: 3/32 in.	Adjust variable capacitors.	J.F.D. Electronics Corp. Adjustment Tool Number 5384.
16. 1X Probe	Connector: BNC	Hum balance adjustment	TEKTRONIX P6101 Part Number 010-6101-03
17. Cable Extender	Multipin connectors: 11 pins.	Connect Power Supply to Single Sweep.	Tektronix Part Number 174-0124-00

[a]Requires a TM 500-series power-module mainframe.

POWER SUPPLY AND CRT DISPLAY

Equipment Required (see Table 4-1)

- Leveled Sine-Wave Generator (Item 1)
- Ramp Generator (Item 4)
- 50-Ω Terminator (Item 10)
- BNC-Male-to-Probe Tip Adapter (Item 7)
- Digital Voltmeter (Item 12)
- DC Voltmeter (Item 13)
- Screwdriver (Item 14)
- 1X Probe (Item 16)

See ADJUSTMENT LOCATIONS 1 at the back of this manual for location of test points and adjustments.

INITIAL CONTROL SETTINGS

Display

INTENSITY	Off (ccw)
STORE	Off (button out)

Vertical (Both Channels)

VOLTS/DIV	50 mV
INPUT COUPLING	GND
POSITION	Midrange
VOLTS/DIV Variable	CAL detent
VERT MODE	CH 1

Trigger

LEVEL/SLOPE	AUTO PRESET
TRIG SOURCE	COMP

Horizontal

HORIZ MAG	CAL detent
POS	Midrange
SEC/DIV	0.1 ms
SINGLE SWP	Off (button out)

PROCEDURE STEPS

1. Check Power Supply DC Levels

a. Connect the digital voltmeter negative (low) lead to chassis ground and connect the positive (volts) lead to the power supplies listed in Table 4-2. Observe proper meter polarity.

b. CHECK—Voltage levels of the power supplies listed in Table 4-2 are within the specified levels.

Table 4-2
Power Supply Limits

Power Supply	Test Point	Reading (Volts)
−5.6 V	P3 pin 4	−5.2 V to −6.0 V
+5.6 V	P3 pin 3	+5.2 V to +6.0 V
+65 V	P3 pin 1	+61 V to +69 V

c. Disconnect the test equipment from the instrument.

d. Connect a dc voltmeter capable of measuring −1000 V between pin 3 of P2 and chassis ground. Pin 3 is negative with respect to the chassis.

e. CHECK—Voltmeter reading is between −920 V and −1000 V.

f. Disconnect the test equipment from the instrument.

2. Check Storage Voltage

a. Connect the digital voltmeter leads between chassis ground and −100 V storage voltage (pin 2 of P25).

b. Set the STORE button to On (button in).

c. CHECK—Storage voltage level reading is −95 V to −110 V.

d. Set the STORE button to Off (button out).

3. Check/Adjust CRT Grid Bias (R273)

a. Connect the digital voltmeter negative lead to chassis ground and positive lead to pin 5 of P3.

b. Rotate the INTENSITY control fully clockwise (on).

c. CHECK—Voltmeter reading of +1.9 V.

d. ADJUST—Crt Grid Bias (R273) for a voltmeter reading of +1.9 V.

e. Rotate the INTENSITY control to normal brightness.

f. Disconnect the test equipment from the instrument.

4. Adjust Focus

a. Position the trace to the middle of the graticule area.

b. Set the SEC/DIV switch to X-Y position and adjust the INTENSITY control for a low display intensity.

c. ADJUST—FOCUS screwdriver adjustment for a well-defined dot.

d. Set the SEC/DIV switch to 1 ms.

5. Check/Adjust Trace Rotation (R141)

a. Position the trace to the center horizontal graticule line.

b. CHECK—The trace is parallel with the center horizontal graticule line.

c. ADJUST—Trace Rotation control (R141) for optimum alignment of the trace with the center horizontal graticule line.

6. Adjust Storage Operating Level (R510)

a. Set:

INTENSITY	Fully clockwise
VERT MODE	BOTH
SEC/DIV	5 ms

b. Adjust the Operating Level control (R510) fully counterclockwise.

c. Connect the digital voltmeter positive lead to pin 4 of P22 and negative lead to chassis ground of the Power Supply circuit board.

d. Set:

STORE	On (button in)
SINGLE SWP	On (button in)

e. Press the ERASE button.

f. Press the RESET button.

g. Adjust the LEVEL/SLOPE control for a triggered sweep.

h. ADJUST—If the traces thicken or begin to flood the crt during the first minute after storage, adjust the Operating Level control (R510) a small amount in a clockwise direction to decrease the storage operating level.

i. Repeat parts e through h until the traces no longer flood or thicken during the first minute after Storage.

j. CHECK—The voltage reading and record it for use in part q.

k. Rotate the INTENSITY control for a minimun stored trace intensity.

l. Repeat parts e through g.

m. CHECK—For stored traces with no breaks in the display during the first minute of storage.

n. ADJUST—If breaks occur in the stored traces during the first minute of storage, adjust the Operating Level control (R510) a small amount in a counterclockwise direction to increase the storage operating level.

o. Repeat parts l through n until no breaks occur in the display during the first minute of storage.

p. CHECK—The voltage reading and record it for use in part q.

q. Subtract the voltage reading recorded in part j from the voltage reading in part p. Add one-half of the difference to the reading taken in step j. For example:

First Reading (part p)	58 V
Second Reading (part j)	− 28 V
Difference	= 30 V

$$\text{Second Reading} + \frac{\text{Difference}}{2} = \text{Operating Level}$$

Operating Level for the example would be +43 volts.

r. ADJUST—Operating Level control (R510) for a reading on the digital voltmeter that is equal to the voltage calculated in part q.

NOTE

If the first reading in part j is greater than +55 V and the second reading in part p is less than +35 V then adjust the Operating Level control (R510) for a reading of +45 V.

s. Disconnect the test equipment from the instrument.

7. Adjust Wall Band Level (R506)

a. Connect the digital voltmeter negative lead to pin 5 of P22 and positive lead to chassis ground (Power Supply circuit board).

b. Rotate Vce control (R506) from fully clockwise to fully counterclockwise.

c. CHECK—For a range of at least −40 V to 0 V while rotating the Vce control (R506).

d. Press and hold in the ERASE button.

e. ADJUST—Vce control (R506) until illuminated part of the display covers the entire crt screen with equal brightness at the center and edges of the screen.

f. Release the ERASE button.

g. CHECK—For uniform erasure of the crt screen.

h. Press in and release STORE and SINGLE SWP buttons.

8. Adjust Enhance Level (R525)

a. Set:

VERT MODE	CH 2
CH 2 INPUT COUPLING	AC
TRIG SOURCE	CH 2
SEC/DIV	5 μs

b. Connect the Channel 2 Probe tip to the output of the leveled sine-wave generator via a 50-Ω terminator and a BNC-male-to-probe tip adapter.

c. Set the generator to produce a 50 kHz, 3.2-division display.

d. Set:

STORE	On (button in)
SINGLE SWP	On (button in)

e. Press and hold in the ERASE button for at least 5 seconds.

f. Release the ERASE button.

g. Press the RESET button.

h. ADJUST—Enhance Level control (R525) for the best possible display.

i. Press the RESET button several times in succession.

j. CHECK—Entire crt screen may be flooded positive.

k. Press in and release STORE and SINGLE SWP buttons.

l. Disconnect the test equipment from the instrument.

9. Adjust Hum Balance (R515)

a. Set:

CH 2 VOLTS/DIV	2 V
SEC/DIV	X-Y

b. Connect the Channel 2 Probe tip to the output of the ramp generator via a BNC-male-to-probe tip adapter.

c. Set the generator for external auto triggering and a 6-V, 100 μs, ramp output.

d. Using the Channel 2 POSITION and Horizontal POS controls, move the display to write the entire crt screen.

e. Position the display near the center of the crt graticule.

f. Set the generator for normal triggering.

g. Connect a 1X probe from the external input jack of the generator to Pin 5 of P20.

h. Adjust the generator triggering controls for a stable display.

i. ADJUST—Hum Balance control (R515) for minimum horizontal deflection.

j. Disconnect the test equipment from the instrument.

VERTICAL DEFLECTION SYSTEM

Equipment Required

Calibration Generator (Item 1)
Leveled Sine-Wave Generator (Item 2)
BNC-Male-to-Probe Tip Adapter (Item 7)
10X Attenuator (Item 9)
50-Ω Termination (Item 10)
Digital Voltmeter (Item 12)
Screwdriver (Item 14)
Low-Capacitance Aligment Tool (Item 15)

See ADJUSTMENT LOCATIONS 1 at the back of this manual for location of test points and adjustments.

INITIAL CONTROL SETTINGS

Display

INTENSITY	As desired
STORE	Off (button out)

Vertical (Both Channels)

VOLTS/DIV	50 mV
INPUT COUPLING	GND
POSITION	Midrange
VOLTS/DIV Variable	CAL detent
VERT MODE	CH 1

Trigger

LEVEL/SLOPE	AUTO PRESET (ccw)
TRIG SOURCE	COMP

Horizontal

HORIZ MAG	CAL detent
POS	Midrange
SEC/DIV	0.2 ms
SINGLE SWP	Off (button out)

PROCEDURE STEPS

1. Check/Adjust Vertical DC Centering (R101)

a. Connect the digital voltmeter positive (volts) lead to pin 11 of U105 on the Amplifier circuit board and negative (low) lead to chassis ground.

b. Adjust the CH 1 POSITION control for a 0 V reading on the digital voltmeter.

c. CHECK—Display trace is within 0.4 division of the center horizontal graticule line. If the Vertical DC Centering is within tolerance, skip to part e. If it is not, continue with part d of this step.

d. ADJUST—Vertical DC Centering control (R101) to set the trace on the center horizontal graticule line.

e. Disconnect the test equipment from the instrument.

2. Check/Adjust CH 1 STEP ATTEN BAL

a. Rotate the CH 1 VOLTS/DIV switch from 50 mV to 1 mV.

b. CHECK—The display trace for 0.1 division, or less, of vertical trace shift between adjacent switch positions from 50 mV to 1 mV. If the CH 1 STEP ATTEN BAL is within tolerance, skip to step 3. If it is not, continue with part c of this step.

c. ADJUST—CH 1 STEP ATTEN BAL control (R417) located on the side panel for minimum trace shift when rotating the CH 1 VOLTS/DIV switch from 50 mV to 1 mV.

3. Check/Adjust CH 2 STEP ATTEN BAL

a. Set the VERT MODE switch to CH 2.

b. Rotate the CH 2 VOLTS/DIV switch from 50 mV to 1 mV.

c. CHECK—The display trace for 0.1 division, or less, of vertical trace shift between adjacent switch positions from 50 mV to 1 mV. If the CH 2 STEP ATTEN BAL is within tolerance, skip to step 4. If it is not, continue with part d of this step.

d. ADJUST—CH 2 STEP ATTEN BAL control (R315) located on the side panel for minimum trace shift when rotating the CH 2 VOLTS/DIV switch from 50 mV to 1 mV.

4. CHECK/ADJUST Vertical Gain (R170)

a. Set:

VOLTS/DIV (both)	5 mV
INPUT COUPLING (both)	DC

b. Connect the Channel 2 Probe tip to the output of the standard amplitude generator via a BNC-male-to-probe tip adapter.

c. Set the generator to produce a 20 mV signal.

d. CHECK—Display amplitude is 4 divisions within 5% (3.8 to 4.2 divisions). If the vertical gain is within tolerance, skip to step 5. If it is not, proceed to part e of this step.

e. ADJUST—Vertical Gain control (R170) for a 4-division display.

5. Check/Adjust Storage Vertical Gain (R275)

a. Set:

STORE	On (button in)
SINGLE SWP	On (button in)

b. Press the ERASE button.

c. Press the RESET button.

d. Adjust the LEVEL/SLOPE control for a triggered display.

e. CHECK—Display amplitude is 4 divisions within 5% (3.8 to 4.2 divisions). If the vertical gain is within tolerance, skip to part h of this step. If it is not, proceed to part f of this step.

f. ADJUST—Storage Vertical Gain (R275) for a 4-division display.

g. Repeat parts b through f until 4-division display is achieved.

h. Press in and release STORE and SINGLE SWP buttons.

6. Check Deflection Accuracy and Variable Range

a. CHECK—Deflection accuracy is within the limits given in Table 4-3 for each CH 2 VOLTS/DIV switch setting and corresponding standard-amplitude signal. When at the 5 mV VOLTS/DIV switch setting rotate the the CH 2 VOLTS/DIV VAR control fully counterclockwise.

b. CHECK-Display amplitude is less than 1.6 divisions.

c. Return the CH 2 VOLT/DIV VAR control to CAL detent.

Table 4-3
Deflection Accuracy Limits

VOLTS/DIV Switch Setting	Standard Amplitude Signal	Vertical Deflection (Divisions)	Accuracy Limits (Divisions)
1 mV	5 mV	5	4.75 to 5.25
2 mV	10 mV	5	4.75 to 5.25
5 mV	20 mV	4	3.8 to 4.2
10 mV	50 mV	5	4.75 to 5.25
20 mV	0.1 V	5	4.75 to 5.25
50 mV	0.2 V	4	3.8 to 4.2
0.1 V	0.5 V	5	4.75 to 5.25
0.2 V	1 V	5	4.75 to 5.25
0.5 V	2 V	4	3.8 to 4.2
1 V	5 V	5	4.75 to 5.25
2 V	10 V	5	4.75 to 5.25
5 V	20 V	4	3.8 to 4.2
10 V	50 V	5	4.75 to 5.25
20 V	100 V	5	4.75 to 5.25
50 V	100 V	2	1.9 to 2.1

d. Remove the Channel 2 Probe tip and connect the Channel 1 probe tip to the output of the standard amplitude generator via a BNC-male-to-probe tip adapter.

e. Set the Vert Mode switch to CH 1.

f. Repeat parts a through c using the Channel 1 controls.

7. Check input Coupling

a. Set both VOLTS/DIV switches to 10 mV.

b. Set the calibration generator to produce a 20-mV signal.

c. Set the bottom of the signal on the center horizontal graticule line using the CH 1 POSITION control.

d. Set CH 1 INPUT COUPLING switch to GND.

e. CHECK—For no vertical deflection; trace is at the center horizontal graticule line.

f. Set the CH 1 INPUT COUPLING switch to AC.

g. CHECK—That the display is centered about the horizontal graticule line.

h. Disconnect the CH 1 probe tip and connect the CH 2 probe tip to the output of the standard amplitude generator via a BNC-male-to-probe tip adapter.

i. Set the VERT MODE switch to CH 2.

j. Repeat parts c through g using the Channel 2 controls.

k. Disconnect the test equipment from the instrument.

8. Check/Adjust CH 1 VOLTS/DIV Compensation (C407, C408, and C409)

a. Set:

VERT MODE	CH 1
CH 1 VOLTS/DIV	0.1 V

b. Connect the CH 1 probe tip to the high-amplitude square wave output via a 50-Ω termination and a BNC-male-to-probe tip adapter.

c. Set the generator to produce a 1-kHz, 4-division display.

d. Adjust the LEVEL/SLOPE control for a stable display.

e. CHECK—The crt display for flat-top waveform with no more than +0.2 division, −0.1 division, or a total of 0.2 division of aberrations. If the aberrations are within tolerance, skip to part g of this step. If it is not, continue with part f of this step.

NOTE

If C307, C308, C309, C407, C408, or C409 require adjustment, it will be necessary to remove the instrument side panel from the Input circuit board. Refer to the disassembly instructions in the "Maintenance Section" of this manual.

f. ADJUST—Channel 1 Compensation (C407) for best flat-top (+0.2 division, −0.1 division, or a total of 0.2 division of aberrations).

g. Set CH 1 VOLTS/DIV switch to 1 V and adjust the generator for a 4-division display.

h. CHECK—The crt display for flat-top waveform with no more than +0.2 division, −0.1 division, or a total of 0.2 division of aberrations. If the aberrations are within tolerance, skip to part j of this step. If it is not, continue with part i of this step.

i. ADJUST—Channel 1 Compensation (C408) for best flat-top (+0.2 division, −0.1 division, or a total of 0.2 division of aberrations).

j. Set CH 1 VOLTS/DIV switch to 10 V, remove the 50-Ω termination from the test setup and adjust the generator for a 4-division display.

k. CHECK—The crt display for flat-top waveform with no more than +0.2 division, −0.1 division, or a total of 0.2 division of aberrations. If the aberrations are within tolerance, skip to part m of this step. If it is not, continue with part l of this step.

l. ADJUST—Channel 1 Compensation (C409) for best flat-top (+0.2 division, −0.1 division, or a total of 0.2 division of aberrations).

m. Disconnect the CH 1 probe tip from the test setup.

9. Check/Adjust CH 2 VOLTS/DIV Compensation (C307, C308, and C309)

a. Set:

VERT MODE	CH 2
CH 2 VOLTS/DIV	0.1 V

b. Connect the CH 2 probe tip to the high-amplitude square wave output via a 50-Ω termination and a BNC-male-to-probe tip adapter.

c. Set the generator to produce a 1-kHz, 4-division display.

d. Adjust the LEVEL/SLOPE control for a stable display.

e. CHECK—The crt display for flat-top waveform with no more than +0.2 division, −0.1 division, or a total of 0.2 division of aberrations. If the aberrations are within tolerance, skip to part g of this step. If it is not, continue with part f of this step.

f. ADJUST—Channel 2 Compensation (C307) for best flat-top (+0.2 division, −0.1 division, or a total of 0.2 division of aberrations).

g. Set CH 2 VOLTS/DIV switch to 1 V and adjust the generator for a 4-division display.

h. CHECK—The crt display for flat-top waveform with no more than +0.2 division, −0.1 division, or a total of 0.2 division of aberrations. If the aberrations are within tolerance, skip to part j of this step. If it is not, continue with part i of this step.

i. ADJUST—Channel 2 Compensation (C308) for best flat-top (+0.2 division, −0.1 division, or a total of 0.2 division of aberrations).

j. Set CH 2 VOLTS/DIV switch to 10 V, remove the 50-Ω termination from the test setup and adjust the generator for a 4-division display.

k. CHECK—The crt display for flat-top waveform with no more than +0.2 division, −0.1 division, or a total of 0.2 division of aberrations. If the aberrations are within tolerance, skip to part m of this step. If it is not, continue with part l of this step.

l. ADJUST—Channel 2 Compensation (C309) for best flat-top (+0.2 division, −0.1 division, or a total of 0.2 division of aberrations).

m. Disconnect the test equipment from the instrument.

10. Check Vertical Amplifier Bandwidth

a. Set the CH 2 VOLTS/DIV switch to 1 mV.

b. Connect the CH 2 probe tip to the output of the leveled sine-wave generator via a 10X attenuator, a 50-Ω terminator, and a BNC-male-to-probe tip adapter.

c. Set the generator to produce a 1-kHz, 6-division display.

d. CHECK—Display amplitude is 4.2 divisions or greater as the generator output frequency is increased up to the value shown in Table 4-4 for the corresponding VOLTS/DIV switch setting.

Table 4-4
Settings for Bandwidth Checks

VOLTS/DIV Switch Setting	Generator Output Frequency
1 mV	100 kHz
2 mV	200 kHz
5 mV	400 kHz
10 mV	500 kHz

e. Repeat parts c and d for all indicated CH 2 VOLTS/DIV switch settings.

f. Remove the CH 2 probe tip from the test setup, and connect CH 1 probe tip to the test setup. Set the VERT MODE to CH 1.

g. Repeat parts c and d for all indicated CH 1 VOLTS/DIV switch settings.

h. Disconnect the test equipment from the instrument.

TRIGGER SYSTEM

Equipment Required

Leveled Sine-Wave Generator (Item 2)
50-Ω BNC Cable (Item 5)
BNC-Male-to-Probe Tip Adapter (Item 7)
BNC-female-to-dual Banana Plug (Item 8)
BNC T-Connector (Item 11)
Screwdriver (Item 14)

See ADJUSTMENT LOCATIONS 1 at the back of this manual for location of test points and adjustments.

INITIAL CONTROL SETTINGS

Display

INTENSITY	As desired
STORE	Off (button out)

Vertical (Both Channels)

VOLTS/DIV	5 mV
INPUT COUPLING	DC
POSITION	Midrange
VOLTS/DIV Variable	CAL detent
VERT MODE	CH 2

Trigger

LEVEL/SLOPE	AUTO PRESET
TRIG SOURCE	CH 2

Horizontal

HORIZ MAG	CAL detent
POS	Midrange
SEC/DIV	1 ms
SINGLE SWP	Off (button out)

PROCEDURE STEPS

1. Check/Adjust AUTO PRESET Level

a. Connect the Channel 2 Probe tip to the output of the standard amplitude generator via a BNC-male-to-probe tip adapter.

b. Set the generator to produce a 1 kHz, 2 division display.

c. Set the CH 2 VOLTS/DIV switch to 50 mV.

d. CHECK—For a stable display. If a stable display appears proceed to step 2. If it does not, continue with part e of this step.

e. ADJUST—AUTO PRESET control for a 0.2-division stable display.

2. Check Trigger Circuit Operation

a. Set:

VERT MODE	CH 2
SEC/DIV	5 μs

b. Connect the Channel 2 Probe tip to the output of the leveled sine-wave generator via a BNC-T connector and a BNC-male-to-probe tip adapter. Then connect the EXT TRIG-COMMON connection to the unused BNC-T-connector via a 50 Ω cable and a BNC-to-banana plug adapter (ground on banana adapter to common).

c. Set the generator to produce a 500-kHz, 1-division display.

d. Set the CH 2 VOLTS/DIV switch to 5 V.

e. CHECK—A stable display can be obtained by adjusting the LEVEL/SLOPE control to trigger on both the positive-going and negative-going slopes of the displayed waveform.

f. Set the TRIG SOURCE switch to COMP position.

g. CHECK—Repeat part e of this step.

h. Set the TRIG SOURCE switch to EXT position.

i. CHECK—Repeat part e of this step.

3. Check Single Sweep Operation

a. Adjust the LEVEL/SLOPE control for a triggered display.

b. Disconnect the CH 2 probe tip from the signal source.

c. Press in the SINGLE SWP button.

d. Press the RESET button.

e. CHECK—READY LED comes on when RESET button is pressed in momentary and remains on until the CH 2 probe tip is reapplied to the signal source.

f. Reconnect the CH 2 probe tip to the leveled sine-wave generator.

g. CHECK—READY LED is extinguished.

h. Press the RESET button.

i. CHECK—That a single-sweep display (one sweep only) is presented.

j. Release the SINGLE SWP button.

k. Disconnect the test equipment from the instrument.

HORIZONTAL DEFLECTION SYSTEM

Equipment Required

Calibration Generator (Item 1)
Time-Mark Generator (Item 3)
BNC-Male-to-Probe Tip Adapter (Item 7)
Digital Voltmeter (Item 12)
Screwdriver (Item 14)

See ADJUSTMENT LOCATIONS 1 at the back of this manual for location of test points and adjustments.

INITIAL CONTROL SETTINGS

Display

INTENSITY	As desired
STORE	Off (button out)

Vertical (Both Channels)

VOLTS/DIV	5 mV
INPUT COUPLING	GND
POSITION	Midrange
VOLTS/DIV Variable	CAL detent
VERT MODE	BOTH

Trigger

LEVEL/SLOPE	AUTO PRESET
TRIG SOURCE	COMP

Horizontal

HORIZ MAG	CAL detent
POS	Midrange
SEC/DIV	X-Y
SINGLE SWP	Off (button out)

PROCEDURE STEPS

1. Check/Adjust Horizontal Centering (R366)

a. Connect the digital voltmeter negative (low) lead to chassis ground and connect the positive (volts) lead to pin 5 of U105 on the Amplifier circuit board.

b. CHECK—Voltmeter reading is between −0.2 V and +0.2 V. If the reading is within these limits skip to step 2. If it does not, continue with part c of this step.

c. ADJUST—Horizontal Centering (R366) for 0 V reading (−0.2 V to +0.2 V).

2. Check/Adjust Horizontal Gain (R175)

a. Connect the Channel 1 Probe tip to the output of the standard amplitude generator via a BNC-male-to-probe tip adapter.

b. Set the generator to produce a 20 mV signal.

c. Set the CH 1 INPUT COUPLING switch to DC.

d. CHECK—Display for 4-divisions of horizontal deflection (3.8 divisions to 4.2 divisions). If the reading is within these limits skip to step 3. If it does not, continue with part e of this step.

e. ADJUST—Horizontal Gain (R175) for 4-divisions of horizontal (3.8 divisions to 4.2 divisions) deflection between dots.

f. Disconnect the test equipment from the instrument.

3. Check/Adjust Timing Accuracy and Linearity

a. Set:

VERT MODE	CH 1
SEC/DIV	1 ms

b. Connect the Channel 1 Probe tip to the output of the time-mark generator via a 50-Ω termination and a BNC-male-to-probe tip adapter.

c. Select 1-ms time markers from the generator.

d. Adjust the CH 1 VOLTS/DIV switch for a display about 3-divisions in amplitude.

e. Use the Horizontal Position control to align the second time marker with the second vertical graticule line.

f. CHECK—Timing accuracy is within 0.4 division at the 10 vertical graticule line and linearity is within 0.1 division over any 2 of the center 8 divisions. If the reading is within these limits skip to part i of this step. If it does not, continue with part g of this step.

g. ADJUST—SWP CAL control for eight divisions of deflection between the 2nd and 10th time markers.

by horiz mag sw/var Right side panel

h. CHECK—Timing and linearity accuracies by applying the appropriate time markers for each position of the SEC/DIV switch. Timing accuracy is 0.4 division over center eight divisions and linearity accuracy is 0.1 division over any 2 of the center 8 divisions.

4. Check Variable Horizontal Magnifier Range

a. Set SEC/DIV switch to 1 ms and generator to 1 ms.

b. Rotate the VAR HORIZ MAG control to fully clockwise position.

c. CHECK—The crt display for at least 5-divisions between adjacent time markers. Spacing of 5-division indicates a VAR HORIZ MAG control range of 5 to 1.

d. Return the VAR HORIZ MAG control to the CAL detent position.

e. Disconnect the test equipment from the instrument.

MAINTENANCE

INTRODUCTION

This section of the manual contains information for conducting preventive maintenance, troubleshooting, and corrective maintenance on the 214 Oscilloscope. Circuit board removal procedures are included in the corrective maintenance part of this section.

STATIC-SENSITIVE COMPONENTS

The following precautions are applicable when performing any maintenance involving internal access to the instrument.

CAUTION

Static discharge can damage any semiconductor component in this instrument.

This instrument contains electrical components that are susceptible to damage from static discharge. Table 5-1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

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

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers or on a metal rail. Label any package that contains static-sensitive components or assemblies.

3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these components. Servicing static-sensitive components or assemblies should be performed only at a static-free work station by qualified service personnel.

4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.

5. Keep the component leads shorted together whenever possible.

6. Pick up components by their bodies, never by their leads.

Table 5-1
Relative Susceptibility to Static-Discharge Damage

Semiconductor Classes	Relative Susceptibility Levels[a]
MOS or CMOS microcircuits or discretes, or linear microcircuits with MOS inputs (Most Sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFET	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (Least Sensitive)	9

[a]Voltage equivalent for levels: (Voltage discharged from a 100 ρF capacitor through a resistance of 100 Ω.)

1 = 100 to 500 V 4 = 500 V 7 = 400 to 1000 V(est)
2 = 200 to 500 V 5 = 400 to 600 V 8 = 900 V
3 = 250 V 6 = 600 to 800 V 9 = 1200 V

7. Do not slide the components over any surface.

8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

10. Use only approved antistatic, vacuum-type desoldering tools for component removal.

PREVENTIVE MAINTENANCE

INTRODUCTION

Preventive maintenance consists of cleaning, visual inspection, and checking instrument performance. When accomplished regularly, it may prevent instrument malfunction and enhance instrument reliability. The severity of the environment in which the instrument is used determines the required frequency of maintenance.

An appropriate time to accomplish preventive maintenance is just before instrument adjustment.

GENERAL CARE

The cabinet minimizes accumulation of dust inside the instrument and should always be in place when operating the 214.

INSPECTION AND CLEANING

The 214 should be visually inspected and cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket, preventing efficient heat dissipation. It also provides an electrical conducting path that could result in instrument failure, especially under high-humidity conditions.

CAUTION

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

Exterior

INSPECTION. Inspect the external portions of the instrument for damage, wear, and missing parts; use Table 5-2 as a guide. Instruments that appear to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Deficiencies found that could cause personal injury or could lead to further damage to the instrument should be repaired immediately.

CAUTION

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

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

Table 5-2
External Inspection Check List

Item	Inspect For	Repair Action
Cabinet and Front Panel	Cracks, scratches, deformations, and damaged hardware or gaskets.	Touch up paint scratches and replace defective components.
Controls	Missing, damaged, or loose knobs, buttons, and controls.	Repair or replace missing or defective items.
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace defective parts. Clean or wash out dirt.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Replace damaged or missing items, frayed cables, and defective parts.

Interior

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

INSPECTION. Inspect the internal portions of the 214 for damage and wear, using Table 5-3 as a guide. Deficiencies found should be repaired immediately. The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged components are found. Overheating usually indicates other trouble in the instrument; therefore, it is important that the cause of overheating be corrected to prevent recurrence of the damage.

CLEANING. To clean the interior, blow off dust with dry, low-pressure air (approximately 9 psi). Remove any remaining dust with a soft brush or a cloth dampened with a solution of mild detergent and water. A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards. If these methods do not remove all the dust or dirt, the instrument may be spray washed using a solution of 5% mild detergent and 95% water as follows:

CAUTION

Exceptions to the following procedure are the Attenuator assemblies and the Front-Panel module. Clean these assemblies only with isopropyl alcohol as described in step 4.

CAUTION

To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the instrument.

Table 5-3
Internal Inspection Check List

Item	Inspect For	Repair Action
Circuit Boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Clean solder corrosion with an eraser and flush with isopropyl alcohol. Resolder defective connections. Determine cause of burned items and repair. Repair defective circuit runs.
Resistors	Burned, cracked, broken, blistered.	Replace defective resistors. Check for cause of burned component and repair as necessary.
Solder Connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Replace defective capacitors. Clean solder connections and flush with isopropyl alcohol.
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors.Remove devices having distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off.
Wiring and Cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

1. Gain access to the parts to be cleaned by removing easily accessible shields and panels.

2. Spray wash dirty parts with the detergent-and-water solution; then use clean water to thoroughly rinse them.

3. Dry all parts with low-pressure air.

NOTE

Most of the switches used in the 214 are sealed and the contacts are inaccessible. If cleaning is deemed necessary, use only isopropyl alcohol.

4. Clean switches with isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate. Then complete drying with low-pressure air.

5. Dry all components and assemblies in an oven or drying compartment using low-temperature (125 F to 150 F) circulating air.

LUBRICATION

There is no periodic lubrication required for this instrument.

SEMICONDUCTOR CHECKS

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

PERIODIC READJUSTMENT

To ensure accurate measurements, check the performance of this instrument every 1000 hours of operation, or if used infrequently, once each year. In addition, replacement of components may necessitate readjustment of the affected circuits.

Complete Calibration Procedure instructions are given in Section 4. Use this procedure to help in localizing certain troubles in the instrument.

TROUBLESHOOTING

INTRODUCTION

Preventive maintenance performed on a regular basis should reveal most potential problems before an instrument malfunctions. However, should troubleshooting be required, the following information is provided to facilitate location of fault. In addition, the material presented in the "Theory of Operation" and "Diagrams" sections of this manual may be helpful while troubleshooting.

TROUBLESHOOTING AIDS

Schematic Diagrams

Complete schematic diagrams are located on tabbed foldout pages in the "Diagrams" section. Portions of circuitry mounted on each circuit board are enclosed by heavy black lines. The assembly number and name of the circuit are shown near either the top or the bottom edge of the diagram.

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

Circuit board illustrations showing the physical location of each component are provided for use in conjunction with each schematic diagram. Each board illustration is found in the "Diagrams" section on the back of a foldout page, preceding the first schematic diagram(s) to which it relates.

Circuit Board Locations

The placement in the instrument of each circuit board is shown in Figure 5-1 or by using the Exploded view in Section 8 Replaceable Mechanical Parts List.

Grid Coordinate System

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

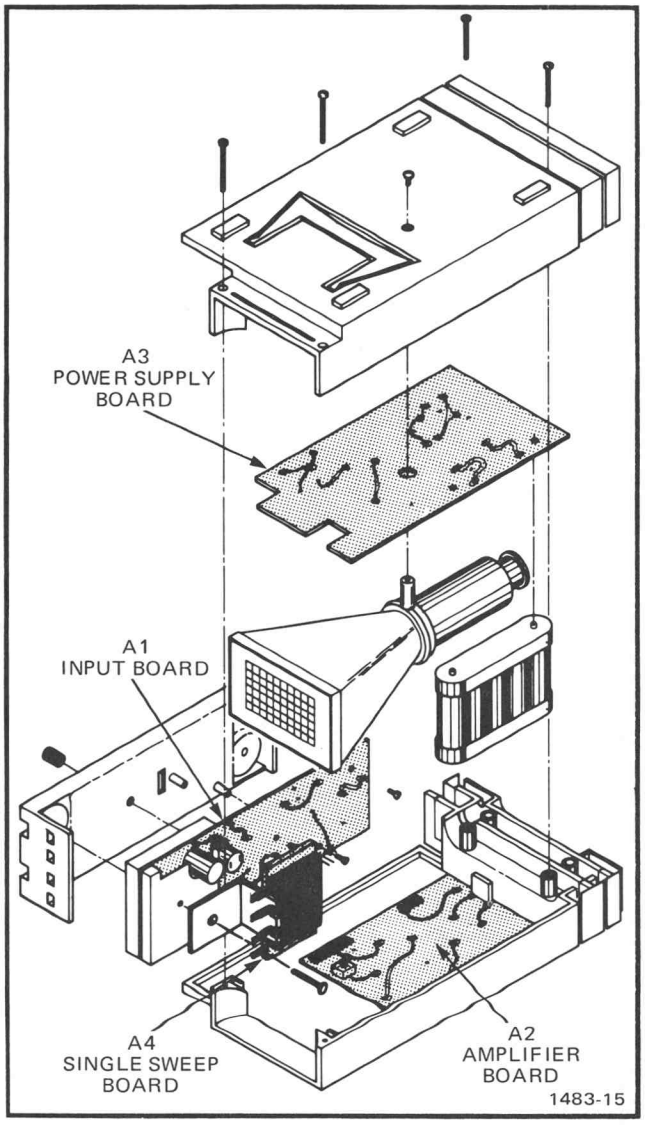


Figure 5-1. Location of circuit boards.

Component Color Coding

Information regarding color codes and markings of resistors and capacitors is located on the color-coding illustration (Figure 8-1) at the beginning of the "Diagrams" section.

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

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

Dipped tantalum capacitors are color coded in microfarads. The color dot indicates both the positive lead and the voltage rating. Since these capacitors are easily destroyed by reversed or excessive voltage, be careful to observe the polarity and voltage rating when replacing them.

DIODE COLOR CODE. The cathode end of each glass-encased diode is indicated by either a stripe, a series of stripes or a dot. For most diodes marked with a series of stripes, the color combination of the stripes identifies three digits of the Tektronix Part Number, using the resistor color-code system. The cathode and anode ends of a metal-encased diode may be identified by the diode symbol marked on its body.

Semiconductor Lead Configurations

Figure 8-2 in the "Diagrams" section shows the lead configurations for semiconductor devices used in the instrument. These lead configurations and case styles are typical of those available at completion of the design of the instrument. Vendor changes and performance improvement changes may result in changes of case styles or lead configurations. If the devise in question does not appear to match the configuration shown in Figure 8-2, examine the associated circuitry or consult a manufacturer's data sheet.

Multipin Connectors

Multipin connector orientation is indexed by two triangles; one on the holder and one on the circuit board. Slot numbers are usually molded into the holder. When a connection is made to circuit board pins, ensure that the index on the holder is aligned with the index on the circuit board (see Figure 5-2).

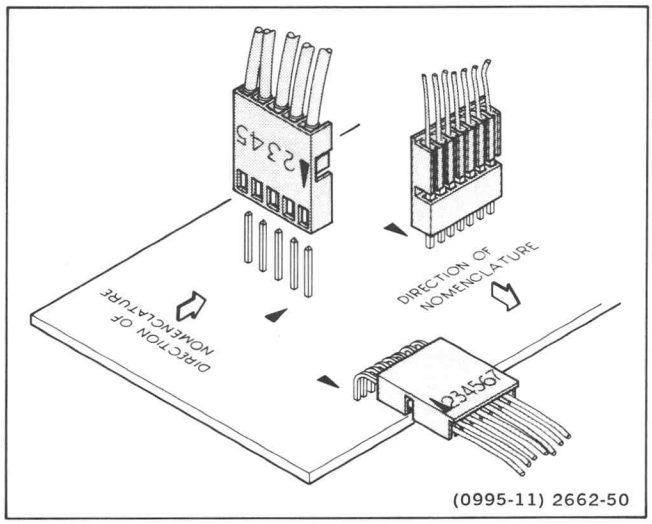


Figure 5-2. Multi-connector holder orientation.

TROUBLESHOOTING EQUIPMENT

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

TROUBLESHOOTING TECHNIQUES

The following procedure is arranged in an order that enables checking simple trouble possibilities before requiring more extensive troubleshooting. The first four checks ensure proper controls settings, connections, operation, and adjustment. If the trouble is not located by these checks, the remaining steps will aid in locating the defective component. When the defective component is located, replace it using the appropriate replacement procedure given under "Corrective Maintenance" in this section.

CAUTION

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

1. Check Control Settings

Incorrect control settings can give a false indication of instrument malfunction. If there is any question about the correct function or operation of any control, refer to either the "Operating Information" in Section 2 of this manual or to the 214 Operators Manual.

2. Check Associated Equipment

Before proceeding, ensure that any equipment used with the 214 is operating correctly. Verify that input signals are properly connected and that the interconnecting cables are not defective. Check that the ac-power-source voltage to all equipment is correct.

WARNING

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

3. Visual Check

Perform a visual inspection. This check may reveal broken connections or wires, damaged components, semiconductors not firmly mounted, damaged circuit boards, or other clues to the cause of an instrument malfunction.

4. Check Instrument Performance and Adjustment.

Check the performance of either those circuits where trouble appears to exist or the entire instrument. The apparent trouble may be the result of misadjustment. Complete calibration instructions are given in Section 4 of this manual.

5. Isolate Trouble to a Circuit

To isolate problems to a particular area, use the trouble symptoms noticed to help identify the circuit in which the trouble is located.

6. Check Power Supplies

When trouble symptoms appear in more that one circuit, first check the power supplies; then check the affected circuits by taking voltage and waveform readings. Check first for the correct output voltage of each individual supply. These voltages are measured between the power supply test points and ground. If the power-supply voltages and ripple are within the listed ranges, the supply can be assumed to be working correctly. If they are outside the range, the supply may be either misadjusted or operating incorrectly.

7. Check Circuit Board Interconnections

After the trouble has been isolated to a particular circuit, again check for loose or broken connections, improperly seated semiconductors, and heat-damaged components.

8. Check Voltages and Waveforms

Often the defective component can be located by checking circuit voltages or waveforms. Typical voltages are listed on the schematic diagrams.

NOTE

Voltages and waveforms indicated on the schematic diagrams are not absolute and may vary slightly between instruments. To establish operating conditions similar to those used to obtain these readings, see the voltage and waveform setup conditions preceding the waveform illustrations.

Note the recommended test equipment, front-panel control settings, voltage and waveform conditions, and cable-connection instructions. Any special control settings required to obtain a given waveform are noted under the waveform illustration. Changes to the control settings from the initial setup, other than those noted, are not required.

9. Check Individual Components

The following procedures describe methods of checking individual components. Two-lead components that are soldered in place are most accurately checked by first disconnecting one end from the circuit board. This isolates the measurement from the effects of the surrounding circuitry. See Figure 8-1 for component value identification and Figure 8-2 for semiconductor lead configurations.

WARNING

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

CAUTION

When checking semiconductors, observe the static-sensitivity precautions located at the beginning of this section.

TRANSISTORS. A good check of a transistor is actual performance under operating conditions. A transistor can most effectively be checked by substituting a known-good component. However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic-type transistor checker for testing. Static-type transistor checkers are not recommended, since they do not check operation under simulated operating conditions.

When troubleshooting transistors in the circuit with a voltmeter, measure both the emitter-to-base and emitter-to-collector voltages to determine whether they are consistent with normal circuit voltages. Voltages across a transistor may vary with the type of device and its circuit function.

Some of these voltages are predictable. The emitter-to-base voltage for a conducting silicon transistor will normally range from 0.6 V to 0.8 V. The emitter-to-collector voltage for a saturated transistor is about 0.2 V. Because these values are small, the best way to check them is by connecting a sensitive voltmeter across the junction rather that comparing two voltages taken with respect to ground. If the former method is used, both leads of the voltmeter must be isolated from ground.

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

CAUTION

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

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

When troubleshooting a field-effect transistor (FET), the voltage across its elements can be checked in the same manner as previously described for other transistors. However, remember that in the normal depletion mode of operation, the gate-to-source junction is reverse biased; in the enhanced mode, the junction is forward biased.

INTEGRATED CIRCUITS. An integrated circuit (IC) can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is essential when troubleshooting a circuit having IC components. Use care when checking voltages and waveforms around the IC so that adjacent leads are not shorted together. An IC test clip provides a convenient means of clipping a test probe to an IC.

CAUTION

When checking a diode, do not use an ohmmeter scale that has a high internal current. High current may damage a diode. Checks on diodes can be performed in much the same manner as those on transistor emitter-to-base junctions. Do not check tunnel diodes or back diodes with an ohmmeter; use a dynamic tester, such as the TEKTRONIX 576 Curve Tracer.

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

When conducting, silicon diodes should have 0.6 to 0.8 V across their junctions, and schottky diodes should have 0.2 to 0.4 V across their junctions. Higher readings indicate that they are either reverse biased or defective, depending on polarity.

RESISTORS. Check resistors with an ohmmeter. Refer to the "Replaceable Electrical Parts" list for the tolerances of resistors used in this instrument. A resistor normally does not require replacement unless its measured value varies widely from its specified value and tolerance.

INDUCTORS. Check for open inductors by checking continuity with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform response when high-frequency signals are passed through the circuit.

CAPACITORS. A leaky or shorted capacitor can best be detected by checking resistance with an ohmmeter set to one of the highest ranges. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after the capacitor is charged to the output voltage of the ohmmeter. An open capacitor can be detected with a capacitance meter or by checking whether the capacitor passes ac signals.

10. Repair and Adjust the Circuit.

If any defective parts are located, follow the replacement procedures given under "Corrective Maintenance" in this section. After any electrical component has been replaced, The performance for that particular circuit should be checked, as well as the performance of other closely related circuits. Since thepower supplies affect all circuits, performance of the entire instrument should be checked if work has been done on the power supplies or if the power transformer has been replaced. Readjustment of the affected circuitry may be necessary. Refer to the "Calibration Procedure" in section 4 of this manual.

CORRECTIVE MAINTENANCE

INTRODUCTION

Corrective maintenance consists of component replacement and instrument repair. This part of the manual describes special techniques and procedures required to replace components in this instrument. If it is necessary to ship your instrument to a Tektronix Service Center for repair or service, refer to the "Repackaging for Shipment" information at the end of this section.

MAINTENANCE PRECAUTIONS

To reduce the possibility of personal injury or instrument damage, observe the following precautions.

1. Disconnect the instrument from the ac-power source before removing or installing components.

2. Verify that the line-rectifier filter capacitors are discharged prior to performing any servicing.

3. Use care not to interconnect instrument grounds which may be at different potentials (cross grounding).

4. When soldering on circuit boards or small insulated wires, use only a 15-watt, pencil-type soldering iron.

OBTAINING REPLACEMENT PARTS

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

NOTE

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

Special Parts

In addition to the standard electronic components, some special parts are used in the 214. 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. The various manufacturers can be identified by referring to the "Cross Index-Mfr Code Number to Manufacturer" at the beginning of the "Replaceable Electrical Parts" list. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts

When ordering replacement parts from Tektronix, Inc., be sure to include all of the following information:

1. Instrument type (include modification or option numbers).

2. Instrument serial number.

3. A description of the part (if electrical, include its full circuit component number)

4. Tektronix part number.

MAINTENANCE AIDS

The maintenance aids listed in Table 5-4 include items required for performing most of the maintenance procedures in this instrument. Equivalent products may be substituted for the examples given, provided their characteristics are similar.

Table 5-4
Maintenance Aids

Description	Specification	Usage	Example
1. Soldering Iron	15 to 25 W.	General soldering and unsoldering.	Antex Precision Model C.
2. Flat-bit Screwdriver	4-inch shaft, 3/16-inch bit.	Assembly and disassembly.	
3. Phillips Screwdriver	Tip sizes: #1, #2, magnetic tip.	Assembly and disassembly.	
4. Long-nose Pliers		Component removal and replacement.	Diamalloy Model LN55-3.
5. Diagonal Cutters		Component removal and replacement.	Diamalloy Model554-3.
6. Vacuum Solder Extractor	No static charge retention.	Unsoldering static-sensitive devices and components on multilayer boards.	Pace Model PC-10.
7. Spray Cleaner	No-Noise ®	Switch and pot cleaning.	Tektronix Part Number 006-0442-02.
8. Pin-replacement Kit	Replace circuit board connector pins.		Tektronix Part Number 040-0542-00.
9. IC-removal Tool		Removing DIP IC packages.	Augat T114-1.
10. Isopropyl Alcohol	Reagent grade.	Cleaning attenutor and front-panel assemblies.	2-Isopropanol.

INTERCONNECTIONS

Interconnections in this instrument are made with pins soldered onto the circuit boards. Several types of mating connectors are used for the interconnecting pins. The following information provides the replacement procedures for the various type connectors.

End-Lead Pin Connectors

Pin connectors used to connect the wires to the interconnect pins are factory assembled. They consist of machine-inserted pin connectors mounted in plastic holders. If the connectors are faulty, the entire wire assembly should be replaced.

Multipin Connectors

When pin connectors are grouped together and mounted in a plastic holder, they are removed, reinstalled, or replaced as a unit. If any individual wire or connector in the assembly is faulty, the entire cable assembly should be replaced. To provide correct orientation of a multipin connector, an index arrow is stamped on the circuit board, and either a matching arrow is molded into or the numeral 1 is marked on the plastic housing as a matching index. Be sure these index marks are aligned with each other when the multipin connector is reinstalled.

TRANSISTORS AND INTEGRATED CIRCUITS

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

Any replacement component should be of the original type or a direct replacement. Bend transistor leads to fit their circuit board holes, and cut the leads to the same length as the original component. See Figure 8-2 in the "Diagrams" section for lead-configuration illustrations.

To remove socketed dual-in-line packaged (DIP) integrated circuits, pull slowly and evenly on both ends of the device. Avoid disengaging one end of the integrated circuit from the socket before the other, since this may damage the pins.

To remove a soldered DIP IC when it is going to be replaced, clip all the leads of the device and remove the leads from the circuit board one at a time. If the device must be removed intact for possible reinstallation, do not heat adjacent conductors consecutively. Apply heat to pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

SOLDERING TECHNIQUES

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used to remove or replace parts. General soldering techniques, which apply to maintenance of any precision electronic equipment, should be used when working on this instrument.

WARNING

To avoid an electric-shock hazard, turn the instrument off and disconnect it from the ac power source before attempting any soldering.

Use rosin-core wire solder containing 63% tin and 37% lead. Contact your local Tektronix Field Office or representative to obtain the names of approved solder types.

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

CAUTION

Only an experienced maintenance person, proficient in the use of vacuum-type desoldering equipment should attempt repair of any circuit board in this instrument. Many integrated circuits are static sensitive and may be damaged by solder extractors that generate static charges. Perform work involving static-sensitive devices only at a static-free work station while wearing a grounded antistatic wrist strap. Use only an antistatic vacuum-type solder extractor approved by a Tektronix Service Center.

CAUTION

Attempts to unsolder, remove, and resolder leads from the component side of a circuit board may cause damage to the reverse side of the circuit board. The following techniques should be used to replace a component on a circuit board:

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

NOTE

Some components are difficult to remove from the circuit board due to a bend placed in the component leads during machine insertion. To make removal of machine-inserted components easier, straighten the component leads on the reverse side of the circuit board.

2. When removing a multipin component, especially an IC, do not heat adjacent pins consecutively. Apply heat to the pins at alternate sides and ends of the IC as solder is removed. Allow a moment for the circuit board to cool before proceeding to the next pin.

CAUTION

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

3. Bend the leads of the replacement component to fit the holes in the circuit board. If the component is replaced while the board is installed in the instrument, cut the leads so they protrude only a small amount through the reverse side of the circuit board. Excess lead length may cause shorting to other conductive parts.

4. Insert the leads into the holes of the board so that the replacement component is positioned the same as the original component. Most components should be firmly seated aganst the circuit board.

5. Touch the soldering iron to the connection and apply enough solder to make a firm solder joint. Do not move the component while the solder hardens.

6. Cut off any excess lead protruding through the circuit board (if not clipped to the correct length in step 3).

7. Clean the area around the solder connection with an approved flux-removing solvent. Be careful not to remove any of the printed information from the circuit board.

DISASSEMBLY INSTRUCTIONS

WARNING

To avoid electric shock, disconnect the instrument from the ac power source and turn the instrument power switch to off before removing the covers. The 214 is battery powered, and up to 1000 volts may be present any time the power switch is in the on position even though the power cord is disconnected. To prevent the possiblity of electrical shock while the covers are removed, disconnect the batteries whenever operation of the instrument is not required or replacing any component or assembly.

Fig. 5-3 will be helpful for diassembly of the instrument cover to gain access to the circuit boards. The exploded view drawings in the "Replaceable Mechanical Parts" list (Section 9) may be helpful during the removal and reinstallation of individual components or subassemblies. Circuit board and component locations are shown in "Diagrams," Section 8 of this manual.

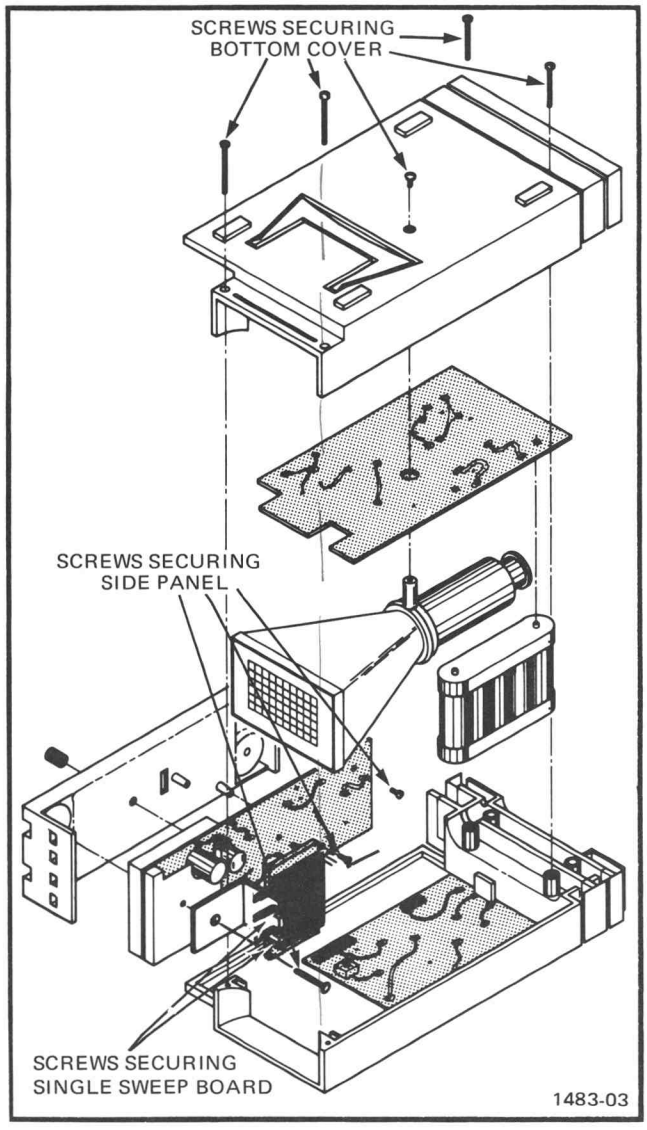


Figure 5-3. Location of screws for disassembly. (Instrument shown upside down.)

Read these instructions completely before attempting any corrective maintenance.

To gain access to the interior of the instrument, unwind both probe cords and the power cord from the instrument's probe wrap at the rear of the 214.

NOTE

The arrows on the probe wrap indicate the proper direction to wrap the probes and power cord. See Fig. 5-4.

Remove the five screws in the bottom cover of the instrument. See Fig. 5-3. Separate the bottom cover from the instrument and lay it aside. The Power Supply (A-3) circuit board, and the batteries, can be lifted up and pivoted out of the way. Most of the internal workings of the instrument are now accessible for maintenace.

For calibration or troubleshooting within the 214, the Single Sweep (A-4) circuit board should be reconnected to the Power Supply (A-3) circuit board. This is done by first removing the front panel pushbuttons by pulling them, one at a time, until they disconnect from the Single Sweep (A-4) board. Next remove the READY light from the front panel and the two screws securing the Single Sweep (A-4) board to the input (A-1) circuit board. (See Fig. 5-3.) Then properly connect the Single Sweep circuit board to the Power Supply circuit board using the cable extender described in table 4-1. Connect between P20 and J20.

If access to the front of the Input (A-1) circuit board is necessary, remove the four screws securing the side panel to the Input circuit board and, with the READY light out of the front panel, remove the instrument side panel.

NOTE

Secure the Single Sweep board to the Input board and replace the front panel pushbuttons before re-assembling the instrument.

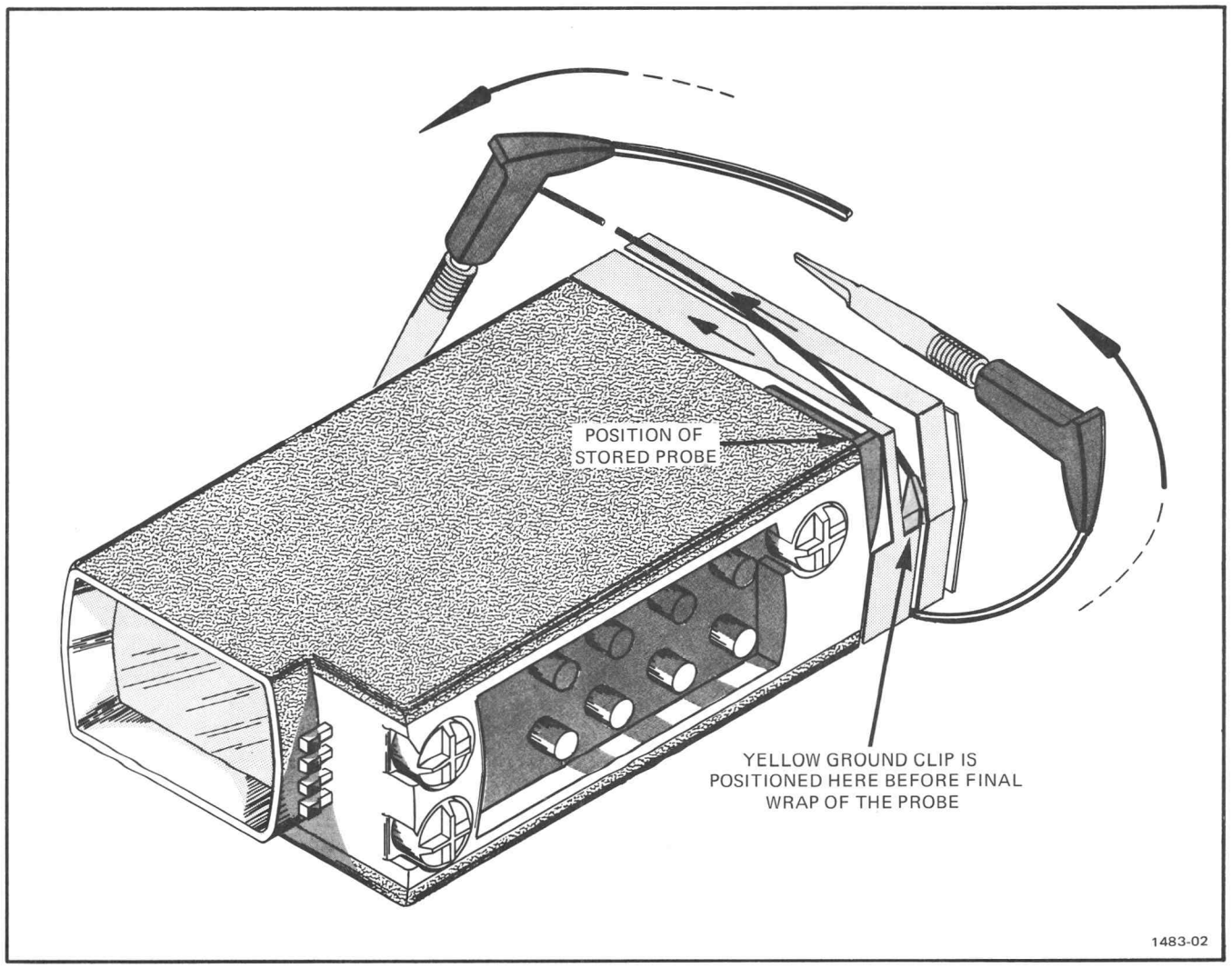


Figure 5-4. Proper method for wrapping probes.

REPACKAGING FOR SHIPMENT

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

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

Surround the instrument with polyethylene sheeting to protect its finish. Obtain a carton of corrugated cardboard having a carton test strength of 200 pounds and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

SELECTABLE COMPONENTS

Power Supply Capacitors

When operating the instrument on power lines other than 115 VAC 60 Hz, it is necessary to change the electrical value of certain capacitors in the instruments power input circuitry. Refer to Table 5-5 for the correct values of capacitance for three of the more commonly used line voltage/line frequency combinations.

CAUTION

Due to the capacitive power line circuit, sudden voltage changes may cause damaging current transients. Avoid operating this instrument from square-wave inverter supplies, or other sources that produce large voltage transients. Power line for this instrument must be sinusoidal.

Table 5-5
Power Supply Capacitors

Power Line	Capacitor Values	
	C210	C212
110 to 126 VAC 58 to 62 Hz (Standard)	3.3 μF, $\pm$10% 200V DC	3.3 μF, $\pm$10% 200V DC
90 to 110 VAC 48 to 52 Hz (Option 02)	4.4 μF, $\pm$10% 200V DC	4.4 μF, $\pm$10% 200V DC
220 to 250 VAC 48 to 52 Hz (Option 01)	2.0 μF, $\pm$10% 400V DC	2.0 μF, $\pm$10% 400V DC

Selection of capacitor values for other line voltage/line frequency combinations is illustrated by the graphs in Figs. 5-5 and 5-6. For example, if the instrument is to be operated on a 60 Hz line, the graph in Fig. 5-6 illustrates the minimum and maximum line voltage limits, with respect to the 3.3 μF capacitance values, for proper operation of the instrument. It also provides information for selecting values of C210 and C212 for other line voltages. Fig. 5-5 provides 50 Hz information. These capacitors should be selected from a type suitable for AC operation and voltage ratings should be at least 1.414 times the value of the applied line voltage.

C204 and C215 values must be changed from the nominal value only when the instrument is to be operated from other than 115 V 50 Hz or 115 V 60 Hz power lines. For 240 V 50 Hz operation, C204 and C215 should be replace with .001 μF, 3000 V capacitors.

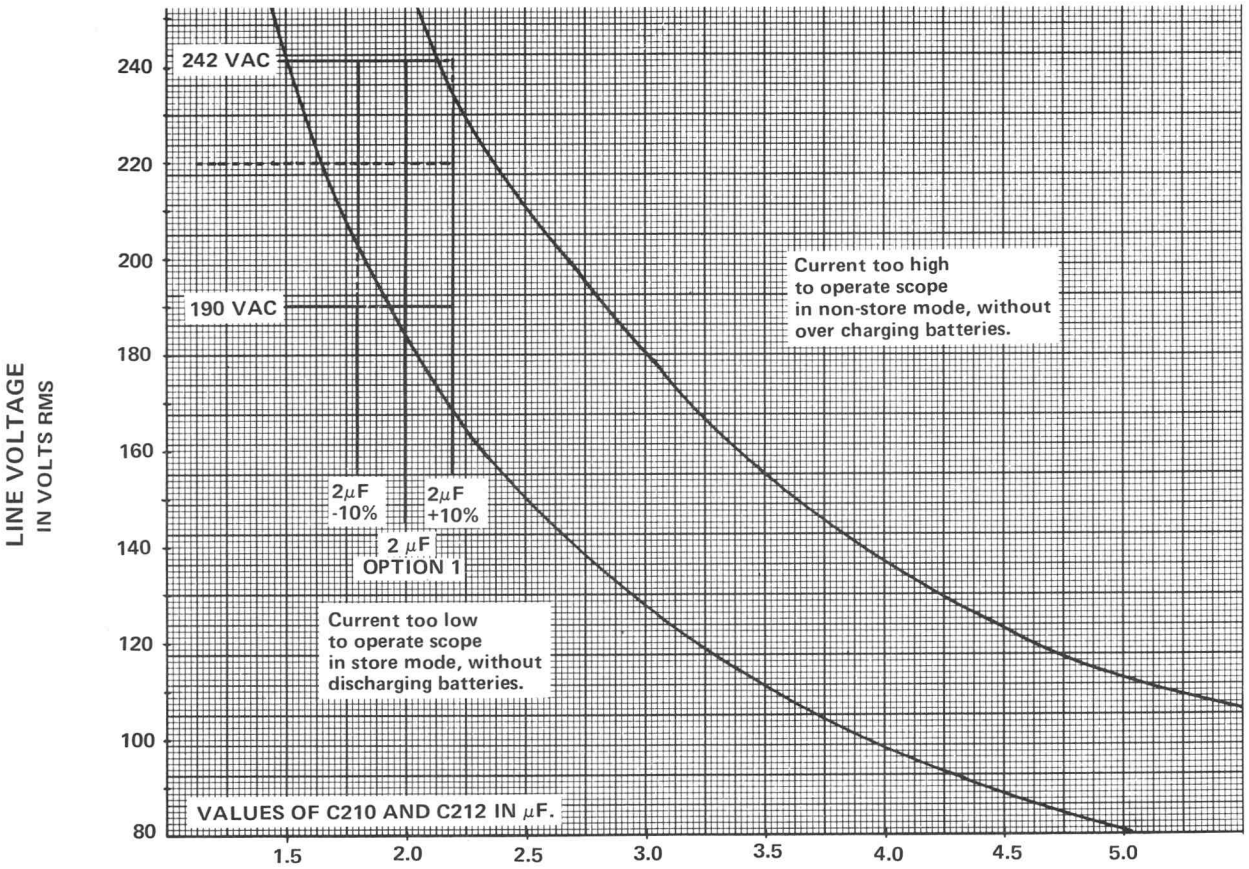


Figure 5-5. Selecting power supply capacitors for 48 to 52 Hz sinewave operation.

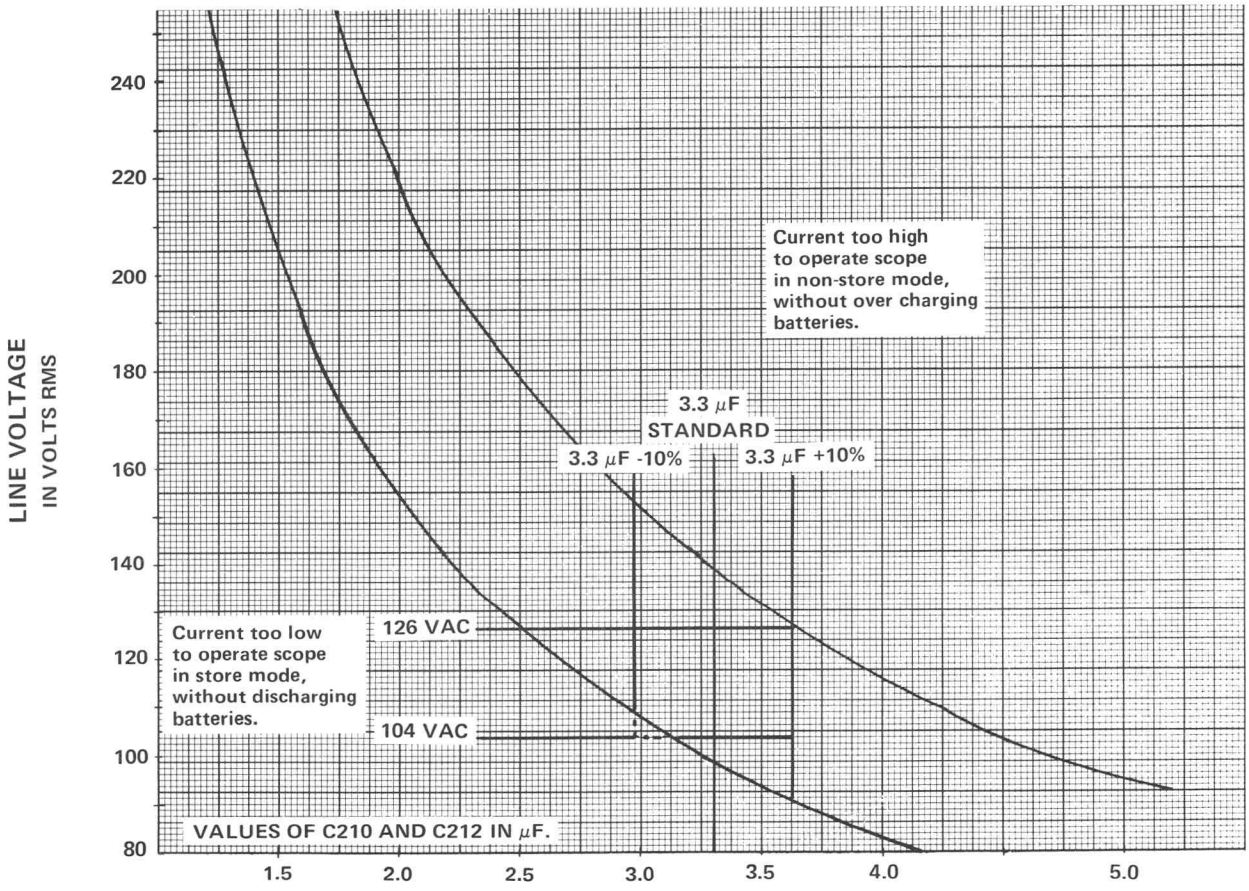


Figure 5-6. Selecting power supply capacitors for 58 to 62 Hz sinewave operation.

OPTIONS

INTRODUCTION

This section contains a description of the available options for the 214 Storage Oscilloscope. Additional information about instrument options and option availability can be obtained either by consulting the current Tektronix Product Catalog or by contacting your local Tektronix Field Office or representative.

OPTION 01

Option 01 equips the 214 for operation from a 220 to 250 V ac 48 to 52 Hz power line source. Option 01 parts values that differ from the standard 214 are listed here. A power cord cable assembly for adapting to appropriate power plugs is included with Option 01 instruments. Refer to the "Corrective Maintenance" and "Diagram" sections of this manual for additional information concerning Option 01.

ELECTRICAL PARTS LIST DIFFERENCES FOR OPTION 01

A3	670-2741-16	CKT BOARD ASSY: POWER SUPPLY (OPTION 01)
C210	285-0933-00	CAP,FXD,PLASTIC: 2 UF,10%,400V
C212	285-0933-00	CAP,FXD,PLASTIC: 2 UF,10%,400V

ADDITIONAL STANDARD ACCESSORIES FOR OPTION 01

161-0077-01	CABLE ASSEMBLY,POWER (Adapts to users plug type)

OPTION 02

Option 02 equips the 214 for operation from a 90 to 110 V ac 48 to 52 Hz power line source. Option 02 parts values that differ from the standard 214 are listed here. Refer to the "Corrective Maintenance" and "Diagram" sections of this manual for additional information concerning Option 02

ELECTRICAL PARTS LIST DIFFERENCES FOR OPTION 02

A3	670-2741-17	CKT BOARD ASSY: POWER SUPPLY
C210	285-0935-00	CAP,FXD,PLASTIC: 4.4 UF,10%,200V
C212	285-0935-00	CAP,FXD,PLASTIC: 4.4 UF,10%,200V

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

LIST OF ASSEMBLIES

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

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

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

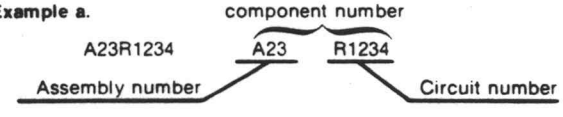
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

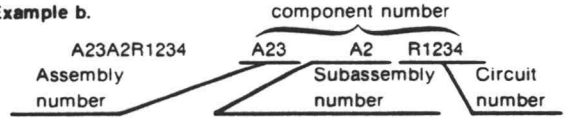
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

Example a.



Read: Resistor 1234 of Assembly 23

Example b.



Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO. (column two of the Electrical Parts List)

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

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

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

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

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

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

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

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

Indicates actual manufacturers part number.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
04099	CAPCO INC	1328 WINTERS AVE PO BOX 1028	GRAND JUNCTION CO 81502
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
07263	FAIRCHILD SEMICONDUCTOR CORP NORTH AMERICAN SALES SUB OF SCHLUMBERGER LTD MS 118	10400 RIDGEVIEW CT	CUPERTINO CA 95014
07716	TRW INC TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
09353	C AND K COMPONENTS INC	15 RIVERDALE AVE	NEWTON MA 02158-1057
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
12954	MICROSEMI CORP - SCOTTSDALE	8700 E THOMAS RD P O BOX 1390	SCOTTSDALE AZ 85252
14433	ITT SEMICONDUCTORS DIV		WEST PALM BEACH FL
14752	ELECTRO CUBE INC	1710 S DEL MAR AVE	SAN GABRIEL CA 91776-3825
19701	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO MINERAL WELLS AIRPORT	PO BOX 760	MINERAL WELLS TX 76067-0760
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
50434	HEWLETT-PACKARD CO OPTOELECTRONICS DIV	370 W TRIMBLE RD	SAN JOSE CA 95131
51406	MURATA ERIE NORTH AMERICA INC HEADQUARTERS AND GEORGIA OPERATIONS	2200 LAKE PARK DR	SMYRNA GA 30080
52763	STETCO INC	3344 SCHIERHORN	FRANKLIN PARK IL 60131
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY PO BOX 1501	SECAUCUS NJ 07094-2917
56289	SPRAGUE ELECTRIC CO WORLD HEADQUARTERS	92 HAYDEN AVE	LEXINGTON MA 02173-7929
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
58756	CTS CORP ELKHART DIV	1142 W BEARDSLEY AVE	ELKHART IN 46514-2224
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
59821	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	7158 MERCHANT AVE	EL PASO TX 79915-1207
60705	CERA-MITE CORPORATION	1327 6TH AVE	GRAFTON WI 53024-1831
61935	SCHURTER INC	1016 CLEGG COURT	PETALUMA CA 94952-1152
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
71450	CTS CORP	905 N WEST BLVD	ELKHART IN 46514-1875
75498	MULTICOMP INC	3005 SW 154TH TERRACE #3	BEAVERTON OR 97006
76493	BELL INDUSTRIES INC JW MILLER DIV	19070 REYES AVE PO BOX 5825	COMPTON CA 90224-5825
79727	C-W INDUSTRIES	130 JAMES WAY	SOUTHAMPTON PA 18966-3818

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
80031	MEPCO/ELECTRA INC	22 COLUMBIA RD	MORRISTOWN NJ 07960
84411	AMERICAN SHIZUKI CORP OGALLALA OPERATIONS	301 WEST O ST	OGALLALA NE 69153-1844
TK1345	ZMAN AND ASSOCIATES	7633 S 180TH	KENT WA 98032
TK1903	MICRO POWER ELECTRONICS	15125 SW KOOL PARKWAY SUITE F	BEAVERTON OR 97006
TK2278	COMTEK MANUFACTURING OF OREGON (METALS)	PO BOX 4200	BEAVERTON OR 97076-4200

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-2353-12	B300000	B302830	CIRCUIT BD ASSY:INPUT	80009	670-2353-12
A1	670-2353-15	B302831		CIRCUIT BD ASSY:INPUT	80009	670-2353-15
A2	670-1505-06	B300000	B302260	CIRCUIT BD ASSY:AMPLIFIER	80009	670-1505-06
A2	670-1505-09	B302261		CIRCUIT BD ASSY:A2 AMPLIFIER	80009	670-1505-09
A3	670-2741-15	B300000	B300628	CIRCUIT BD ASSY:POWER SUPPLY	80009	670-2741-15
A3	670-2741-22	B300629		CIRCUIT BD ASSY:PWR SPLY (STANDARD ONLY)	80009	670-2741-22
A3	670-2741-16	B300000	B300628	CIRCUIT BD ASSY:POWER SUPPLY	80009	670-2741-16
A3	670-2741-23	B300629		CIRCUIT BD ASSY:PWR SPLY (OPTION 01 ONLY)	80009	670-2741-23
A3	670-2741-17	B300000	B300628	CIRCUIT BD ASSY:POWER SUPPLY	80009	670-2741-17
A3	670-2741-24	B300629		CIRCUIT BD ASSY:PWR SPLY (OPTION 02 ONLY)	80009	670-2741-24
A4	670-2676-03			CIRCUIT BD ASSY:SINGLE SWEEP	80009	670-2676-03

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-2353-12	B300000	B302830	CIRCUIT BD ASSY:INPUT	80009	670-2353-12
A1	670-2353-15	B302831		CIRCUIT BD ASSY:INPUT	80009	670-2353-15
A1C301	285-0697-06			CAP,FXD,PLASTIC:0.1UF,+5-15%,600V	80009	285-0697-06
A1C307	281-0178-00			CAP,VAR,PLASTIC:1-3.5PF,500V	80031	2805D013R5BH02F0
A1C308	281-0178-00			CAP,VAR,PLASTIC:1-3.5PF,500V	80031	2805D013R5BH02F0
A1C309	281-0178-00			CAP,VAR,PLASTIC:1-3.5PF,500V	80031	2805D013R5BH02F0
A1C319	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
A1C321	283-0168-00			CAP,FXD,CER DI:12PF,5%,100V	04222	SR151A120JAA
A1C323	281-0645-00			CAP,FXD,CER DI:8.2PF,+/-0.25PF,500V	52763	2RDPLZ007 8P20CC
A1C327	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
A1C348	281-0791-00			CAP,FXD,CER DI:270PF,10%,100V	04222	MA101C271KAA
A1C349	283-0076-00			CAP,FXD,CER DI:27PF,10%,500V	59660	831-500S2L270K
A1C353	290-0524-00			CAP,FXD,ELCTLT:4.7UF,20%,10V	05397	T368A475M010AZ
A1C362	295-0144-00			CAP SET,MATCHED:1UF,0.01UF,0.001UF,MATCHED 2%	84411	TEK 101-0009R5
A1C363	----- -----			(PART OF C362)		
A1C364	----- -----			(PART OF C362)		
A1C368	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	04222	SR155E103MAA
A1C370	283-0251-00			CAP,FXD,CER DI:87 PF,5%,100V	04222	3418 100A 870J
A1C371	290-0523-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T368A225M020AS
A1C373	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C374	290-0523-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T368A225M020AS
A1C376	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A1C378	283-0204-00			CAP,FXD,CER DI:0.01UF,20%,50V	04222	SR155E103MAA
A1C382	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
A1C383	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
A1C385	281-0812-00			CAP,FXD,CER DI:1000PF,10%,100V	04222	MA101C102KAA
A1C389	281-0763-00			CAP,FXD,CER DI:47PF,10%,100V	04222	MA101A470KAA
A1C390	281-0812-00			CAP,FXD,CER DI:1000PF,10%,100V	04222	MA101C102KAA
A1C392	283-0087-00			CAP,FXD,CER DI:300PF,10%,1000V	59660	0838020X5F00301K
A1C395	283-0013-00			CAP,FXD,CER DI:0.01UF,-0+100%,1000V	59660	818-602ZSU0103P
A1C401	285-0697-06			CAP,FXD,PLASTIC:0.1UF,+5-15%,600V	80009	285-0697-06
A1C407	281-0178-00			CAP,VAR,PLASTIC:1-3.5PF,500V	80031	2805D013R5BH02F0
A1C408	281-0178-00			CAP,VAR,PLASTIC:1-3.5PF,500V	80031	2805D013R5BH02F0
A1C409	281-0178-00			CAP,VAR,PLASTIC:1-3.5PF,500V	80031	2805D013R5BH02F0
A1C413	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
A1C421	283-0168-00			CAP,FXD,CER DI:12PF,5%,100V	04222	SR151A120JAA
A1C423	281-0612-00			CAP,FXD,CER DI:5.6PF,+/-0.5PF,500V	52763	2RDPLZ007 5P60DC
A1C440	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR305E105ZAA
A1C453	290-0524-00			CAP,FXD,ELCTLT:4.7UF,20%,10V	05397	T368A475M010AZ
A1C491	290-0535-01	B300000	B303544	CAP,FXD,ELCTLT:33UF,20%,10VDC	56289	196D336X0010KA1
A1C491	290-0535-00	B303545		CAP,FXD,ELCTLT:33UF,20%,10V TANTALUM	56289	196D336X0010KA1
A1C493	290-0535-01	B300000	B303544	CAP,FXD,ELCTLT:33UF,20%,10VDC	56289	196D336X0010KA1
A1C493	290-0535-00	B303545		CAP,FXD,ELCTLT:33UF,20%,10V TANTALUM	56289	196D336X0010KA1
A1CR313	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
A1CR346	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR383	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR413	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
A1CR440	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR446	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1DS320	150-1061-00			LT EMITTING DIO:RED,660NM,50MA MAX	50434	HLMP-1301
A1DS343	150-1061-00			LT EMITTING DIO:RED,660NM,50MA MAX	50434	HLMP-1301
A1DS420	150-1061-00			LT EMITTING DIO:RED,660NM,50MA MAX	50434	HLMP-1301
A1P10	131-0787-00	B300000	B302830	TERMINAL,PIN:0.64 L X 0.025 SQ PH BRZ	22526	47359-000
A1P10	131-0589-00	B302831		TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1Q314	151-1057-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	04713	SFD1057
A1Q363	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A1Q367	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1Q380	151-1078-00			TRANSISTOR:FET,N-CHAN,SI,TO-92	04713	SPF3040
A1Q388	151-0342-00			TRANSISTOR:PNP,SI,TO-92	07263	S035928
A1Q392	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A1Q414	151-1057-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	04713	SFD1057
A1Q454	151-0342-00			TRANSISTOR:PNP,SI,TO-92	07263	S035928
A1R301	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R306	307-0307-01			NTWK,HYB CKT:	80009	307-0307-01
A1R311	315-0107-00			RES,FXD,FILM:100M OHM,5%,0.25W	01121	CB1075
A1R312	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
A1R313	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A1R314	321-0164-00			RES,FXD,FILM:499 OHM,1%,0.125W,TC=T0	19701	5033ED499R0F
A1R315	311-0622-00			RES,VAR,NONWW:TRMR,100 OHM,0.5W	32997	3329H-L58-101
A1R316	321-0776-03			RES,FXD,FILM:3.501K OHM,0.25%,0.125W,TC-T2	19701	5033RC3K501C
A1R317	321-0168-00			RES,FXD,FILM:549 OHM,1%,0.125W,TC=T0	07716	CEAD549R0F
A1R318	321-0776-03			RES,FXD,FILM:3.501K OHM,0.25%,0.125W,TC-T2	19701	5033RC3K501C
A1R319	307-0395-00			RES,FXD,FILM:5 RES NETWORK	80009	307-0395-00
A1R320	311-1406-00			RES,VAR,NONWW:PNL,20K OHM,0.25W,W/SW	12697	CM-43469
A1R321	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R323	321-0306-00			RES,FXD,FILM:15.0K OHM,1%,0.125W,TC=T0	19701	5033ED15J00F
A1R324	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
A1R327	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R328	317-0102-00			RES,FXD,CMPSN:1K OHM,5%,0125W	01121	BB1025
A1R340	311-2250-00			RES,VAR,NONWW:20K OHM,20%,0.25W,LINEAR	80009	311-2250-00
A1R341	315-0393-00			RES,FXD,FILM:39K OHM,5%,0.25W	57668	NTR25J-E39K0
A1R342	321-0309-00			RES,FXD,FILM:16.2K OHM,1%,0.125W,TC=T0	19701	5033ED16K20F
A1R343	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W,TC=T0	19701	5033ED4K020F
A1R344	317-0682-00			RES,FXD,CMPSN:6.8K OHM,5%,0.125W	01121	BB6825
A1R346	317-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.125W	01121	BB1045
A1R348	315-0114-00			RES,FXD,FILM:110K OHM,5%,0.25W	19701	5043CX110K0J
A1R349	315-0914-00			RES,FXD,FILM:910K OHM,5%,0.25W	19701	5043CX910K00J
A1R355	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A1R361	307-0308-00			RES,FXD,FILM:2X50K,100K,300K,500K,1MEG OHM, 1.5%	80009	307-0308-00
A1R362	325-0118-00			RES,FXD,FILM:3M OHM,1%,0.125W,TC=TE	19701	5053YL3M0F
A1R363	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R364	317-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.125W	01121	BB1045
A1R365	315-0204-00			RES,FXD,FILM:200K OHM,5%,0.25W	19701	5043CX200K0J
A1R366	311-1243-00			RES,VAR,NONWW:TRMR,500K OHM,0.5W	32997	3386X-T07-504
A1R367	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R368	317-0223-00			RES,FXD,CMPSN:22K OHM,5%,0.125W	01121	BB2235
A1R369	317-0273-00			RES,FXD,CMPSN:27K OHM,5%,0.125W	01121	BB2735
A1R370	311-1272-00			RES,VAR,NONWW:TRMR,100K OHM,0.5W	32997	3329P-L58-104
A1R371	317-0391-00			RES,FXD,CMPSN:390 OHM,5%,0.125W	01121	BB3915
A1R372	317-0105-00			RES,FXD,CMPSN:1M OHM,5%,0.125W	01121	BB1055
A1R374	311-1269-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	32997	3329P-L58-203
A1R375	311-1172-01			RES,VAR,NONWW:50K OHM,20%,0.25W,W/O DETENT	12697	CM43472
A1R376	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R377	317-0182-00			RES,FXD,CMPSN:1.8K OHM,5%,0.125W	01121	BB1825
A1R378	317-0363-00			RES,FXD,CMPSN:36K OHM,5%,0.125W	01121	BB3635
A1R379	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R380	317-0102-00			RES,FXD,CMPSN:1K OHM,5%,0125W	01121	BB1025
A1R382	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R383	315-0122-00			RES,FXD,FILM:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
A1R384	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A1R385	317-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.125W	01121	BB1045
A1R386	317-0913-00			RES,FXD,CMPSN:91K OHM,5%,0.125W	01121	BB9135
A1R387	317-0512-00			RES,FXD,CMPSN:5.1K OHM,5%,0.125	01121	BB5125
A1R389	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035

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A1R390	317-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,0.125W	01121	BB2425
A1R391	317-0102-00			RES,FXD,CMPSN:1K OHM,5%,0125W	01121	BB1025
A1R392	317-0303-00			RES,FXD,CMPSN:30K OHM,5%,0.125W	01121	BB3035
A1R393	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R394	311-1275-00			RES,VAR,NONWW:TRMR,1M OHM,0.5W	32997	3329P-L58-105
A1R395	311-1169-00			RES,VAR,NONWW:PNL,2M OHM,0.2W	58756	MODEL270(ADVISE)
A1R396	315-0225-00			RES,FXD,FILM:2.2M OHM,5%,0.25W	01121	CB2255
A1R397	317-0391-00			RES,FXD,CMPSN:390 OHM,5%,0.125W	01121	BB3915
A1R398	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R401	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R406	307-0307-01			NTWK,HYB CKT:	80009	307-0307-01
A1R411	315-0107-00			RES,FXD,FILM:100M OHM,5%,0.25W	01121	CB1075
A1R412	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
A1R413	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A1R414	321-0164-00			RES,FXD,FILM:499 OHM,1%,0.125W,TC=T0	19701	5033ED499R0F
A1R415	321-0168-00			RES,FXD,FILM:549 OHM,1%,0.125W,TC=T0	07716	CEAD549R0F
A1R416	321-0776-03			RES,FXD,FILM:3.501K OHM,0.25%,0.125W,TC-T2	19701	5033RC3K501C
A1R417	311-0622-00			RES,VAR,NONWW:TRMR,100 OHM,0.5W	32997	3329H-L58-101
A1R418	321-0776-03			RES,FXD,FILM:3.501K OHM,0.25%,0.125W,TC-T2	19701	5033RC3K501C
A1R419	307-0395-00			RES,FXD,FILM:5 RES NETWORK	80009	307-0395-00
A1R420	311-1406-00			RES,VAR,NONWW:PNL,20K OHM,0.25W,W/SW	12697	CM-43469
A1R421	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R422	307-0696-00			RES NTWK,FXD,FI:7,10K OHM,2%,0.15W EACH	01121	108A103
A1R423	321-0306-00			RES,FXD,FILM:15.0K OHM,1%,0.125W,TC=T0	19701	5033ED15J00F
A1R424	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R425	315-0243-00	B300000	B302830	RES,FXD,FILM:24K OHM,5%,0.25W	57668	NTR25J-E24K0
A1R425	322-3322-00	B302831	B303544	RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 22K1
A1R425	322-3318-00	B303545		RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R440	311-2250-00			RES,VAR,NONWW:20K OHM,20%,0.25W,LINEAR	80009	311-2250-00
A1R441	315-0393-00			RES,FXD,FILM:39K OHM,5%,0.25W	57668	NTR25J-E39K0
A1R442	321-0309-00			RES,FXD,FILM:16.2K OHM,1%,0.125W,TC=T0	19701	5033ED16K20F
A1R443	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W,TC=T0	19701	5033ED4K020F
A1R446	317-0104-00			RES,FXD,CMPSN:100K OHM,5%,0.125W	01121	BB1045
A1R454	317-0103-00			RES,FXD,CMPSN:10K OHM,5%,0125W	01121	BB1035
A1R476	311-1172-01			RES,VAR,NONWW:50K OHM,20%,0.25W,W/O DETENT	12697	CM43472
A1R480	311-1171-00	B300000	B303308	RES,VAR,NONWW:PNL,100K OHM,0.25W	71450	FX9406
A1R480	311-1172-01	B303309		RES,VAR,NONWW:50K OHM,20%,0.25W,W/O DETENT	12697	CM43472
A1R481	315-0333-00	B300000	B303308	RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A1R481	315-0153-00	B303309		RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R482	315-0153-00	B300000	B303308	RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R482	315-0333-00	B303309		RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A1S305	260-0984-01			SWITCH,SLIDE:DPTT W/PLASTIC PLATE	79727	G-128-S-0095
A1S345	260-0984-01			SWITCH,SLIDE:DPTT W/PLASTIC PLATE	79727	G-128-S-0095
A1S370	260-0984-01			SWITCH,SLIDE:DPTT W/PLASTIC PLATE	79727	G-128-S-0095
A1S405	260-0984-01			SWITCH,SLIDE:DPTT W/PLASTIC PLATE	79727	G-128-S-0095
A1U320	155-0083-00			MICROCKT,LINEAR:DUAL OPNL AMPL & CHAN SW	80009	155-0083-00
A1U328	156-1149-01			MICROCKT,LINEAR:OPERATION AMP JFET INPUT	27014	AL160307
A1U370	155-0048-01			MICROCKT,DGTL:SELECTED FOR LEVEL RANGE	80009	155-0048-01
A1U388	156-1225-00			MICROCKT,LINEAR:DUAL COMPARATOR	01295	LM393P
A1U440	156-0366-02	B300000	B302230	MICROCKT,DGTL:CMOS,DUAL D FLIP-FLOP,SCRN	02735	CD4013BFX
A1U440	156-0366-00	B302231		MICROCKT,DGTL:DUAL D FLIP-FLOP	02735	CD4013BF

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A2	670-1505-06	B300000	B302260	CIRCUIT BD ASSY:AMPLIFIER	80009	670-1505-06
A2	670-1505-09	B302261		CIRCUIT BD ASSY:A2 AMPLIFIER	80009	670-1505-09
A2C101	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A2C103	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A2C104	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A2C113	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A2C115	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A2C125	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1
A2C127	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1
A2C129	290-0177-00			CAP,FXD,ELCTLT:1UF,20%,50V	05397	T320A105M050AS
A2C145	290-0177-00			CAP,FXD,ELCTLT:1UF,20%,50V	05397	T320A105M050AS
A2C150	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A2C153	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A2CR171	152-0141-02	B302261		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2CR176	152-0141-02	B302261		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2L108	108-0691-00			COIL,RF:FIXED,1.8MH	76493	02279
A2L111	108-0691-00			COIL,RF:FIXED,1.8MH	76493	02279
A2P10	136-0328-02			SOCKET,PIN TERM:U/W 0.025 SQ PINS (QUANTITY OF 12)	00779	102081-1
A2P11	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 6)	22526	48283-036
A2P12	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 3)	22526	48283-036
A2Q107	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A2Q110	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A2Q119	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A2Q122	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A2Q134	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A2R101	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A2R105	321-0218-00			RES,FXD,FILM:1.82K OHM,1%,0.125W,TC=T0	19701	5033ED1K82F
A2R106	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R107	322-0331-00			RES,FXD,FILM:27.4K OHM,1%,0.25W,TC=T0	19701	5043RD27K40F
A2R108	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A2R109	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R110	322-0331-00			RES,FXD,FILM:27.4K OHM,1%,0.25W,TC=T0	19701	5043RD27K40F
A2R111	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A2R117	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=T0	19701	5033ED4K990F
A2R118	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R119	321-0373-00			RES,FXD,FILM:75.0K OHM,1%,0.125W,TC=T0	19701	5033ED75K00F
A2R121	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R122	321-0373-00			RES,FXD,FILM:75.0K OHM,1%,0.125W,TC=T0	19701	5033ED75K00F
A2R125	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A2R127	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A2R129	321-0169-00			RES,FXD,FILM:562 OHM,1%,0.125W,TC=T0	07716	CEAD562R0F
A2R132	315-0123-00			RES,FXD,FILM:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A2R134	321-0354-00			RES,FXD,FILM:47.5K OHM,1%,0.125W,TC=T0	19701	5043ED47K50F
A2R135	321-0377-00			RES,FXD,FILM:82.5K OHM,1%,0.125W,TC=T0	07716	CEAD82501F
A2R136	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A2R137	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A2R141	311-1246-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	32997	3386X-T07-503
A2R144	321-0354-00			RES,FXD,FILM:47.5K OHM,1%,0.125W,TC=T0	19701	5043ED47K50F
A2R145	321-0377-00			RES,FXD,FILM:82.5K OHM,1%,0.125W,TC=T0	07716	CEAD82501F
A2R150	315-0470-00	B300000	B302260	RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A2R151	315-0153-00	B300000	B302260	RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A2R151	315-0114-00	B302261		RES,FXD,FILM:110K OHM,5%,0.25W	19701	5043CX110K0J
A2R153	315-0470-00	B300000	B302260	RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A2R154	315-0473-00	B300000	B302260	RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A2R154	315-0334-00	B302261		RES,FXD,FILM:330K OHM,5%,0.25W	57668	NTR25J-E 330K

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A2R155	315-0392-00	B300000	B302260	RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A2R155	315-0912-00	B302261		RES,FXD,FILM:9.1K OHM,5%,0.25W	57668	NTR25J-E09K1
A2R156	315-0202-00	B302261		RES,FXD,FILM:2K OHM,5%,0.25W (NOMINAL VALUE)	57668	NTR25J-E 2K
A2R156	315-0182-00	B302261		RES,FXD,FILM:1.8K OHM,5%,0.25W (TEST SELECTED)	57668	NTR25J-E1K8
A2R156	315-0222-00	B302261		RES,FXD,FILM:2.2K OHM,5%,0.25W (TEST SELECTED)	57668	NTR25J-E02K2
A2R156	315-0272-00	B302261		RES,FXD,FILM:2.7K OHM,5%,0.25W (TEST SELECTED)	57668	NTR25J-E02K7
A2R170	311-1230-00	B300000	B302260	RES,VAR,NONWW:TRMR,20K OHM,0.5W	32997	3386F-T04-203
A2R170	311-1228-00	B302261		RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3386F-T04-103
A2R171	315-0223-00	B300000	B302260	RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A2R171	322-3322-00	B302261		RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 22K1
A2R172	315-0223-00	B300000	B302260	RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A2R172	322-3322-00	B302261		RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 22K1
A2R173	315-0472-00	B300000	B302260	RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A2R173	322-3365-00	B302261		RES,FXD,FILM:61.9K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 61K9
A2R174	315-0103-00	B300000	B302260	RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R174	322-3322-00	B302261		RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 22K1
A2R175	311-1230-00	B300000	B302260	RES,VAR,NONWW:TRMR,20K OHM,0.5W	32997	3386F-T04-203
A2R175	311-1228-00	B302261		RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3386F-T04-103
A2R176	321-0348-00	B302261		RES,FXD,FILM:41.2K OHM,1%,0.125W,TC=T0	19701	5043ED41K20F
A2R177	315-0333-00	B300000	B302260	RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A2R177	315-0683-00	B302261		RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A2R181	315-0333-00	B300000	B303308	RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A2R181	315-0153-00	B303309		RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A2R182	315-0683-00	B300000	B303308	RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A2R182	315-0333-00	B303309		RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A2R191	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A2R193	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A2R515	311-1243-00			RES,VAR,NONWW:TRMR,500K OHM,0.5W	32997	3386X-T07-504
A2U105	155-0047-00	B300000	B302260	MICROCKT,LINEAR:OUTPUT AMPLIFIER	80009	155-0047-00
A2U105	156-3175-00	B302261		MICROCKT,LINEAR:DUAL OUTPUT AMPLIFIER DRVR	80009	156-3175-00
A2W103	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A2W105	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07

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A3	670-2741-15	B300000	B300628	CIRCUIT BD ASSY:POWER SUPPLY	80009	670-2741-15
A3	670-2741-22	B300629		CIRCUIT BD ASSY:PWR SPLY (STANDARD ONLY)	80009	670-2741-22
A3	670-2741-16	B300000	B300628	CIRCUIT BD ASSY:POWER SUPPLY	80009	670-2741-16
A3	670-2741-23	B300629		CIRCUIT BD ASSY:PWR SPLY (OPTION 01 ONLY)	80009	670-2741-23
A3	670-2741-17	B300000	B300628	CIRCUIT BD ASSY:POWER SUPPLY	80009	670-2741-17
A3	670-2741-24	B300629		CIRCUIT BD ASSY:PWR SPLY (OPTION 02 ONLY)	80009	670-2741-24
A3C204	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V (STANDARD,OPTION 01 ONLY)	51406	DHR17Y55102M5KV
A3C206	283-0008-00			CAP,FXD,CER DI:0.1UF,20%,500V	04222	SR507C104MAA
A3C207	283-0008-00			CAP,FXD,CER DI:0.1UF,20%,500V	04222	SR507C104MAA
A3C210	285-0924-00			CAP,FXD,PLASTIC:1.7UF,10%,200V (STANDARD ONLY)	04099	C703C175K
A3C210	285-0933-00			CAP,FXD,PLASTIC:2UF,10%,400V (OPTION 01 ONLY)	04099	C706D205K
A3C210	285-0935-00			CAP,FXD,PLASTIC:4.4UF,10%,200V (OPTION 02 ONLY)	04099	C708
A3C212	285-0925-00			CAP,FXD,PLASTIC:3.3UF,10%,200V (STANDARD ONLY)	14752	YK230B1C335K
A3C212	285-0933-00			CAP,FXD,PLASTIC:2UF,10%,400V (OPTION 01 ONLY)	04099	C706D205K
A3C212	285-0935-00			CAP,FXD,PLASTIC:4.4UF,10%,200V (OPTION 02 ONLY)	04099	C708
A3C215	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V (STANDARD,OPTION 01 ONLY)	51406	DHR17Y55102M5KV
A3C216	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C236	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A3C238	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A3C239	290-0283-00			CAP,FXD,ELCTLT:0.47UF,10%,35V	05397	T320A474K035AS
A3C241	283-0028-00			CAP,FXD,CER DI:0.0022UF,20%,50V	59660	0805585Y5S0222M
A3C247	290-0846-00			CAP,FXD,ELCTLT:47UF,+75-20%,35V	54473	ECE-A35V47LU
A3C251	290-0535-01	B300000	B303544	CAP,FXD,ELCTLT:33UF,20%,10VDC	56289	196D336X0010KA1
A3C251	290-0535-00	B303545		CAP,FXD,ELCTLT:33UF,20%,10V TANTALUM	56289	196D336X0010KA1
A3C253	290-0535-01	B300000	B303544	CAP,FXD,ELCTLT:33UF,20%,10VDC	56289	196D336X0010KA1
A3C253	290-0535-00	B303545		CAP,FXD,ELCTLT:33UF,20%,10V TANTALUM	56289	196D336X0010KA1
A3C256	290-0517-00			CAP,FXD,ELCTLT:6.8UF,20%,35V	05397	T368B685M035AZ
A3C257	283-0057-00			CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A3C258	290-0517-00			CAP,FXD,ELCTLT:6.8UF,20%,35V	05397	T368B685M035AZ
A3C260	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C261	290-0308-00	B300000	B301700	CAP,FXD,ELCTLT:1UF,20%,35V TANTALUM	24546	HV105A-20/9011
A3C261	290-0177-00	B301701		CAP,FXD,ELCTLT:1UF,20%,50V	05397	T320A105M050AS
A3C262	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C263	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C264	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C265	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C266	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C267	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C268	283-0068-00			CAP,FXD,CER DI:0.01UF,+100-0%,500V	59660	871-533E103P
A3C269	283-0001-00			CAP,FXD,CER DI:0.005UF,+100-0%,500V	59821	2DDH61L502P
A3C270	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A3C273	283-0105-00			CAP,FXD,CER DI:0.01UF,+80-20%,2000V	60705	564CBA202IP203ZA
A3C280	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
A3C281	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SR305C104MAA
A3C282	290-0164-00			CAP,FXD,ELCTLT:1UF,+50-10%,150V	56289	500D105F150BA2R2
A3C508	283-0178-00			CAP,FXD,CER DI:0.1UF,20%,100V	05397	C330C104Z1U1CA
A3C510	283-0198-00			CAP,FXD,CER DI:0.22UF,20%,50V	05397	C330C224M5U1CA
A3C512	283-0208-00			CAP,FXD,CER DI:0.22UF,10%,200V	04222	SR502C224KAA

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3C515	283-0067-00			CAP,FXD,CER DI:0.001UF,10%,200V	59660	835-515-YSE0102K
A3CR215	152-0488-00			SEMICOND DVC,DI:BRIDGE,SI,200V,1.5A	80009	152-0488-00
A3CR216	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A3CR240	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR241	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR251	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR252	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR253	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR254	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR256	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A3CR258	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A3CR261	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR261	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR262	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR262	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR263	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR263	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR264	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR264	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR265	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR265	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR266	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR266	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR267	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR267	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR268	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR268	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR280	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR280	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR281	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR281	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR509	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR511	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR512	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR512	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR513	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR514	152-0107-03	B300000	B302260	SEMICOND DVC,DI:RECT,SI,400V,400MA,A1	04713	1N4004
A3CR514	152-0400-00	B302261		SEMICOND DVC,DI:RECT,SI,400V,1A	04713	SR1977KRL
A3CR522	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR524	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR526	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR528	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3F201	159-0121-00			FUSE,CARTRIDGE:DIN,0.4A,250V,5SEC	61935	FSF034.1512
A3L257	108-0654-00			COIL,RF:FIXED,2.2MH	76493	01872
A3P1	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 3)	22526	48283-029
A3P2	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 6)	22526	48283-029
A3P3	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 6)	22526	48283-029
A3P4	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 2)	22526	48283-029
A3P7	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 3)	22526	48283-029
A3P8	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 2)	22526	48283-029
A3P17	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 3)	22526	48283-029

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3P20	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 11)	22526	48283-029
A3P21	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 5)	22526	48283-029
A3P25	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL (QUANTITY OF 2)	22526	48283-029
A3Q215	151-0503-00			SCR:SI,TO-92	04713	SCR5138
A3Q231	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A3Q235	151-0220-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0220-00
A3Q242	151-0334-00			TRANSISTOR:NPN,SI,TO-126	80009	151-0334-00
A3Q249	151-0334-00			TRANSISTOR:NPN,SI,TO-126	80009	151-0334-00
A3Q502	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A3Q505	151-0347-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7951
A3Q510	151-0444-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS797
A3Q512	151-0444-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS797
A3Q520	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6700
A3Q521	151-0410-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6765
A3R204	315-0475-00			RES,FXD,FILM:4.7M OHM,5%,0.25W	01121	CB4755
A3R205	315-0475-00			RES,FXD,FILM:4.7M OHM,5%,0.25W	01121	CB4755
A3R210	301-0154-00			RES,FXD,FILM:150K OHM,5%,0.5W	19701	5053CX150K0J
A3R211	301-0120-00			RES,FXD,FILM:12 OHM,5%,0.5W	19701	5053CX12R00J
A3R212	301-0154-00			RES,FXD,FILM:150K OHM,5%,0.5W	19701	5053CX150K0J
A3R213	310-0120-00			RES,FXD,FILM:453 OHM,1%,1W	01295	CD1R4530F
A3R215	307-0103-00			RES,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
A3R216	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A3R217	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A3R225	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
A3R227	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A3R229	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R230	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A3R231	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A3R232	315-0393-00	B300000	B300628	RES,FXD,FILM:39K OHM,5%,0.25W	57668	NTR25J-E39K0
A3R232	315-0243-00	B300629		RES,FXD,FILM:24K OHM,5%,0.25W	57668	NTR25J-E24K0
A3R235	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A3R236	315-0131-00			RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A3R238	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R239	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A3R241	315-0131-00			RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A3R264	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A3R268	315-0274-00			RES,FXD,FILM:270K OHM,5%,0.25W	57668	NTR25J-E270K
A3R271	315-0274-00			RES,FXD,FILM:270K OHM,5%,0.25W	57668	NTR25J-E270K
A3R272	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A3R273	311-1252-00			RES,VAR,NONWW:TRMR,500K OHM,0.5W	32997	3386F-T04-504
A3R278	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A3R279	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A3R501	321-0407-00			RES,FXD,FILM:169K OHM,1%,0.125W,TC=T0	07716	CEAD16902F
A3R502	321-0431-00			RES,FXD,FILM:301K OHM,1%,0.125W,TC=T0	07716	CEAD30102F
A3R505	315-0154-00			RES,FXD,FILM:150K OHM,5%,0.25W	57668	NTR25J-E150K
A3R506	311-1252-00			RES,VAR,NONWW:TRMR,500K OHM,0.5W	32997	3386F-T04-504
A3R508	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
A3R510	311-1254-00			RES,VAR,NONWW:TRMR,1M OHM,0.5W	32997	3386F-T04-105
A3R511	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
A3R512	315-0684-00			RES,FXD,FILM:680K OHM,5%,0.25W	01121	CB6845
A3R513	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A3R516	315-0274-00			RES,FXD,FILM:270K OHM,5%,0.25W	57668	NTR25J-E270K
A3R521	315-0333-00			RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A3R522	315-0475-00			RES,FXD,FILM:4.7M OHM,5%,0.25W	01121	CB4755
A3R523	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3R524	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A3R525	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A3R527	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A3R529	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A3S201	260-2190-00			SWITCH,SLIDE:DPST,6A,120VAC,POWER	09353	1201 M2 A Q
A3T207	120-1103-00			TRANSFORMER,RF:COMMON MODE REJECTION POT	80009	120-1103-00
A3T250	120-0735-00			XFMR,PWR,SDN&SU:	75498	ORDER BY DESCR
A3T270	108-0772-00			COIL,RF:FIXED,148UH	TK1345	ORDER BY DESCR
A3T280	120-0865-01			TRANSFORMER,RF:	80009	120-0865-01
A3VR216	152-0590-00			SEMICOND DVC,DI:ZEN,SI,18V,5%,400MW	80009	152-0590-00
A3VR228	152-0306-00			SEMICOND DVC,DI:ZEN,SI,9.1V,5%,0.4W,DO-7	80009	152-0306-00
A3VR238	152-0514-00	B300000	B300628	SEMICOND DVC,DI:ZEN,SI,10V,1%,0.4W,DO-7	04713	SZG15RL
A3VR238	152-0662-00	B300629		SEMICOND DVC,DI:ZEN,SI,5V,1%,400MW,DO-7	04713	SZG195RL
A3VR239	152-0662-00	B300629		SEMICOND DVC,DI:ZEN,SI,5V,1%,400MW,DO-7	04713	SZG195RL
A3W270	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4	670-2676-03			CIRCUIT BD ASSY:SINGLE SWEEP	80009	670-2676-03
A4C530	283-0176-00			CAP,FXD,CER DI:0.0022UF,20%,50V	04222	SR205C222MAA
A4C535	283-0268-00			CAP,FXD,CER DI:0.015UF,20%,50V	04222	3439-050C-153K
A4C536	283-0139-00			CAP,FXD,CER DI:150PF,20%,50V	05397	C312C151M5G5CA
A4C537	283-0326-00			CAP,FXD,CER DI:0.082UF,10%,50V	04222	SR205C823KAA
A4CR530	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4J20	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
A4Q530	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A4Q532	151-0342-00			TRANSISTOR:PNP,SI,TO-92	07263	S035928
A4Q535	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A4R530	315-0562-00			RES,FXD,FILM:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A4R531	315-0113-00			RES,FXD,FILM:11K OHM,5%,0.25W	19701	5043CX11K00J
A4R532	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A4R535	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A4R536	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A4R537	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A4R541	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A4S510	----- -----			(NOT AVAILABLE,USE A4)		

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
BT216	146-0033-01	B300000	B301322	BATTERY,STORAGE:6V,0.66AH @ 66MA,(5)A CELL, NICAD W/LEADS,NEG TERM FUSEW/3 A.F.	80009	146-0033-01
BT216	146-0033-02	B301323		BATTERY,STORAGE:6V,0.75AH W/3A FUSE,(5)A CE LL	TK1903	ORDER BY DESCR
BT217	146-0033-01	B300000	B310322	BATTERY,STORAGE:6V,0.66AH @ 66MA,(5)A CELL, NICAD W/LEADS,NEG TERM FUSEW/3 A.F.	80009	146-0033-01
BT217	146-0033-02	B301323		BATTERY,STORAGE:6V,0.75AH W/3A FUSE,(5)A CE LL	TK1903	ORDER BY DESCR
DS310	150-1031-01			LT EMITTING DIO:RED,650NM,40MA MAX W/WIRE & CONN	80009	150-1031-01
F216	159-0220-00			FUSE,WIRE LEAD:3A,125V,FAST (FURNISHED WITH BT216)	71400	TRA3
F217	159-0220-00			FUSE,WIRE LEAD:3A,125V,FAST (FURNISHED WITH BT217)	71400	TRA3
J348	129-0398-00			POST,CONTACT:TIP JACK,CKT BD MTG	TK2278	ORDER BY DESCR
J349	129-0398-00			POST,CONTACT:TIP JACK,CKT BD MTG	TK2278	ORDER BY DESCR
L300	----- -----			(PART OF V300)		
V300	154-0732-00			ELECTRON TUBE:CRT,P400,INT SCALE	80009	154-0732-00

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

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

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

Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

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

The overline on a signal name indicates that the signal performs its intended function when it goes to the low state.

Abbreviations are based on ANSI Y1.1-1972.

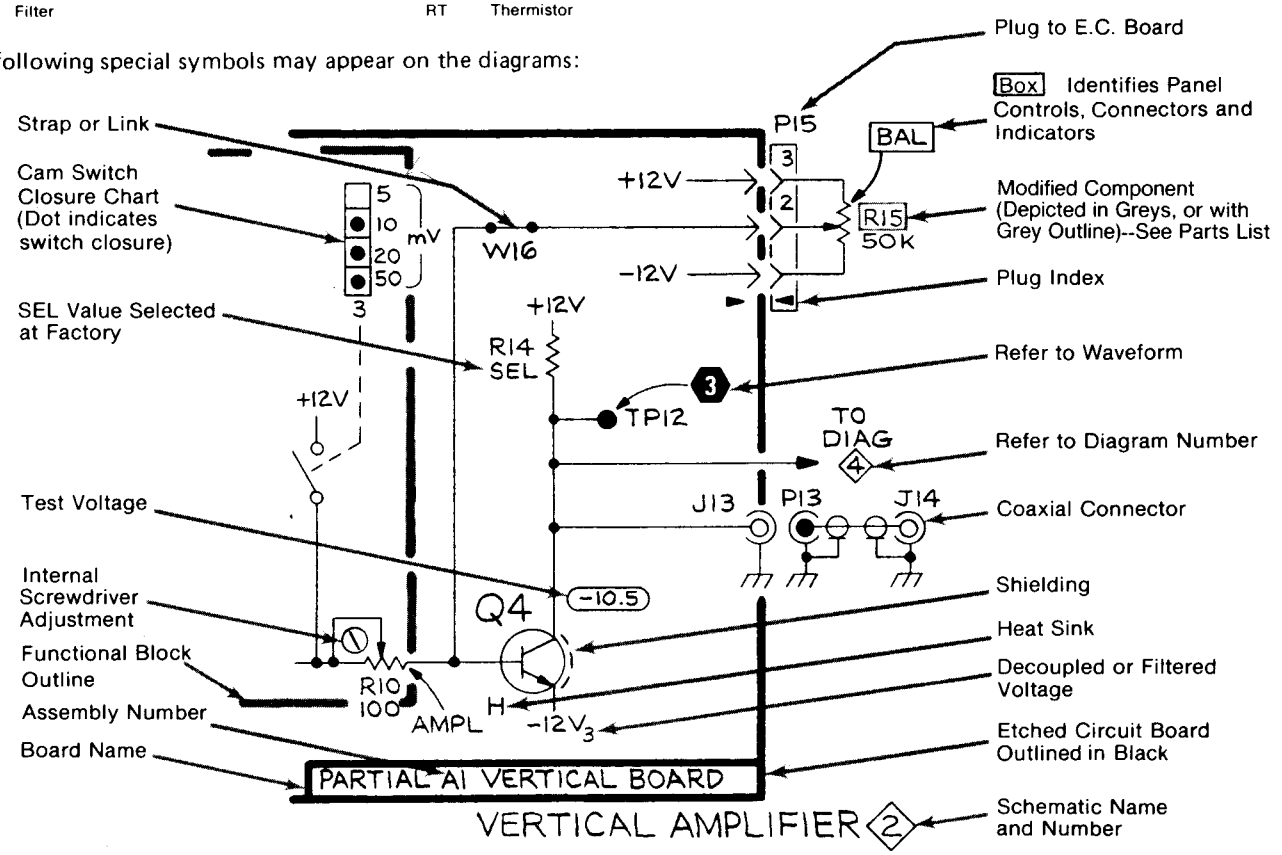
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

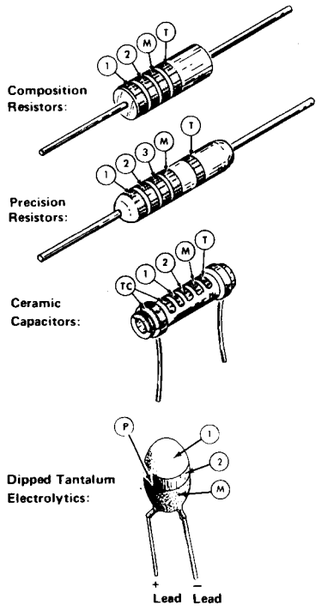
Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

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

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

The following special symbols may appear on the diagrams:





Resistor and Capacitor Color Code

Color	Figures	Multiplier		Tolerance		Voltage
		Resistors	Capacitors	Resistors	Capacitors	Rating**
Silver	– – –	10^{-2}	– – –	±10%	– – –	– – –
Gold	– – –	10^{-1}	– – –	±5%	– – –	– – –
Black	0	1	1	– – –	±20% or 2 pF*	4 VDC
Brown	1	10	10	±1%	±1% or 0.1 pF*	6 VDC
Red	2	10^{2}	10^{2}	±2%	±2%	10 VDC
Orange	3	10^{3}	10^{3}	±3%	±3%	15 VDC
Yellow	4	10^{4}	10^{4}	±4%	+100% –9%	20 VDC
Green	5	10^{5}	10^{5}	±0.5%	±5% or 0.5 pF*	25 VDC
Blue	6	10^{6}	10^{6}	– – –	– – –	35 VDC
Violet	7	– – –	– – –	– – –	– – –	50 VDC
Gray	8	– – –	10^{-2}	– – –	+80% –20% or 0.25 pF*	– – –
White	9	– – –	10^{-1}	– – –	±10% or 1 pF*	3 VDC
(none)	– – –	– – –	– – –	±20%	±10% or 1 pF*	– – –

*For capacitance of 10 pF or less.

**For dipped tantalum capacitors only.

(1)(2) and (3) —1st, 2nd, and 3rd significant figures:
(M) —multiplier; (T) —tolerance:
(TC) —temperature coefficient;
(P) —polarity and voltage rating.

NOTE: (T) and/or (TC) color code for capacitors depends upon manufacturer and capacitor type. May not be present in some cases.

(1879-6)5055-05

Fig. 8-1. Color codes for resistors and capacitors.

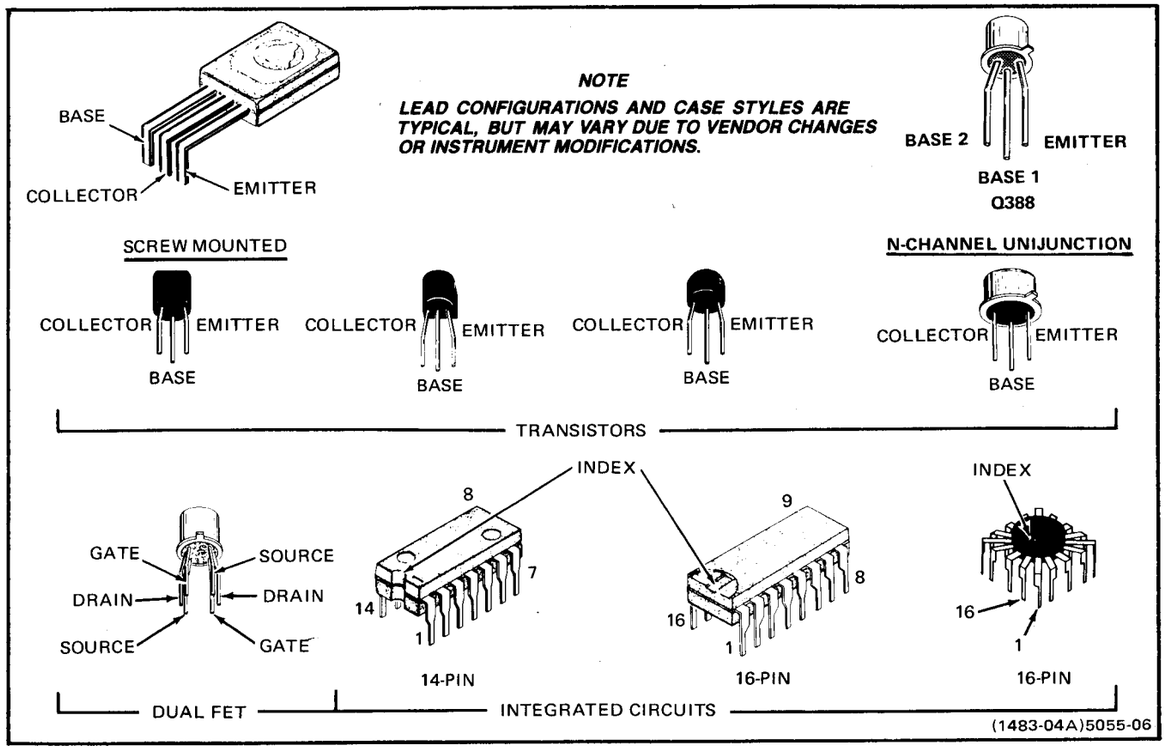


Fig. 8-2. Semiconductor lead configurations.

214 SERVICE
SN B300000 & ABOVE

To identify any component mounted on a circuit board and to locate that component in the appropriate schematic diagram

1. Locate the Circuit Board Illustration

a. Identify the particular circuit board that the component is located on by using the Circuit Board Location illustration (Figure 9-5) to determine the Assembly Number.

b. In the manual locate and pull out tabbed page whose title corresponds with the Assembly Number of the circuit board. Circuit board assembly numbers and board nomenclature are printed on the back side of the tabs (facing the rear of the manual).

2. Determine the Circuit Number

a. Compare the circuit board with its illustration and locate the desired component by area and shape on the illustration.

b. Scan the table adjacent to the Circuit Board Illustration and find the Circuit Number of the desired component.

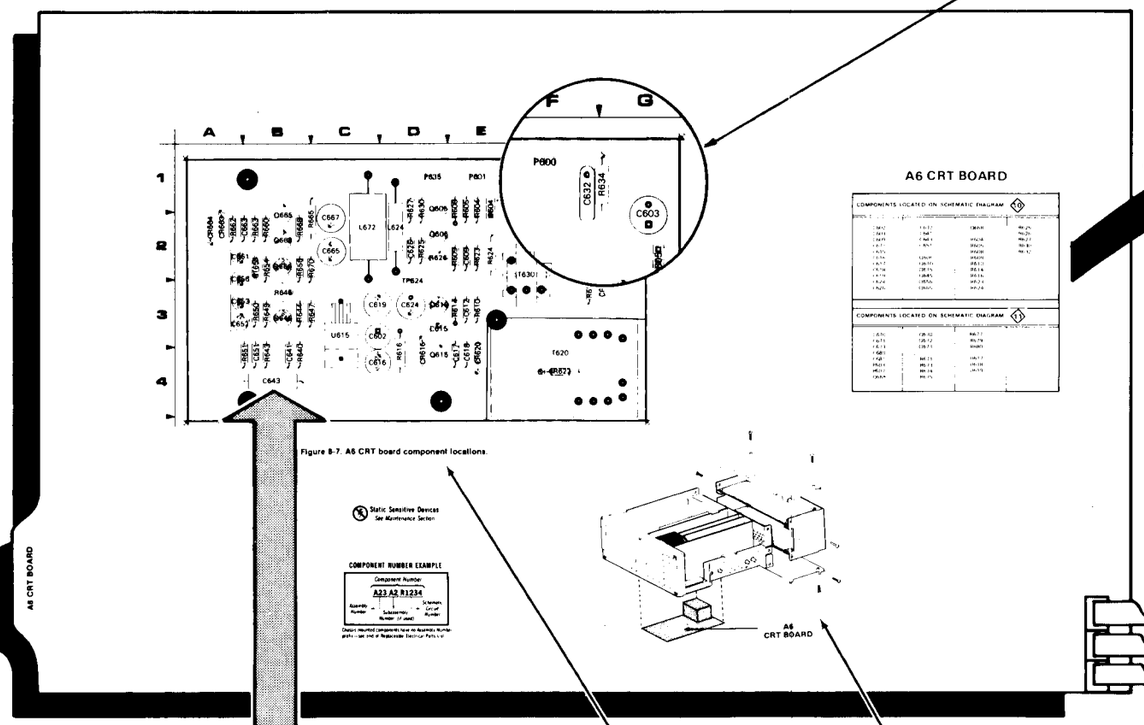
c. Determine the Schematic Diagram Number in which the component is located.

A6 CRT BOARD

COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 10			
C602	C632	Q668	R625
C603	C641		R626
C609	C643	R604	R627
C671	C651	R605	R630
C615		R608	R632
C616	Q606	R609	
C617	Q610	R610	
C618	Q615	R614	
C619	Q645	R616	
C624	Q656	R623	
C626	Q665	R624	

COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 11			
C670	Q670	R677	
C671	Q672	R679	
C673	Q673	R680	
C680			
C681	R671	U617	
P603	R673	U618	
P607	R674	U619	
Q669	R675		

COMPONENT LOCATION TABLE



CRT CIRCUIT DIAGRAM 10

MANUAL BINDER

A6 ASSEMBLY

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C602	2C	3C	Q656	2F	2B
C603	1C	1G	Q665	1G	1B
C609	4E	2E	Q668	2G	2B
C612	7C	3E			
C615	7C	3D	R604	4C	1E
C616	2C	3C	R605	5D	1E
C617	7D	3D	R608	4E	1D
C618	7E	3E	R609	4E	2D
C619	6E	3C	R610	7B	3E
C624	4F	3D	R614	7C	3D
C626	7G	2D	R616	1C	3D
C632	8G	1E	R623	4D	2E
C643	3D	4B	R625	7F	2D
C651	3E	3B	R626	7F	2D
		3B	R627	7G	1D
			R630	4F	1D
Q606	4E	2D			
Q610	7C	3D	TP624	3B	2D
Q615	7D	3D			
Q645	3E	3B	U615	1D	3C

CHASSIS MOUNTED PARTS

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
L635	51	CHASSIS	V635	6J	CHASSIS

PULL OUT PAGE TABS FOR CIRCUIT BOARD ILLUSTRATION

ASSEMBLY NUMBER AND CIRCUIT BOARD NAME

ILLUSTRATION FOR INSTRUMENT CIRCUIT BOARD LOCATION

4. Determine the Circuit Board Illustration and Component Location

a. From the schematic diagram, determine the Assembly Number of the circuit board on which the component is mounted. This information is boxed and located in a corner of the heavy line that distinguishes the board outline.

b. Scan the Component Location Table for the Assembly Number just determined and find the Circuit Number of the desired component.

c. Under the BOARD LOCATION column, read the grid coordinates for the desired component.

5. Locate the Component on the Circuit Board

a. In the manual, locate and pull out the tabbed page whose title and Assembly Number correspond with the desired circuit board. This information is on the back side of the tabs.

b. Using the Circuit Number and grid coordinates, locate the component on the Circuit Board Illustration.

c. In the circuit board location illustration, determine the location of the circuit board in the instrument.

d. Find the circuit board in the instrument and compare it with its illustration in the manual to locate the desired component on the board.

Fig. 8-3. Locating components on schematic diagrams and circuit board illustrations.

he Circuit Number

e the circuit board with its illustration and locate red component by area and shape on the illustra-

e table adjacent to the Circuit Board Illustration and Circuit Number of the desired component.

ne the Schematic Diagram Number in which the ent is located.

3. Locate the Component on the Schematic Diagram

a. Locate and pull out tabbed page whose number and title correspond with the Schematic Diagram Number just determined in the table. Schematic diagram nomenclature and numbers are printed on the front side of the tabs (facing the front of the manual).

b. Scan the Component Location Table adjacent to the schematic diagram and find the Circuit Number of the desired component.

c. Under the SCHEM LOCATION column, read the grid coordinates for the desired component.

d. Using the Circuit Number and grid coordinates, locate the component on the schematic diagram.

A6 CRT BOARD

COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 10

C602	C632	Q668	R625
C603	C641		R626
C609	C643	R604	R627
C671	C651	R605	R630
C615		R608	R632
C616	Q606	R609	
C617	Q610	R610	
C618	Q615	R614	
C619	Q645	R616	
C624	Q656	R623	
C626	Q665	R624	

COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 11

C670	Q670	R677	
C671	Q672	R679	
C673	Q673	R680	
C680			
C681	R671	U617	
P603	R673	U618	
P607	R674	U619	
Q669	R675		

CRT CIRCUIT DIAGRAM 10

MANUAL BINDER

COMPONENT LOCATION TABLE

CRT CIRCUIT DIAGRAM 10

PULL OUT PAGE TABS FOR SCHEMATIC DIAGRAMS

CRT CIRCUIT 10

MANUAL BINDER

ILLUSTRATION FOR INSTRUMENT CIRCUIT BOARD LOCATION

ion and Component

termine the Assembly which the component is d and located in a corner es the board outline.

able for the Assembly he Circuit Number of the

column, read the grid nent.

on schematic diagrams and circuit board illustrations.

A6 ASSEMBLY

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C602	2C	3C	Q656	2F	2B
C603	1C	1G	Q665	1G	1B
C609	4E	2E	Q668	2G	2B
C612	7C	3E			
C615	7C	3D	R604	4C	1E
C616	2C	3C	R605	5D	1E
C617	7D	3D	R608	4E	1D
C618	7E	3E	R609	4E	2D
C619	6E	3C	R610	7B	3E
C624	4F	3D	R614	7C	3D
C626	7G	2D	R616	1C	3D
C632	8G	1E	R623	4D	2E
C643	3D	4B	R625	7F	2D
C651	3E	3B	R626	7F	2D
		3B	R627	7G	1D
			R630	4F	1D
Q606	4E	2D			
Q610	7C	3D	TP624	3B	2D
Q615	7D	3D			
Q645	3E	3B	U615	1D	3C

CHASSIS MOUNTED PARTS

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
L635	51	CHASSIS	V635	6J	CHASSIS

Numeral and letter at signal lines to or from other diagrams indicates the grid coordinates on another schematic (for example: 4E)

To identify any component in a schematic diagram and to locate that component on its respective circuit board.

PARTIAL A6 CRT CIRCUIT BOARD

CRT CIRCUIT 10

SCHEMATIC DIAGRAM NAME AND NUMBER

4204-58

VOLTAGES AND WAVEFORMS

The voltages and waveforms shown on the diagrams in this section were obtained by using the following test set-ups and test equipment.

Voltage Measurements:

Set the front and side panel controls to mid-range.

Input coupling switches to ground (GND). Trace positioned to the center horizontal line.

Voltmeter common is connected to the instrument common.

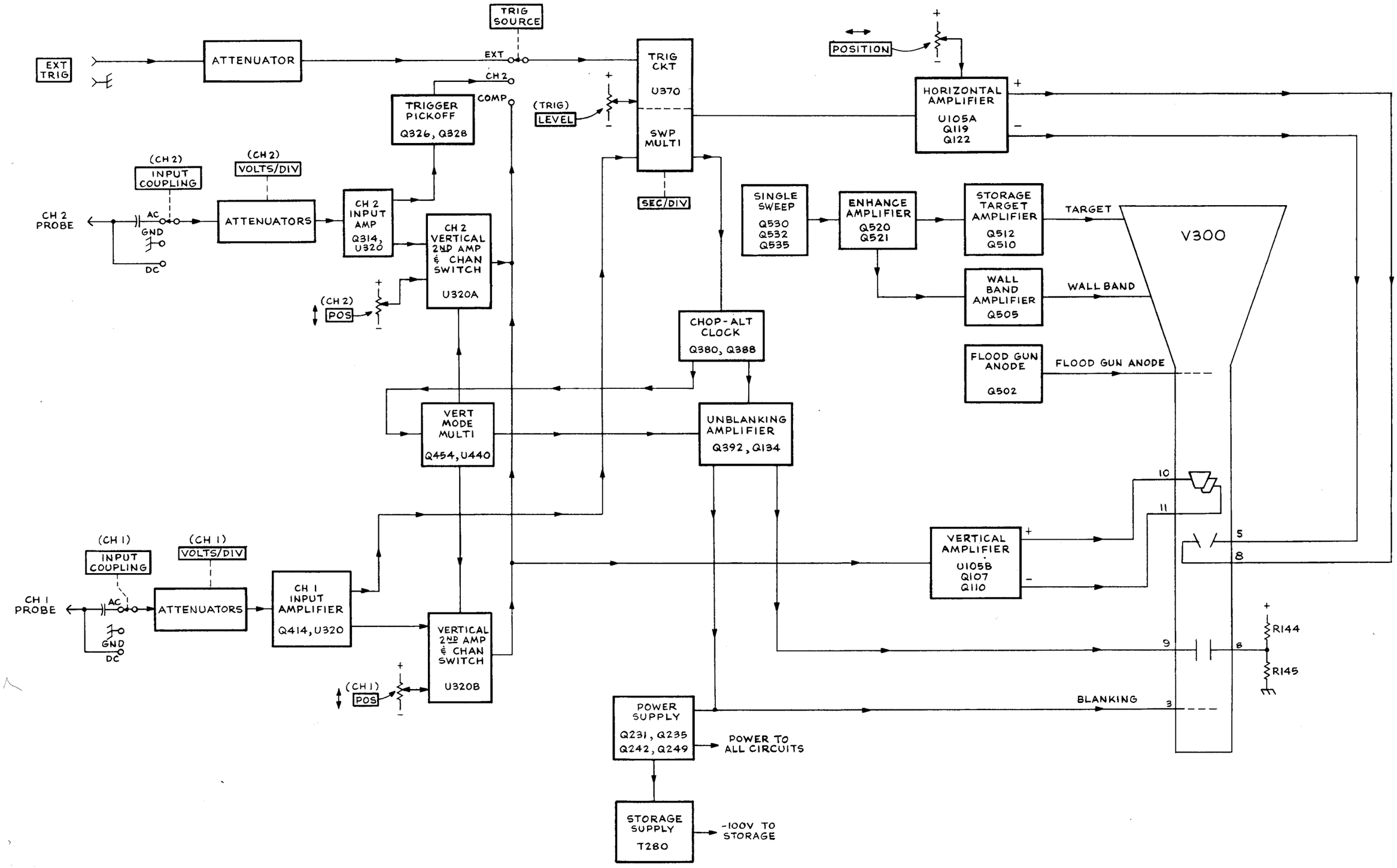
Waveform Measurements:

The 214 Oscilloscope under test: The front and side panel controls are set to mid-range. The input coupling switches are set to AC. The vertical deflection is set to 1 mV with a 2 mV square wave connected to CH 1 and a 2 mV sine wave connected to CH 2. The SEC/DIV switch is set for 0.5 ms with a triggered display.

Test Oscilloscope: The test oscilloscope is internally triggered; the vertical deflection and horizontal timing is indicated on the waveform photo. The vertical input is AC coupled. The tolerance of the voltages and waveforms is 20%.

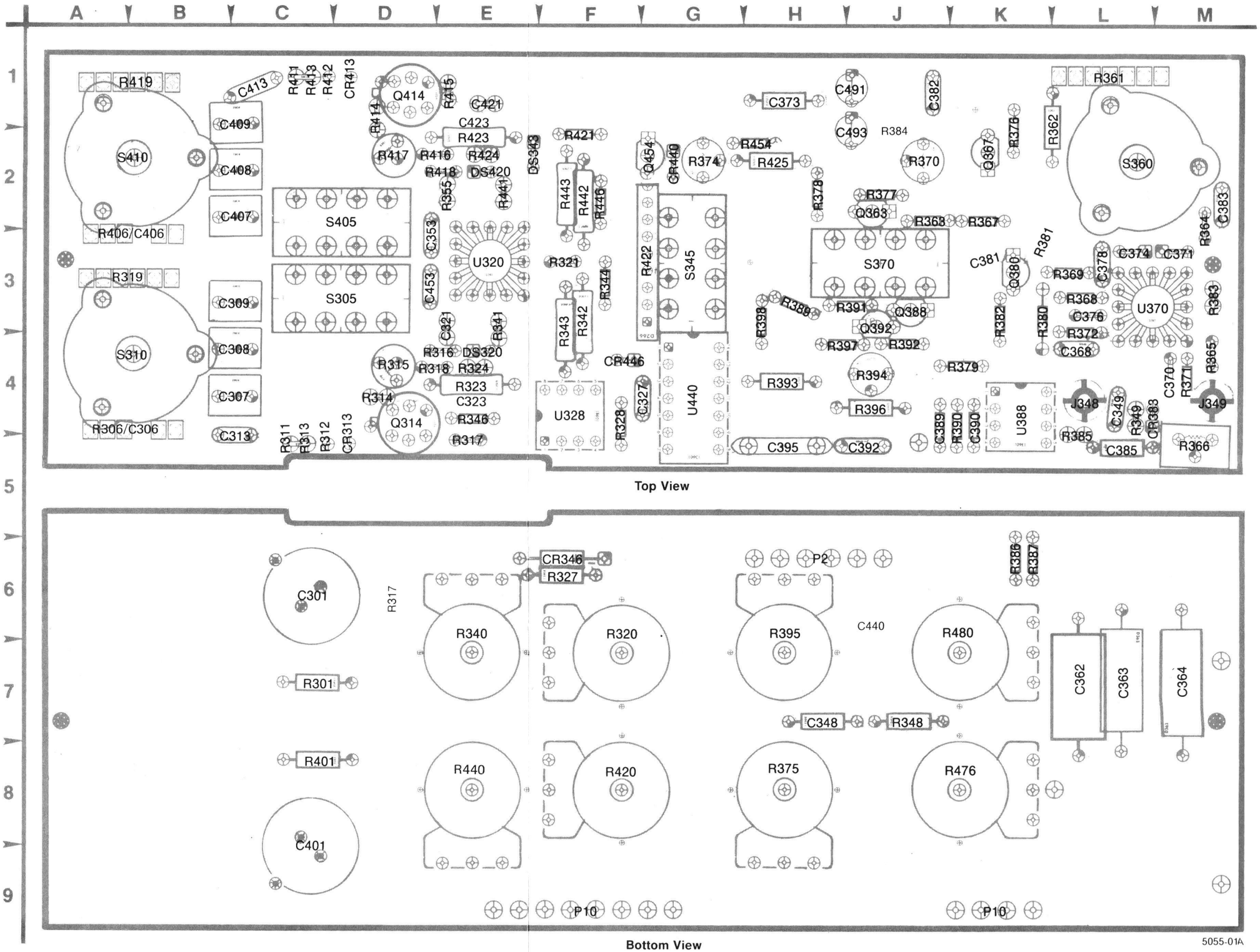
RECOMMENDED TEST EQUIPMENT

ITEM	SPECIFICATIONS	RECOMMENDED TYPE
Oscilloscope	Frequency response 500 kHz.	Tektronix 2213A or equivalent.
Voltmeter nonloading digital multimeter.	Input impedance: 10 MΩ Range: 0—1 kV.	DM 501A. (Requires a TM 500-series power-module mainframe.)



5055-14

BLOCK DIAGRAM



Top View

Bottom View

5055-01A

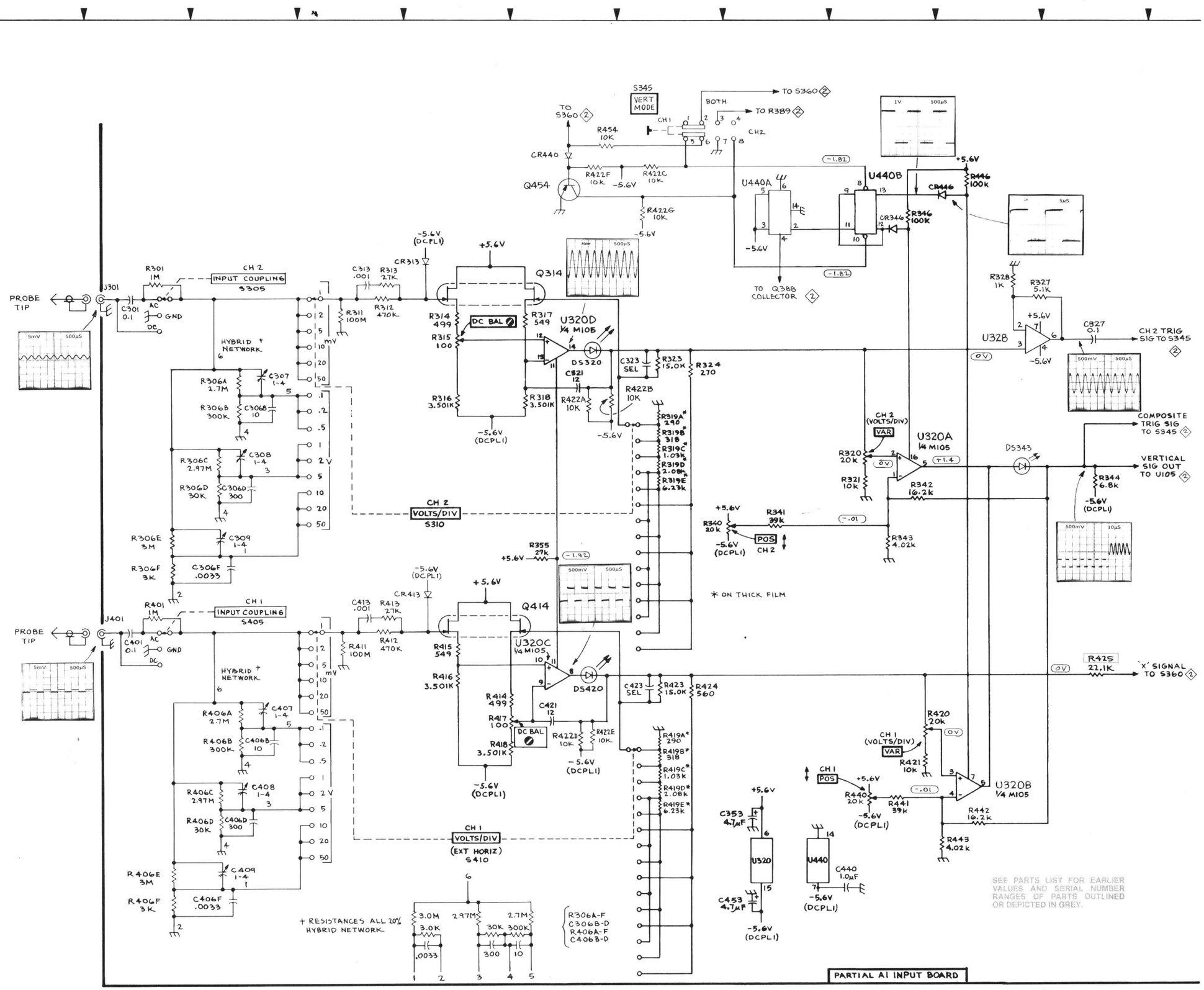
REV JAN 1985

Fig. 8-4. A1-Input Circuit Board component locations—Front View (top) and Back View (bottom).

P/O A1 ASSY — Vertical Amplifier ◇1◇

Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C301	B3	C6	R306C	C5	A4	R415	E6	E1
C306B	C4	B4	R306D	C5	A4	R416	E7	E2
C306D	C5	B4	R306E	B5	A4	R417	E7	D2
C306F	C6	B4	R306F	B6	A4	R418	E7	E2
C307	C4	C4	R311	D3	C4	R419A	G7	A1
C308	C5	C4	R312	D3	C4	R419B	G7	A1
C309	C5	C3	R313	D3	C4	R419C	G8	A1
C313	D3	C4	R314	E3	D4	R419D	G8	A1
C321	F4	E3	R315	E3	D4	R419E	G8	A1
C323	G4	E4	R316	E4	E4	R420	K7	F7
C327	L3	G4	R317	F3	E4	R440	J8	F2
C440	H8	J6	R318	F4	E4	R421	J7	G3
C353	H8	D3	R319A	G4	A3	R422A	K4	G3
C401	B6	C8	R319B	G4	A3	R422B	K4	G3
C407	C7	C1	R319C	G5	A3	R422C	G2	G3
C408	C8	C1	R319D	G5	A3	R422D	F6	G3
C409	C8	C1	R319E	G5	A3	R422E	F6	G3
C413	D6	C1	R320	J5	F6	R422F	F2	G3
C421	F7	E1	R321	J5	F3	R422G	G2	G3
C423	G7	E1	R323	G4	E4	R423	G7	E2
C453	H8	D3	R324	G4	E4	R424	G7	E2
			R327	L3	F6	R425	L7	H2
CR313	E3	D4	R328	K3	F4	R440	J8	E9
CR346	J2	F6	R340	G5	E6	R441	J8	E2
CR413	E6	D1	R341	H5	E3	R442	K8	F2
CR440	F2	G2	R342	J5	F3	R443	K8	F2
CR446	K2	F4	R343	J5	F3	R446	K2	F2
			R344	L5	F3	R454	F2	H2
DS320	F4	E4	R346	J2	E4			
DS343	K5	E2	R355	F5	E2	S305	C3	D3
DS420	F7	E2	R401	B6	C8	S310	E5	B4
			R406A	C7	A2	S345	G1	G3
J301	B3		R406B	C7	A2	S405	C6	D2
J401	B6		R406C	D8	A2	S410	E8	B2
			R406D	C8	A2			
Q314	F4	D4	R406E	B8	A2	U320A	K4	E3
Q414	F6	D1	R406F	B8	A2	U320B	K8	E3
Q454	F2	G2	R411	D6	C1	U320C	F6	E3
			R412	D6	C1	U320D	F3	E3
R301	B3	C6	R413	D6	C1	U328	K3	F4
R306A	C4	A4	R414	E7	D1	U440A	H2	G4
R306B	C4	A4				U440B	J2	G4

P/O A1 ASSY also shown on ◇2◇ & ◇3◇


S345
VERT MODE
BOTH
TO S360
TO R389
CH1
CH2
R454 10K
CR440
R422F 10K
R422C 10K
Q454
-5.6V
R422G 10K
U440A
U440B
CR446
R446 100K
R346 100K
CR346
TO Q388 COLLECTOR
+5.6V
PROBE TIP
J301
C301 0.1
AC
GND
DC
R301 1M
CH 2 INPUT COUPLING S305
HYBRID + NETWORK
R306A 2.7M
C307 1-4
R306B 300K
C306B 10
R306C 2.97M
C308 1-4
R306D 30K
C306D 300
R306E 3M
C309 1-4
R306F 3K
C306F .0033
R311 100M
C313 .001
R313 27K
R312 470K
CR313
-5.6V (DCPL1)
Q314
R314 499
R315 100
DC BAL
R316 3.501K
R317 549
R318 3.501K
U320D 1/4 M105
DS320
C321 12
R422A 10K
R422B 10K
C323 SEL
R323 15.0K
R324 270
R319A* 290
R319B* 318
R319C* 1.03K
R319D* 2.08K
R319E* 6.23K
CH 2 VOLTS/DIV S310
CH 2 (VOLTS/DIV) VAR
U320A 1/4 M105
R320 20K
R321 10K
R342 16.2K
R344 6.8K
R340 20K
R341 39K
POS
CH 2
R343 4.02K
DS343
COMPOSITE TRIG SIG TO S345
VERTICAL SIG OUT TO U105
R328 1K
R327 5.1K
U328
C327 0.1
CH 2 TRIG SIG TO S345
R355 27K
J401
R401 1M
CH 1 INPUT COUPLING S405
R411 100M
C413 .001
R413 27K
R412 470K
CR413
Q414
R415 549
R416 3.501K
R414 499
R417 100
DC BAL
R418 3.501K
U320C 1/4 M105
DS420
C421 12
R422D 10K
R422E 10K
C423 SEL
R423 15.0K
R424 560
R425 22.1K
X SIGNAL TO S360
R406A 2.7M
C407 1-4
R406B 300K
C406B 10
R406C 2.97M
C408 1-4
R406D 30K
C406D 300
R406E 3M
C409 1-4
R406F 3K
C406F .0033
CH 1 VOLTS/DIV (EXT HORIZ) S410
CH 1 (VOLTS/DIV) VAR
R420 20K
R421 10K
CH 1 POS
R440 20K
R441 39K
U320B 1/4 M105
R442 16.2K
R443 4.02K
U320
U440
C353 4.7µF
C453 4.7µF
C440 1.0µF
R306A-F
C306B-D
R406A-F
C406B-D
+ RESISTANCES ALL 20% HYBRID NETWORK
3.0M
3.0K
.0033
2.97M
30K
300
2.7M
300K
10
* ON THICK FILM
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
PARTIAL A1 INPUT BOARD

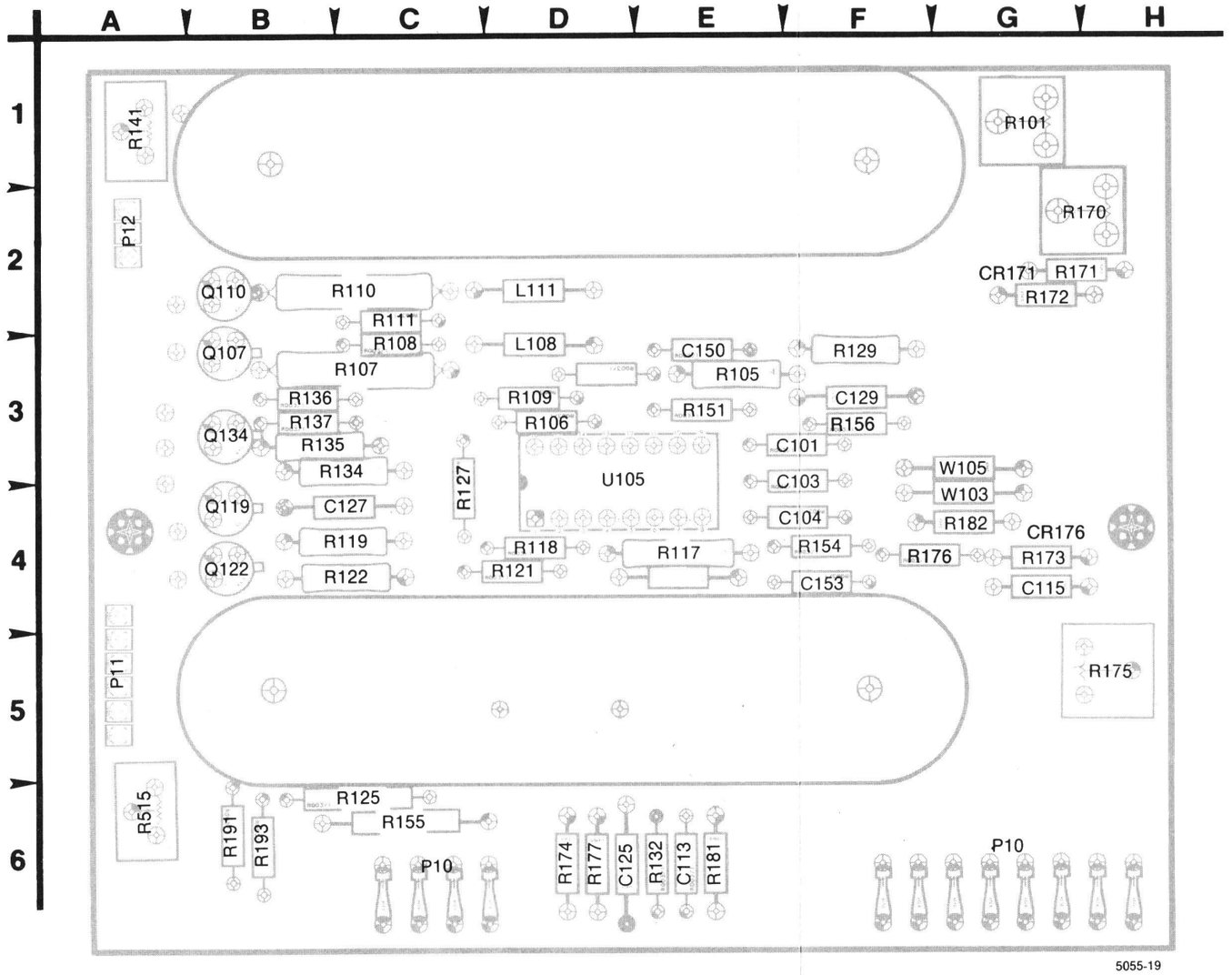


Fig. 8-5A. A2—Amplifier Circuit Board component locations (SN B302261 & above).

P/O A1 ASSY — **Horiz & Vert Output, Trigger & Sweep (SN B302261 & Above)** ◇2

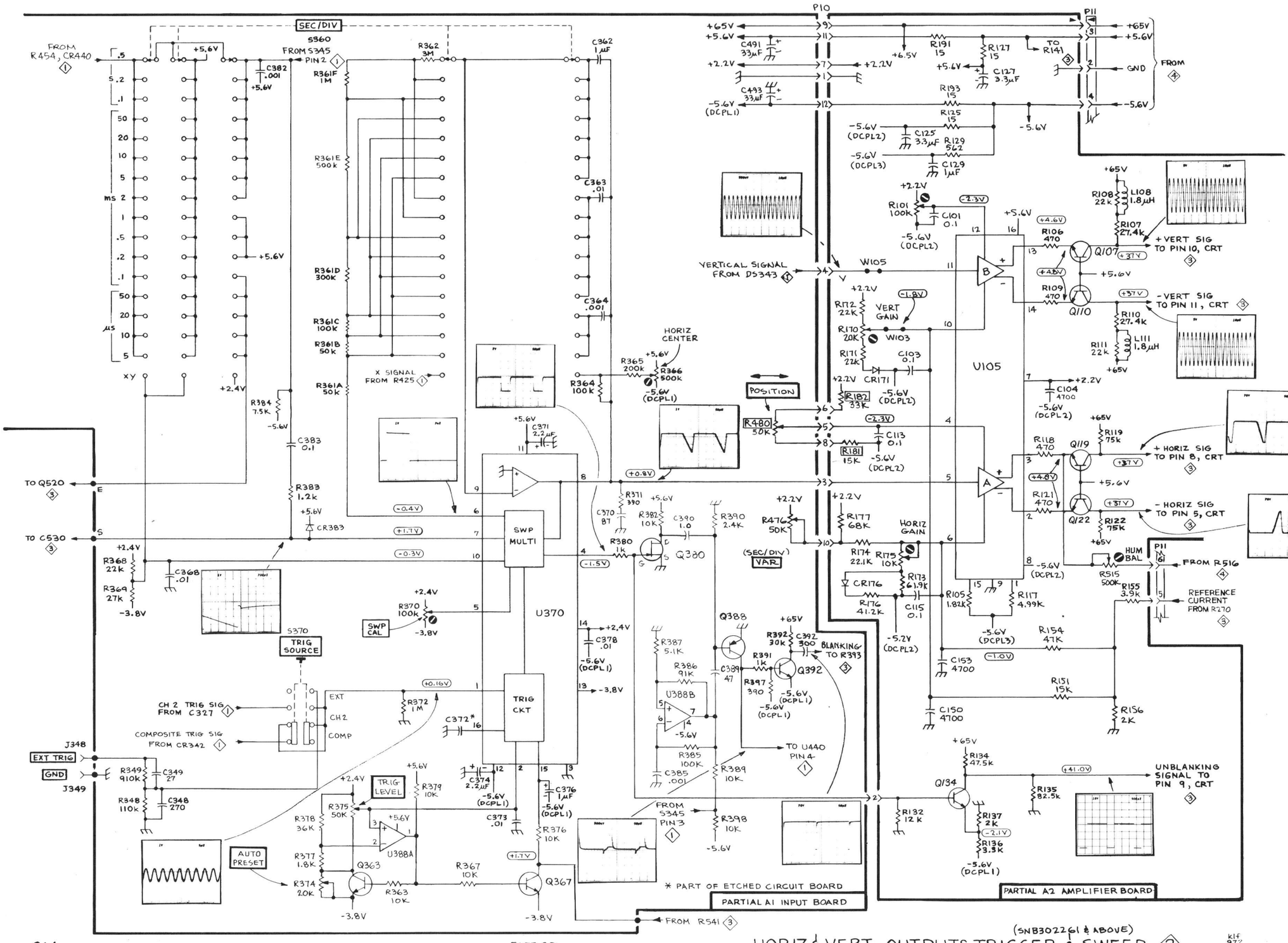
Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C348	B8	H7	P10	H1	K9	R376	F8	K2
C349	B8	L4				R377	C8	J2
C362	F1	L7	Q363	D8	J2	R378	C8	H2
C363	F3	L7	Q367	F8	K2	R379	D8	K4
C364	F4	M7	Q380	G6	K3	R382	F6	K3
C368	B6	L4	Q388	G6	J4	R383	C5	M3
C370	F6	M4	Q392	H7	J4	R384	B4	J2
C371	E5	M3				R385	G8	L4
C372	E7		R348	B8	J7	R386	G7	K6
C373	E8	H1	R349	B8	L4	R387	G7	K6
C374	E8	L3	R361A	D4	L1	R389	G8	H3
C376	F8	L3	R361B	D4	L1	R390	G6	K4
C378	F7	L3	R361C	D4	L1	R391	G7	J3
			R361D	D3	L1	R392	H7	J4
C382	C2	J1	R361E	D2	L1	R397	G7	J4
C383	C5	M3	R361F	D2	L1	R398	G8	H3
C385	G8	L4	R362	D1	L2	R476	H6	K8
C389	G7	J4	R363	D8	J2	R480	H5	K6
C390	G6	K4	R364	F4	M2			
C392	H7	J4	R365	F4	M4	S360	D1	L2
C491	H1	J1	R366	G4	M5	S370	C7	J3
C493	H2	J2	R367	E8	K2			
			R368	B6	L3	U370	F6	L3
CR383	D6	L4	R369	B6	L3	U388A	D8	K4
			R370	D6	J2	U388B	G7	K4
J348	A8	L4	R371	F5	M4			
J349	A8	M4	R372	D8	L3			
			R374	C8	G2			
P10	H1	F9	R375	D8	H8			

P/O A1 ASSY also shown on ◇1 & ◇3

P/O A2 ASSY — **Horiz & Vert Output, Trigger & Sweep (SN B302261 & Above)** ◇2

C101	J3	F3	Q119	K5	B4	R137	J8	B3
C103	J4	F3	Q122	K6	B4	R151	K7	E3
C104	K4	F4	Q134	J8	B3	R154	K6	F4
C113	J5	E6				R155	L6	C6
C115	J6	G4	R101	J3	G1	R156	L7	F3
C125	J2	D6	R105	J6	E3	R170	H4	H2
C127	K2	C4	R106	K3	D3	R171	H4	G2
C129	J2	F3	R107	L3	C3	R172	H4	G2
C150	J7	E3	R108	K3	C3	R173	J6	G4
C153	J7	F4	R109	K4	D3	R174	H6	D6
			R110	L4	C2	R175	J6	H5
CR171	H4	G2	R111	K4	C2	R176	H6	G4
CR176	H6	G4	R117	K6	E4	R177	H5	D6
			R118	K5	D4	R181	H5	E6
L108	L3	D3	R119	L5	C4	R182	H4	G4
L111	L4	D2	R121	K5	D4	R191	J1	B5
			R122	L6	C4	R193	J2	B5
P10	H1	C6	R125	J2	C6	R515	K6	A6
P10	H1	G6	R127	J1	C4			
P11	K1	A5	R129	J2	F3	U105	J4	D3
P11	L6	A5	R132	J8	E6			
			R134	J8	C3	W103	J4	G4
Q107	K3	B3	R135	K8	B3	W105	H3	G3
Q110	K4	B2	R136	J8	B3			

P/O A2 ASSY also shown on ◇3



HORIZ & VERT OUTPUTS, TRIGGER & SWEEP (SN B302261 & ABOVE) 2

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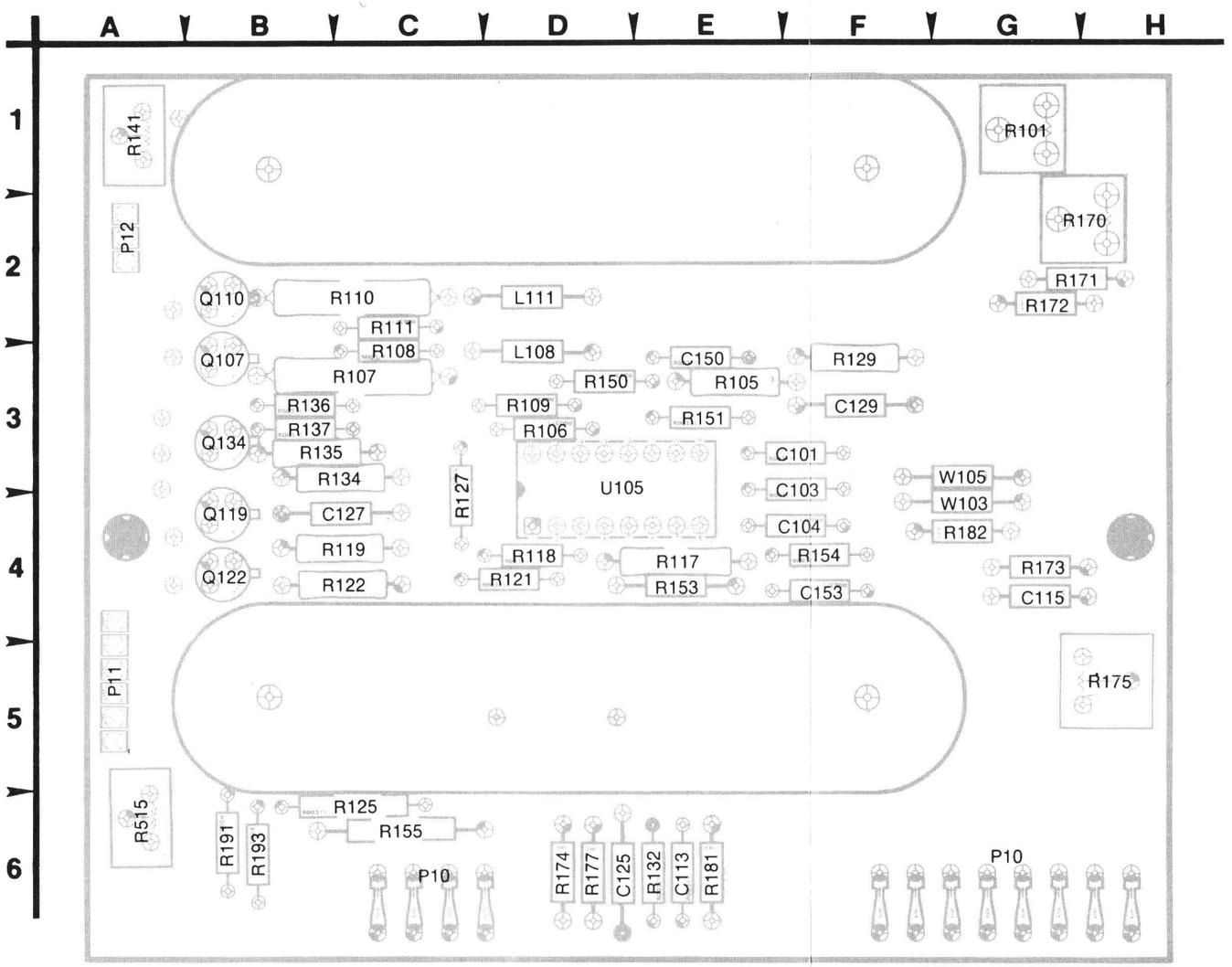


Fig. 8-5B. A2—Amplifier Circuit Board component locations (SN B302260 & below).

A2 AMPLIFIER BOARD
COMPONENT LOCATIONS
(SN B302260 & BELOW)

P/O A1 ASSY — **Horiz & Vert Output, Trigger & Sweep (SN B302260 & Below)** ◇2

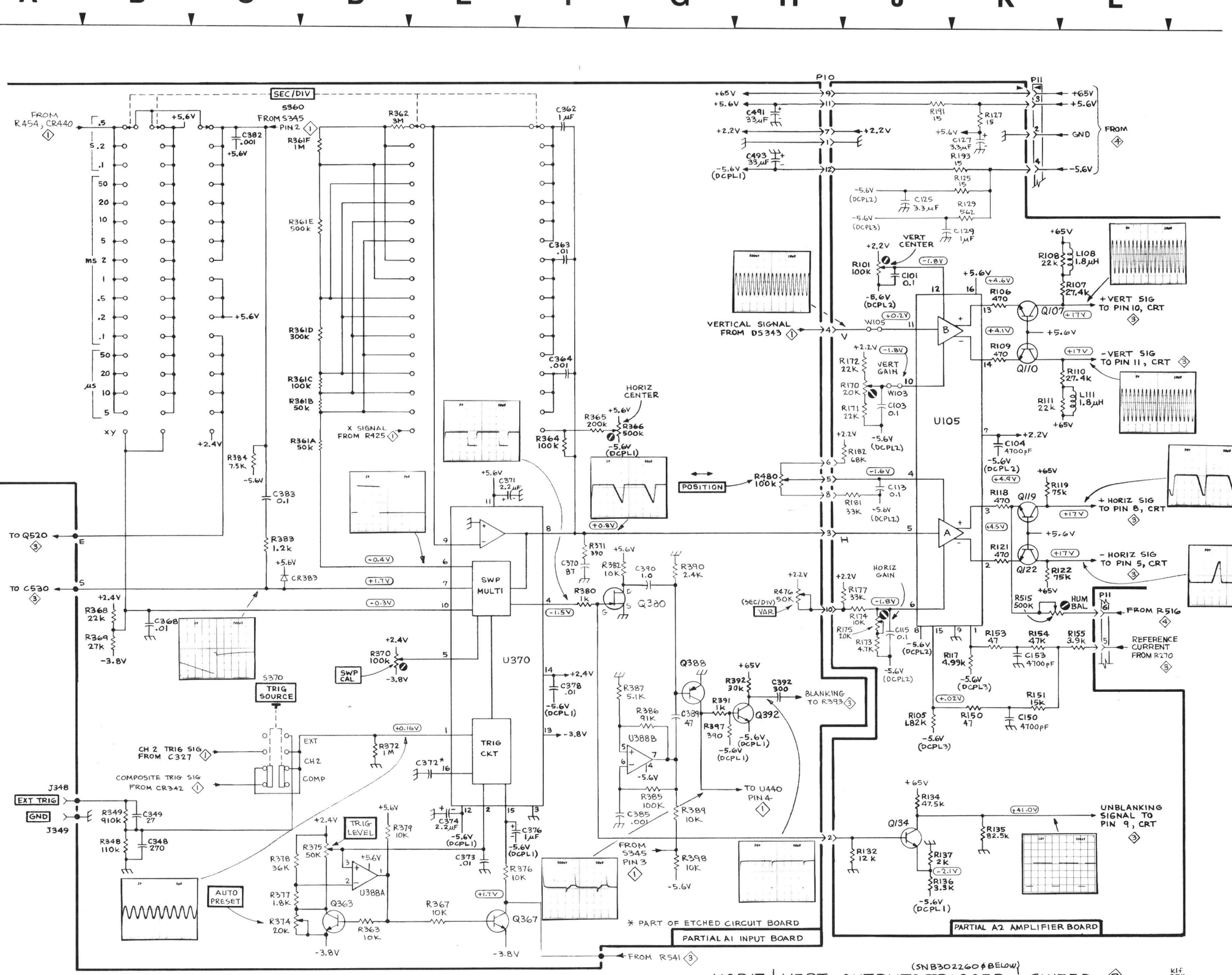
Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C348	B8	H7	P10	H1	K9	R376	F8	K2
C349	B8	L4				R377	C8	J2
C362	F1	L7	Q363	D8	J2	R378	C8	H2
C363	F3	L7	Q367	F8	K2	R379	D8	K4
C364	F4	M7	Q380	G6	K3	R382	F6	K3
C368	B6	L4	Q388	G6	J4	R383	C5	M3
C370	F6	M4	Q392	H7	J4	R384	B4	J2
C371	E5	M3				R385	G8	L4
C372	E7		R348	B8	J7	R386	G7	K6
C373	E8	H1	R349	B8	L4	R387	G7	K6
C374	E8	L3	R361A	D4	L1	R389	G8	H3
C376	F8	L3	R361B	D4	L1	R390	G6	K4
C378	F7	L3	R361C	D4	L1	R391	G7	J3
			R361D	D3	L1	R392	H7	J4
C382	C2	J1	R361E	D2	L1	R397	G7	J4
C383	C5	M3	R361F	D2	L1	R398	G8	H3
C385	G8	L4	R362	D1	L2	R476	H6	K8
C389	G7	J4	R363	D8	J2	R480	H5	K6
C390	G6	K4	R364	F4	M2			
C392	H7	J4	R365	F4	M4	S360	D1	L2
C491	H1	J1	R366	G4	M5	S370	C7	J3
C493	H2	J2	R367	E8	K2			
			R368	B6	L3	U370	F6	L3
CR383	D6	L4	R369	B6	L3	U388A	D8	K4
			R370	D6	J2	U388B	G7	K4
J348	A8	L4	R371	F5	M4			
J349	A8	M4	R372	D8	L3			
			R374	C8	G2			
P10	H1	F9	R375	D8	H8			

P/O A1 ASSY also shown on ◇1 & ◇3

P/O A2 ASSY — **Horiz & Vert Output, Trigger & Sweep (SN B302260 & Below)** ◇2

C101	J3	F3	Q134	J8	B3	R150	K7	D3
C103	J4	F3				R151	K7	E3
C104	K4	F4	R101	J3	G1	R153	K6	E4
C113	J5	E6	R105	J7	E3	R154	K6	F4
C115	J6	G4	R106	K3	D3	R155	L6	C6
C125	J2	D6	R107	L3	C3	R170	J4	H2
C127	K2	C4	R108	K3	C3	R171	J4	G2
C129	K2	F3	R109	K4	D3	R172	J4	G2
C150	K7	E3	R110	L4	C2	R173	J6	G4
C153	K6	F4	R111	K4	C2	R174	J6	D6
			R117	K6	E4	R175	J6	H5
L108	L3	D3	R118	K5	D4	R177	J6	D6
L111	L4	D2	R119	L5	C4	R181	J5	E6
			R121	K5	D4	R182	J4	G4
P10	H1	C6	R122	L6	C4	R191	J1	B5
P10	H1	G6	R125	K2	C6	R193	K2	B5
P11	KI	A5	R127	K1	C4	R515	K6	A6
P11	L6	A5	R129	K2	F3			
			R132	J8	E6	U105	K4	D3
Q107	K3	B3	R134	J8	C3			
Q110	K4	B2	R135	K8	B3	W103	J4	G4
Q119	K5	B4	R136	J8	B3	W105	J3	G3
Q122	K6	B4	R137	J8	B3			

P/O A2 ASSY also shown on ◇3



214 (SN B300000 & ABOVE)

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HORIZ & VERT OUTPUTS, TRIGGER & SWEEP (SN B302260 & BELOW) 2

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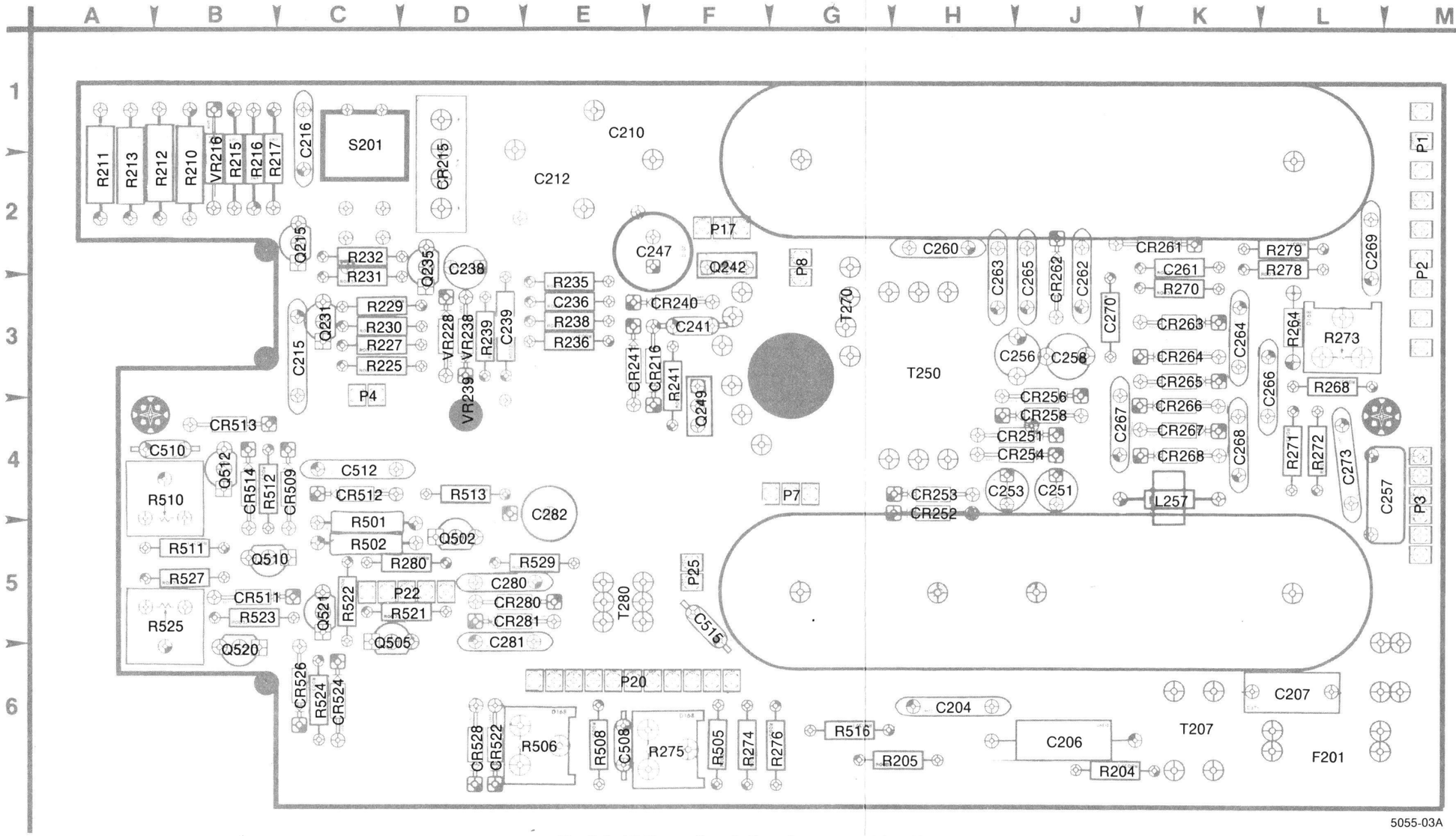


5055-03A

Fig. 8-6. A3-Power Supply Board component locations.

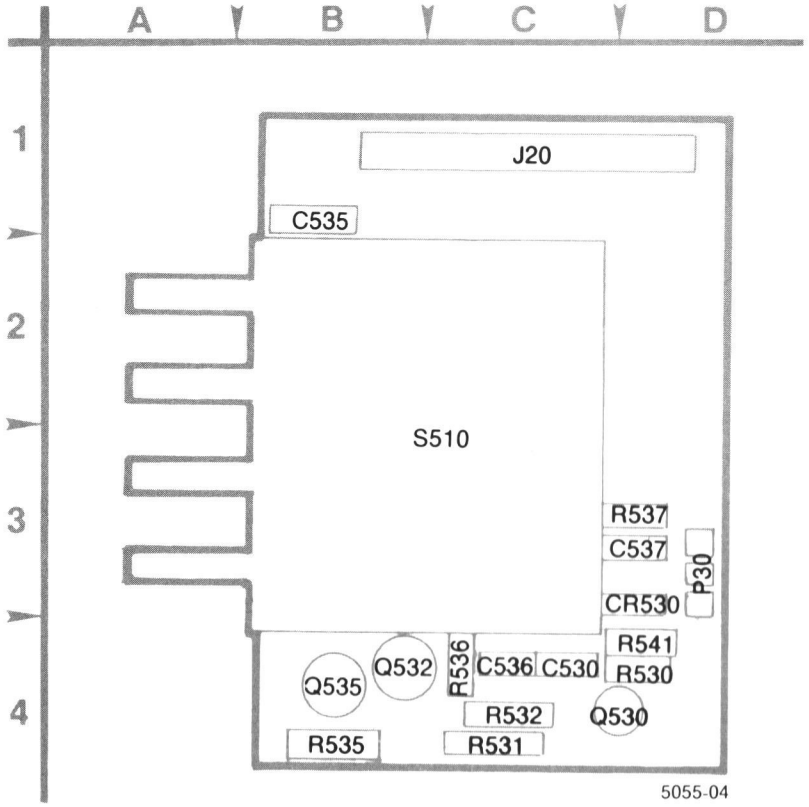


Fig. 8-7. A4-Single Sweep Board component locations.

P/O A1 ASSY — **CRT & Storage Circuit 3**

Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C395	F8	H5	P2	E8	H6	R395	F8	H6
						R396	F6	J4
P2	F6	H6	R393	F8	H4			
P2	F7	H6	R394	F6	J4	S360	F2	L2

P/O A1 ASSY also shown on 1 & 2

P/O A2 ASSY — **CRT & Storage Circuit 3**

P12	K3	A2	R141	L3	A1			

P/O A2 ASSY also shown on 2

P/O A3 ASSY — **CRT & Storage Circuit 3**

C260	B5	H2	CR513	G2	B4	R273	E7	L3
C261	D6	K2	CR514	G2	B4	R274	D6	F6
C262	C6	J2	CR522	E4	D6	R275	D6	F6
C263	B6	H3	CR524	F3	C6	R276	D6	G6
C264	C6	K3	CR526	F3	C6	R278	D8	L2
C265	B6	J3	CR528	F3	D6	R279	D8	L2
C266	C6	L3				R501	H4	C5
C267	B6	J4	P1	H7	M1	R502	H4	C5
C268	C6	K4	P2	E6	M2	R505	G4	F6
C269	E6	L2	P2	E6	M2	R506	G4	E6
C270	E6	J3	P3	E5	M4	R508	G4	E6
C273	F7	L4	P8	H8	G2	R510	G2	B4
C508	G3	E6	P20	E3	E6	R511	G3	B5
C510	G2	B4	P22	H3	D5	R512	G2	B4
C512	G2	C4				R513	F2	D4
			Q502	H5	D5	R521	F3	D5
CR261	C5	K2	Q505	H4	C5	R522	F3	C5
CR262	C6	J3	Q510	H2	B5	R523	G4	B5
CR263	C6	K3	Q512	G2	B4	R524	E4	C6
CR264	C6	K3	Q520	G3	B6	R525	G4	B5
CR265	C6	K3	Q521	F4	C5	R527	G4	B5
CR266	C6	K4				R529	E4	E5
CR267	C6	K4	R264	D6	L3			
CR268	C7	K4	R268	D6	L3	T270	D8	G3
CR509	H3	C4	R270	D6	K3			
CR511	G3	B5	R271	D7	L4			
CR512	G1	C4	R272	C7	L4			

P/O A3 ASSY also shown on 4

P/O A4 ASSY — **CRT & Storage Circuit 3**

C530	B3	C4	P30	F3	D3	R536	C2	C4
C535	D3	B1				R537	D2	D3
C536	C3	C4	Q530	C3	D4	R541	B2	D4
C537	D3	D3	Q532	C3	B4			
			Q535	C3	B4	S510A	E1	C3
CR530	B3	D3				S510B	D1	C3
			R530	B3	D4	S510C	C1	C3
J20	E3	C1	R531	C3	C4	S510D	C1	C3
			R532	C2	C4			
P30	B3	D3	R535	C4	B4			

P/O A4 ASSY also shown on 4

CHASSIS MOUNTED PARTS — **CRT & Storage Circuit 3**

DS535	C4	CHASSIS	P35	D4	CHASSIS	V300	J3	CHASSIS
L300	J3	CHASSIS						

A4 - SINGLE SWEEP BOARD

PARTIAL A1 INPUT BOARD

PARTIAL A2 AMPLIFIER BOARD

PARTIAL A3 - POWER SUPPLY BOARD

P/O A3 ASSY

Power Supply 4

Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location	Circuit Number	Schematic Location	Board Location
C204	B6	J6	CR254	J5	J4	R212	C2	B2
C206	B5	J6	CR256	J3	J3	R213	C3	A2
C207	B5	L6	CR258	J3	J4	R215	D2	B2
C210	B4	E1	CR280	J6	D5	R216	D3	B2
C212	B2	E2	CR281	J6	D5	R217	D3	B2
C215	D5	C3				R225	E4	C3
C216	C4	C1	F201	C6	L6	R227	F4	C3
C236	G3	E3				R229	F3	C3
C238	C2	D2	L257	K3	K4	R230	F3	C3
C239	G2	D3				R231	F2	C2
C241	H3	F3	P2	L3	M2	R232	F3	C2
C247	H3	F2	P3	L7	M4	R235	G3	E3
C251	K5	J4	P4	E3	C3	R236	G4	E3
C253	K5	H4	P7	D2	G4	R238	G2	E3
C256	K3	J3	P17	D3	F2	R239	F2	D3
C257	K3	M4	P25	L7	F5	R241	H4	F3
C258	K3	J3				R280	K6	D5
C280	J6	D5	Q215	D3	C2	R516	K8	G6
C281	K6	D5	Q231	G3	C3			
C282	L6	E4	Q235	G3	D2	S201	B1	C1
C515	J7	F5	Q242	H3	F2			
			Q249	H5	F4	T207	A5	K6
CR215	C5	D2				T250	J1	H3
CR216	D2	F3	R204	B6	J6	T280	J6	E5
CR240	H2	F3	R205	B6	H6			
CR241	H5	E3	R208	B4	J6	VR216	D2	B2
CR251	J4	J4	R209	B4	J6	VR228	E3	D3
CR252	J5	H4	R210	B3	B2	VR238	F3	D3
CR253	J5	H4	R211	B3	A2	VR239*	F2	D4

P/O A3 ASSY also shown on 3

P/O A4 ASSY

Power Supply 4

S510B	H6	C3						

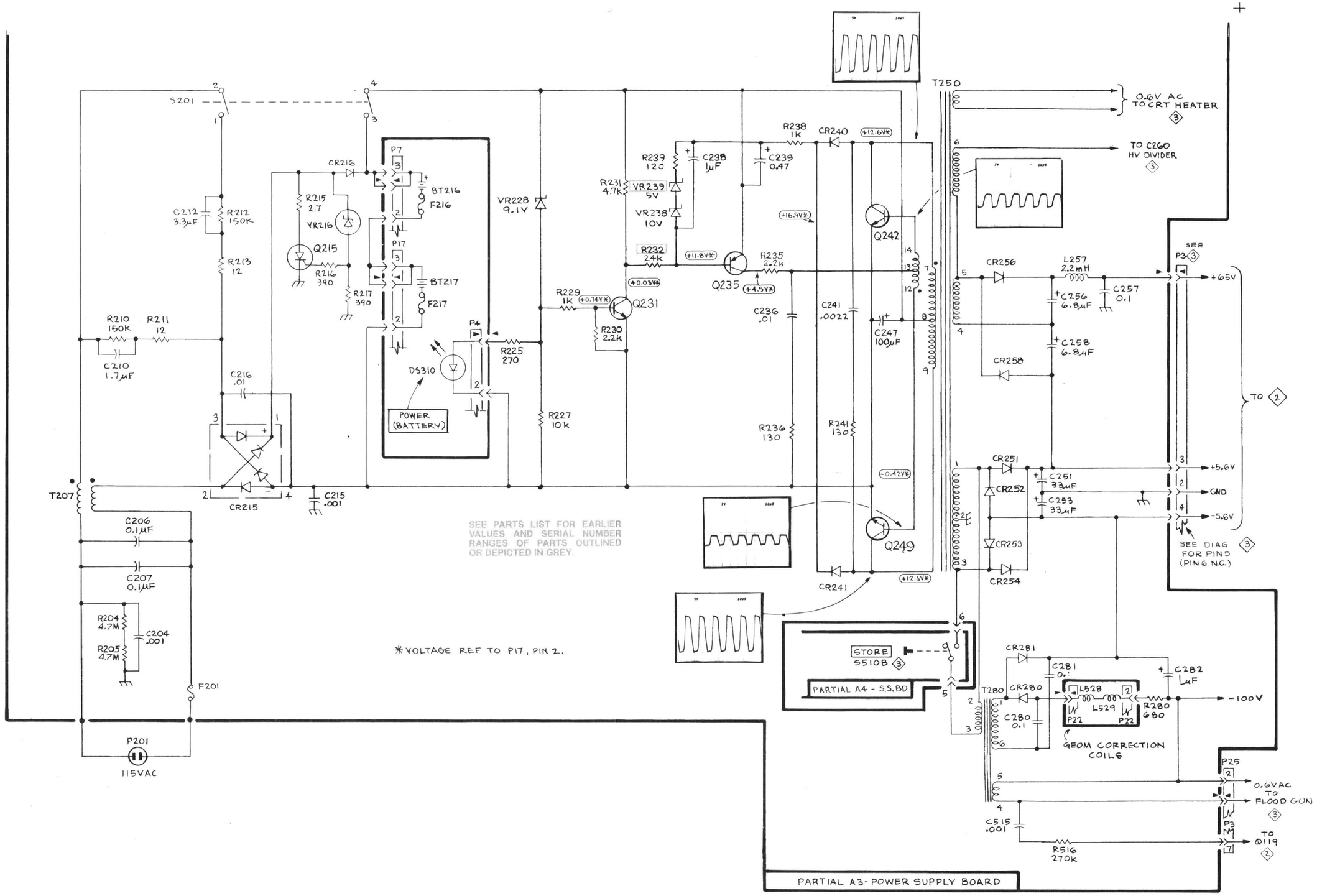
P/O A4 ASSY also shown on 3

CHASSIS MOUNTED PARTS

Power Supply 4

BT216	E2	CHASSIS	L528	K6	CHASSIS	P7	D2	CHASSIS
BT217	E3	CHASSIS	L529	K6	CHASSIS	P17	D3	CHASSIS
						P201	B7	CHASSIS
DS310	D4	CHASSIS						

***See Parts List for serial number ranges.**


S201
R210 150K
R211 12
C210 1.7µF
R212 150K
C212 3.3µF
R213 12
C216 .01
CR215
C215 .001
T207
C206 0.1µF
C207 0.1µF
R204 4.7M
R205 4.7M
C204 .001
F201
P201
115VAC
CR216
R215 2.7
VR216
Q215
R216 390
R217 390
P7
P17
BT216
F216
BT217
F217
P4
DS310
POWER (BATTERY)
R225 270
R227 10k
VR228 9.1V
R229 1K
Q231
R230 2.2k
R231 4.7k
VR239 5V
VR238 10V
R239 120
C238 1µF
C239 0.47
R232 2.4k
R238 1K
CR240
Q235
R235 2.2k
C236 .01
C241 .0022
C247 100µF
Q242
R236 130
R241 130
Q249
CR241
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
*VOLTAGE REF TO P17, PIN 2.
STORE
S510B
PARTIAL A4 - S.S.BD
T250
0.6V AC TO CRT HEATER
TO C260 HV DIVIDER
CR256
L257 2.2mH
C256 6.8µF
C257 0.1
C258 6.8µF
CR258
SEE P3
+65V
TO
CR251
CR252
CR253
CR254
C251 33µF
C253 33µF
+5.6V
GND
-5.6V
SEE DIAG FOR PIN5 (PIN6 N.C.)
CR281
C281 0.1
C282 1µF
T280
CR280
L528
L529
R280 680
-100V
C280 0.1
GEOM CORRECTION COILS
P25
0.6VAC TO FLOOD GUN
C515 .001
R516 270k
P3
TO Q119
PARTIAL A3- POWER SUPPLY BOARD

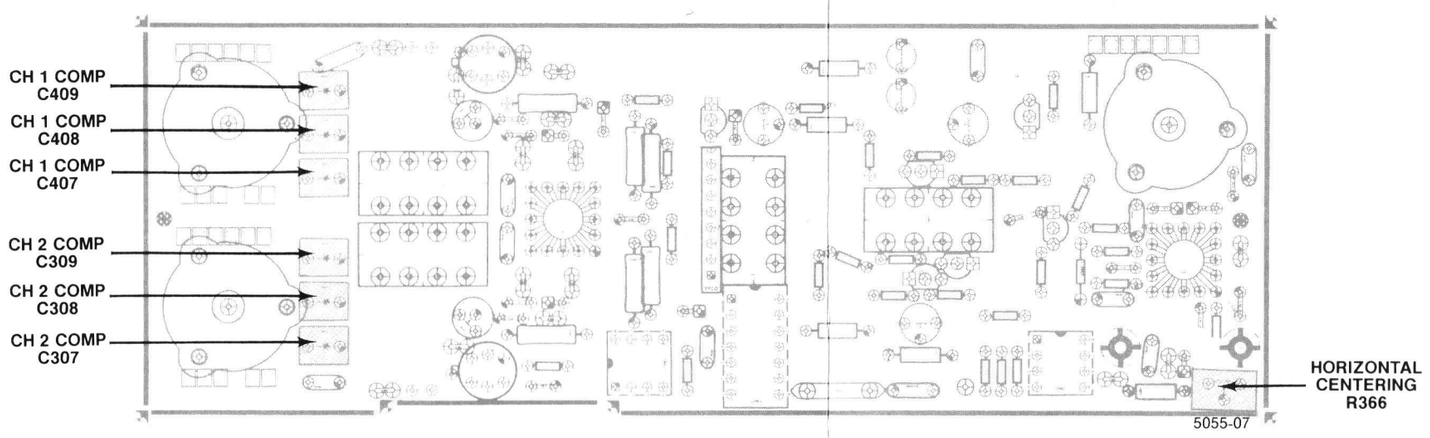


Fig. 8-8. A1-Input Board

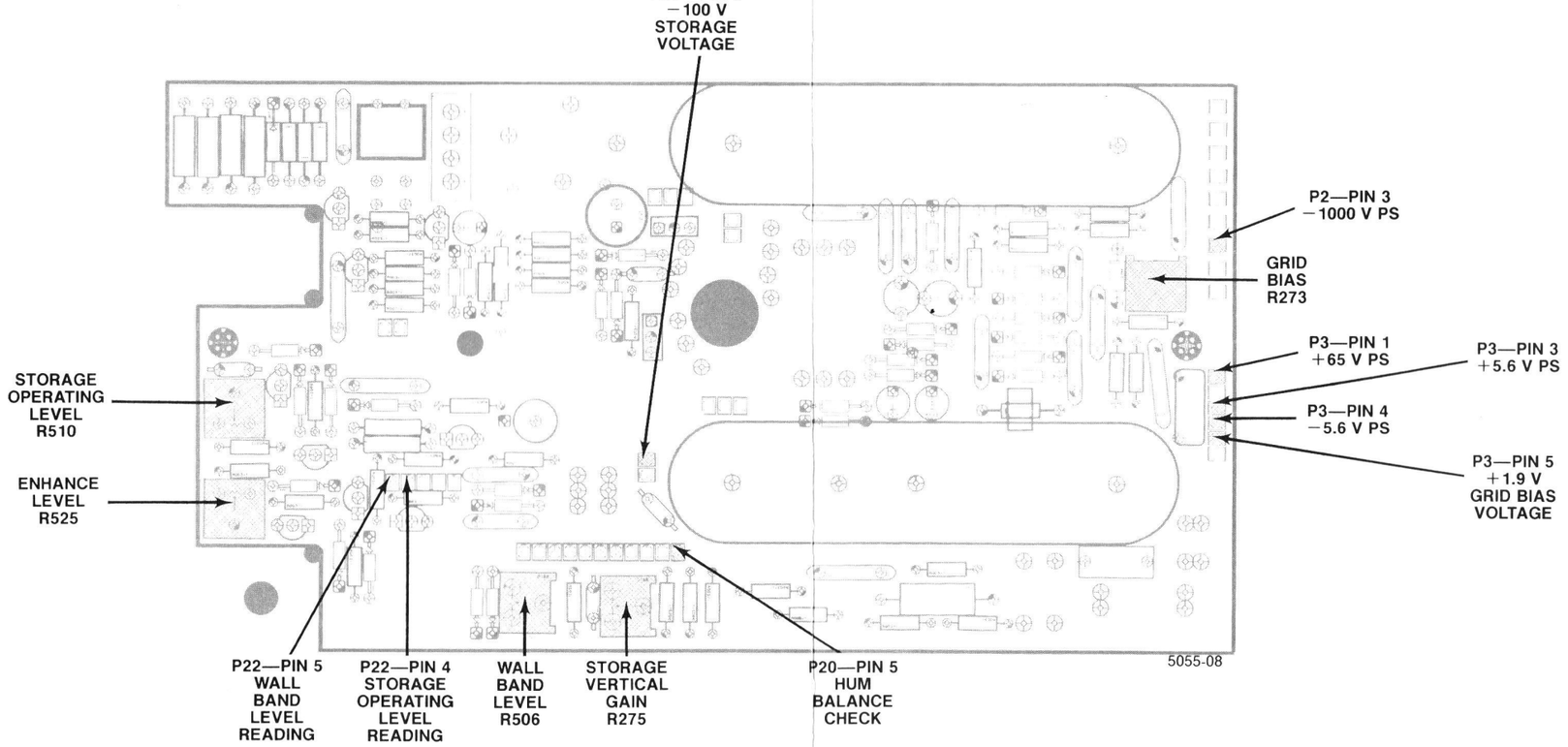


Fig. 8-9. A3-Power Supply Board

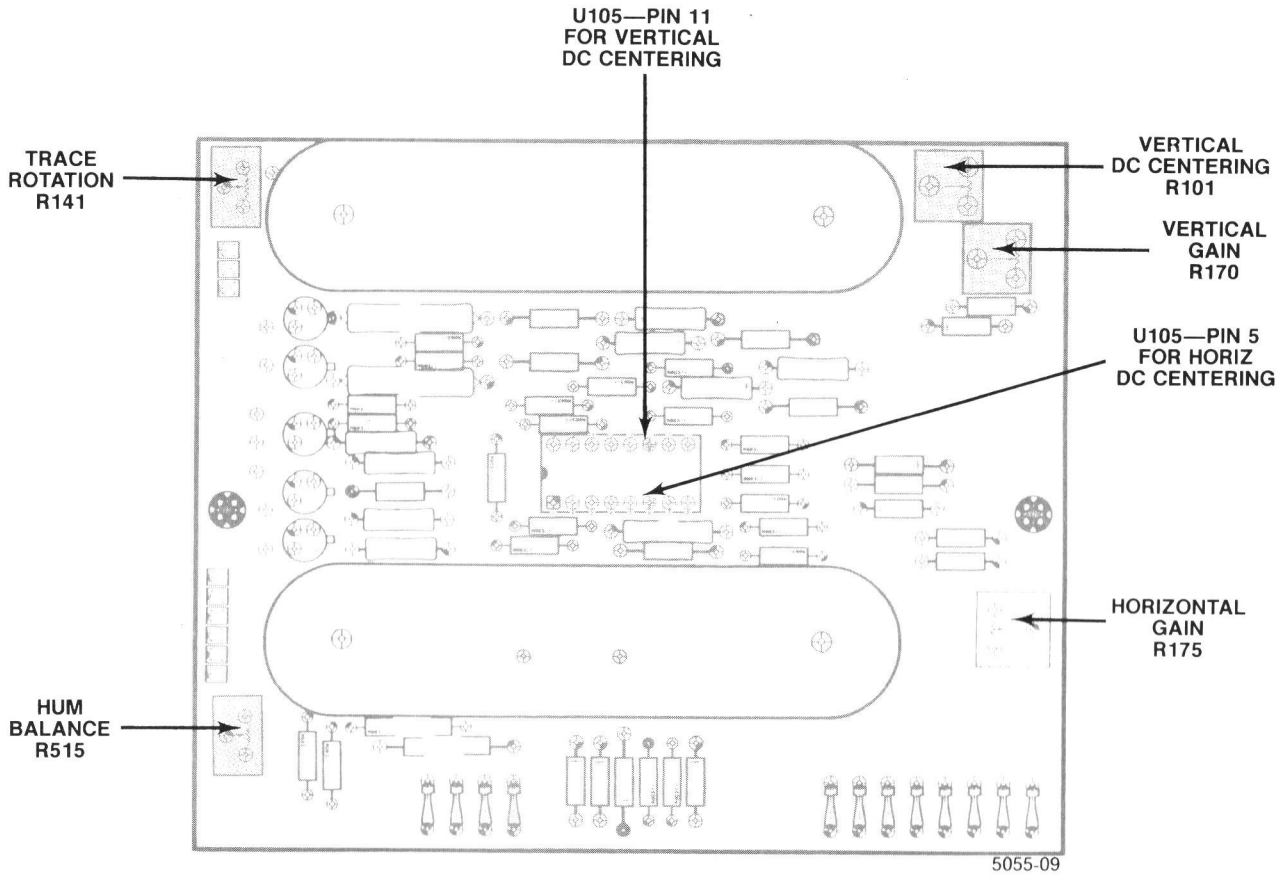


Fig. 8-10. A2-Amplifier Board

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

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.

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 Name & Description

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

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

Attaching parts must be purchased separately, unless otherwise specified.

ABBREVIATIONS

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
02768	ILLINOIS TOOL WORKS INC FASTEX DIVISION	195 ALGONQUIN ROAD	DES PLAINES IL 60016-6103
06950	SCREWCORP VSI AEROSPACE PRODUCTS DIV SUB OF FAIRCHILD INDUSTRIES INC	13001 E TEMPLE AVE PO BOX 730	CITY OF INDUSTRY CA 91746-1417
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
08530	RELIANCE MICA CORP	341-39TH ST	BROOKLYN NY 11212-2903
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
18121	WILSHIRE FOAM PRODUCTS INC	1240 E 230TH ST	CARSON CA 90745-5010
19209	GATES ENERGY PRODUCTS INC	441 HWY N PO BOX 861	GAINESVILLE FL 32602
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
23050	PRODUCT COMPONENTS CORP	30 LORRAINE AVE	MT VERNON NY 10553-1222
23740	AMUNEAL MFG CORP	4737 DARRAH	PHILADELPHIA PA 19124-2705
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
77900	ILLINOIS TOOL WORKS SHAKEPROOF DIV	ST CHARLES RD	ELGIN IL 60120
79727	C-W INDUSTRIES	130 JAMES WAY	SOUTHAMPTON PA 18966-3818
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
91260	CONNOR SPRING AND MFG CO A SLOSS AND BRITTAN INC CO	1729 JUNCTION AVE	SAN JOSE CA 95112
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
TK0174	BADGLEY MFG CO	1620 NE ARGYLE	PORTLAND OR 97211
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK1319	MORELLIS Q & D PLASTICS	1812 16-TH AVE	FOREST GROVE OR 97116
TK2165	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999
TK2278	COMTEK MANUFACTURING OF OREGON (METALS)	PO BOX 4200	BEAVERTON OR 97076-4200

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	366-1468-01			1	KNOB:GY,VOLTS/DIV,0.159 ID X 0.812 OD X 0.45H	80009	366-1468-01
-2	366-1469-01			1	KNOB:SIL GY,VOLTS/DIV,0.159 ID X 0.812 OD X 0.45 H	80009	366-1469-01
-3	366-1322-05			1	KNOB:GY,POS,0.127 ID X 0.384 OD X 0.375 H	TK2165	ORDER BY DESCR
-4	366-1466-02			1	KNOB:SIL GY,POS,0.127 ID X 0.384 OD X 0.375 H	80009	366-1466-02
-5	366-1322-02			1	KNOB:GY,VAR,0.127 ID X 0.384 OD X 0.375 H	TK2165	ORDER BY DESCR
-6	366-1466-01			1	KNOB:SIL GY,VAR,0.127 ID X 0.384 OD X 0.375	80009	366-1466-01
-7	366-1467-03			1	KNOB:CHARCOAL,TRIG,0.127 ID X 0.384 OD X 0.375 H	80009	366-1467-03
-8	366-1467-02			1	KNOB:CHARCOAL,INT,0.127 ID X 0.384 OD X 0.375 H	80009	366-1467-02
-9	366-1467-01			1	KNOB:CHARCOAL,VAR,0.127 ID X 0.384 OD X 0.375 H	80009	366-1467-01
-10	366-1467-04			1	KNOB:CHARCOAL,POS,0.127 ID X 0.384 OD	80009	366-1467-04
-11	366-1470-01			1	KNOB:CHARCOAL,SEC/DIV,0.159 ID X 0.812 OD	80009	366-1470-01
-12	348-0285-00			1	FLIP-STAND,CAB.:1.95 H,POLYCARBONATE	80009	348-0285-00
					ATTACHING PARTS		
-13	211-0213-00			1	SCREW,MACHINE:4-40 X 0.312,PNH,NYL	23050	ORDER BY DESCR
-14	211-0170-00			2	SCREW,MACHINE:4-40 X 2.25,PNH,SST	93907	ORDER BY DESCR
-15	355-0181-00			2	STUD,CRYG HDL:	TK2278	ORDER BY DESCR
-16	211-0019-00			2	SCREW,MACHINE:4-40 X 1.0,PNH,STL	93907	ORDER BY DESCR
					END ATTACHING PARTS		
-17	437-0147-02			1	CABINET,SCOPE:	80009	437-0147-02
	337-1703-00			1	.SHIELD,ELEC:UPPER	TK2278	ORDER BY DESCR
	337-1704-00			1	.SHIELD,ELEC:LOWER	TK2278	ORDER BY DESCR
-18	214-1850-00			4	.PIN,ALIGNMENT:CIRCUIT BOARD	80009	214-1850-00
-19	348-0254-01			4	.FOOT,CABINET:BLACK RUBBER	80009	348-0254-01
-20	334-1859-00			1	MARKER,IDENT:MKD DANGER,VOLTAGE	80009	334-1859-00
-21	386-1999-00			1	SUPPORT,CRT:FRONT	80009	386-1999-00
	331-0445-00			1	MASK,CRT SCALE:	80009	331-0445-00
-22	378-0691-00			1	FILTER,LT,CRT:BLUE,2.53 X 1.73 X 0.03	80009	378-0691-00
-23	354-0423-00			1	RING,CRT SPRT:BLACK VINYL	TK1319	N/A
-24	253-0153-00			AR	TAPE,PRESS SENS:FOAM,0.25 X 0.125	18121	ORDER BY DESCR
-25	337-1458-00			1	SHIELD,CRT:	23740	337-1458-00-D
-26	386-2185-00			1	SPRT,CRT SHIELD:REAR	80009	386-2185-00
-27	200-1400-00			1	COVER,ELEC CONN:POWER CORD	TK2165	ORDER BY DESCR
-28	214-1805-00			1	SPOOL,CORD WRAP:REAR	80009	214-1805-00
-29	200-1469-00			2	COVER,CORD WRAP:UPPER & LOWER	80009	200-1469-00
-30	200-1470-00			1	COVER,CORD WRAP:PROBE,TOP	80009	200-1470-00
-31	200-1467-00			1	COVER,CORD WRAP:PROBE,LOWER	80009	200-1467-00
-32	136-0549-00			1	.SKT,PL-IN ELEK:ELCTRN TUBE,11 CONT W/LEADS	80009	136-0549-00
	136-0453-00			1	..SKT,PL-IN ELEK:ELECTRON TUBE,11 CONTACT	80009	136-0453-00
-33	----- -----			1	CKT BOARD ASSY:AMPLIFIER(SEE A2 REPL)		
-34	342-0113-00			1	.INSULATOR,PLATE:CIRCUIT BOARD,MYLAR	TK2278	ORDER BY DESCR
-35	131-1172-00			1	.CONTACT,ELEC:CKT BD GND,PH BRZ,CU-SN-ZN PL	80009	131-1172-00
-36	131-0608-00			9	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-37	136-0328-03			12	.SOCKET,PIN TERM:U/W 0.025 SQ PINS	22526	47710
	136-0328-02			12	.SOCKET,PIN TERM:U/W 0.025 SQ PINS	00779	102081-1
-38	352-0169-00			1	..HLDR,TERM CONN:2 WIRE,BLACK	80009	352-0169-00
-39	352-0199-00			1	..HLDR,TERM CONN:3 WIRE,BLACK	80009	352-0199-00
-40	131-0707-00			7	..CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL	22526	47439-000
-41	131-0621-00			3	..CONN,TERM:22-26 AWG,BRS,CU BE GLD PL	22526	46231-000
	131-1109-00			7	..CONNECTOR,TERM:20-26 AWG,U/O 0.04 OD PIN	00779	42869-6
	131-1109-02			4	..CONNECTOR,TERM:20-26 AWG,U/O 0.04 OD PIN	00779	P73-7444
-42	253-0154-00			4	.TAPE,PRESS SENS:FOAM,0.25 X 0.125,0.25 DIA .DOTS,ADH BOTH SIDES	18121	MT8
	----- -----			2	BATTERY ASSY:(SEE BT216/BR217 REPL)		
-43	200-1238-03	B300000	B301322	4	.COVER,BAT SET:	80009	200-1238-03
-44	146-0026-00	B300000	B301322	2	.BATTERY,STORAGE:6V,0.66AH @ 66MA,(5)A CELL, .NICAD	19209	41B906FD02-G1
	198-3183-00	B300000	B301322	2	.WIRE SET,ELEC:	80009	198-3183-00
-45	352-0161-00	B300000	B301322	1	..HLDR,TERM CONN:3 WIRE,BLACK	80009	352-0161-00
-46	131-0707-00	B300000	B301322	3	..CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL	22526	47439-000
	253-0153-00	B300000	B301322	AR	.TAPE,PRESS SENS:FOAM,0.25 X 0.125	18121	ORDER BY DESCR
-47	----- -----			1	CKT BOARD ASSY:POWER SUPPLY(SEE A3 REPL)		
	214-3012-00			2	.FSTNR,SNAP-IN:0.437 L X 0.3 DIA,ROUND HD	02768	254-090601-01

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-48	----- -----			1	.SWITCH,SLIDE:DPST(SEE A3S201 REPL)		
-49	136-0252-07			24	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-50	131-0589-00			47	.TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
-51	348-0089-00			1	.BUMPER,PLASTIC:0.312 DIA X 0.855 L,BLACK	80009	348-0089-00
-52	253-0154-00			4	.TAPE,PRESS SENS:FOAM,0.25 X 0.125,0.25 DIA .DOTS,ADH BOTH SIDES	18121	MT8
-53	342-0176-02			1	.INSULATOR,FILM:POWER SUPPLY BOARD	TK2278	ORDER BY DESCR
-54	131-1172-00			1	.CONTACT,ELEC:CKT BD GND,PH BRZ,CU-SN-ZN PL	80009	131-1172-00
-55	344-0255-00			2	.CLIP,ELECTRICAL:FUSE,CKT BD MT,CU BE	80009	344-0255-00
-56	334-1926-00			2	.MARKER,IDENT:MKD DANGER	07416	ORDER BY DESCR
-57	161-0078-01			1	.CABLE ASSY,PWR,:2,18AWG,125V,50.0 L W/FERRU .LE	80009	161-0078-01
-58	384-1198-00			4	EXTENSION SHAFT:STORAGE SWITCH	80009	384-1198-00
-59	----- -----			1	CKT BOARD ASSY:SINGLE SWEEP(SEE A4 REPL)		
					ATTACHING PARTS		
-60	211-0125-00			2	SCREW,MACHINE:1-72 X 0.25,PNH,STL	93907	ORDER BY DESCR
					END ATTACHING PARTS		
					CKT BOARD ASSY INCLUDES:		
-61	366-1493-00			1	.ACTR ASSY,PB:4 BUTTON,0.3 SPACING	80009	366-1493-00
-62	131-0589-00			2	.TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
-63	136-0252-04			12	.SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-64	131-0608-00			3	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-65	136-0328-02			11	.SOCKET,PIN TERM:U/W 0.025 SQ PINS	00779	102081-1
	131-0722-00			6	.CONTACT,ELEC:CAM SW,CU BE	80009	131-0722-00
-66	342-0095-00			1	INSULATOR,FILM:SHIELD,POLYESTER	80009	342-0095-00
-67	337-1795-01			1	SHIELD,ELEC:STORAGE SWITCH	TK2278	ORDER BY DESCR
					ATTACHING PARTS		
-68	211-0062-00			1	SCREW,MACHINE:2-56 X 0.312,PNH,STL	06950	ORDER BY DESCR
-69	210-0405-00			1	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
-70	210-0001-00			1	WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
-71	361-0549-00			1	SPACER,SLEEVE:0.105 L X 0.093 ID,AL	TK2278	ORDER BY DESCR
					END ATTACHING PARTS		
-72	407-1285-00			1	BRACKET,ELEC SW:ALUMINUM	TK2278	ORDER BY DESCR
					ATTACHING PARTS		
-73	211-0019-00			1	SCREW,MACHINE:4-40 X 1.0,PNH,STL	93907	ORDER BY DESCR
					END ATTACHING PARTS		
-74	----- -----			1	CKT BOARD ASSY:INPUT(SEE A1 REPL)		
					ATTACHING PARTS		
-75	211-0008-00			3	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					END ATTACHING PARTS		
					CKT BOARD ASSY INCLUDES:		
-76	136-0252-04			60	.SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-77	136-0269-02			1	.SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP	09922	DILB14P-108T
-78	131-0787-00			12	.TERMINAL,PIN:0.64 L X 0.025 SQ PH BRZ	22526	47359-000
-79	343-0213-00			1	.CLAMP,CABLE:0.2 ID,PLASTIC	80009	343-0213-00
-80	337-1734-00			1	.SHIELD,ELEC:REAR ATTEN COVER	TK2278	ORDER BY DESCR
	337-3226-00			1	.SHIELD,ELEC:BRASS	80009	337-3226-00
-81	337-1735-00			1	.SHIELD,ELEC:FRONT ATTEN COVER	TK2278	ORDER BY DESCR
					ATTACHING PARTS		
-82	211-0091-00			1	.SCREW,MACHINE:2-56 X 0.875,OVH,SST	TK0435	ORDER BY DESCR
-83	210-0405-00			1	.NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
-84	210-0001-00			1	.WASHER,LOCK:#2 INTL,0.013 THK,STL	77900	1202-00-00-0541C
					END ATTACHING PARTS		
-85	337-1767-00			1	.SHIELD,ELEC:ATTEN CKT BD,REAR CTR	80009	337-1767-00
-86	337-1768-00			1	.SHIELD,ELEC:ATTEN CKT BD,FRONT CTR	80009	337-1768-00
-87	337-1766-00			1	.SHIELD,ELEC:ATTEN CKT BD,PERIPHERAL	80009	337-1766-00
-88	380-0244-00			3	.HOUSING,SWITCH:POLYCARBONATE	80009	380-0244-00
-89	401-0127-01	B300000	B303487	2	.ROTOR,ELEC SW:W/CONTACTS	80009	401-0127-01
	401-0127-04	B303488		2	.ROTOR,ELEC SW:W/CONTACT	80009	401-0127-04
-90	401-0127-02	B300000	B303433	1	.ROTOR,ELEC SW:W/CONTACTS	80009	401-0127-02
	401-0127-05	B303434		1	.ROTOR CONT ASSY:W/GOLD PLATED 3 FINGER CONT	80009	401-0127-05
-91	214-1576-01	B300000	B303487	1	.DTT-CONT ASSY:20 DEG,17 POSITION	80009	214-1576-01
	214-1576-02	B303488		1	.DETENT CONT AS:W/GOLD PLATED 3 FINGER CONT	80009	214-1576-02
-92	214-1577-01	B300000	B303487	2	.DETENT-CONT AS:20 DEG,15 POSITION	80009	214-1577-01
	214-1577-02	B303488		2	.DETENT CONT AS:W/GOLD PLATED 2 FINGER CONT	80009	214-1577-02
-93	214-1579-00			3	.SPRING,DETENT:0.59 ID X 0.08 W X 0.01 THK C .U BE	91260	ORDER BY DESCR
-94	214-1127-00			3	.ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00

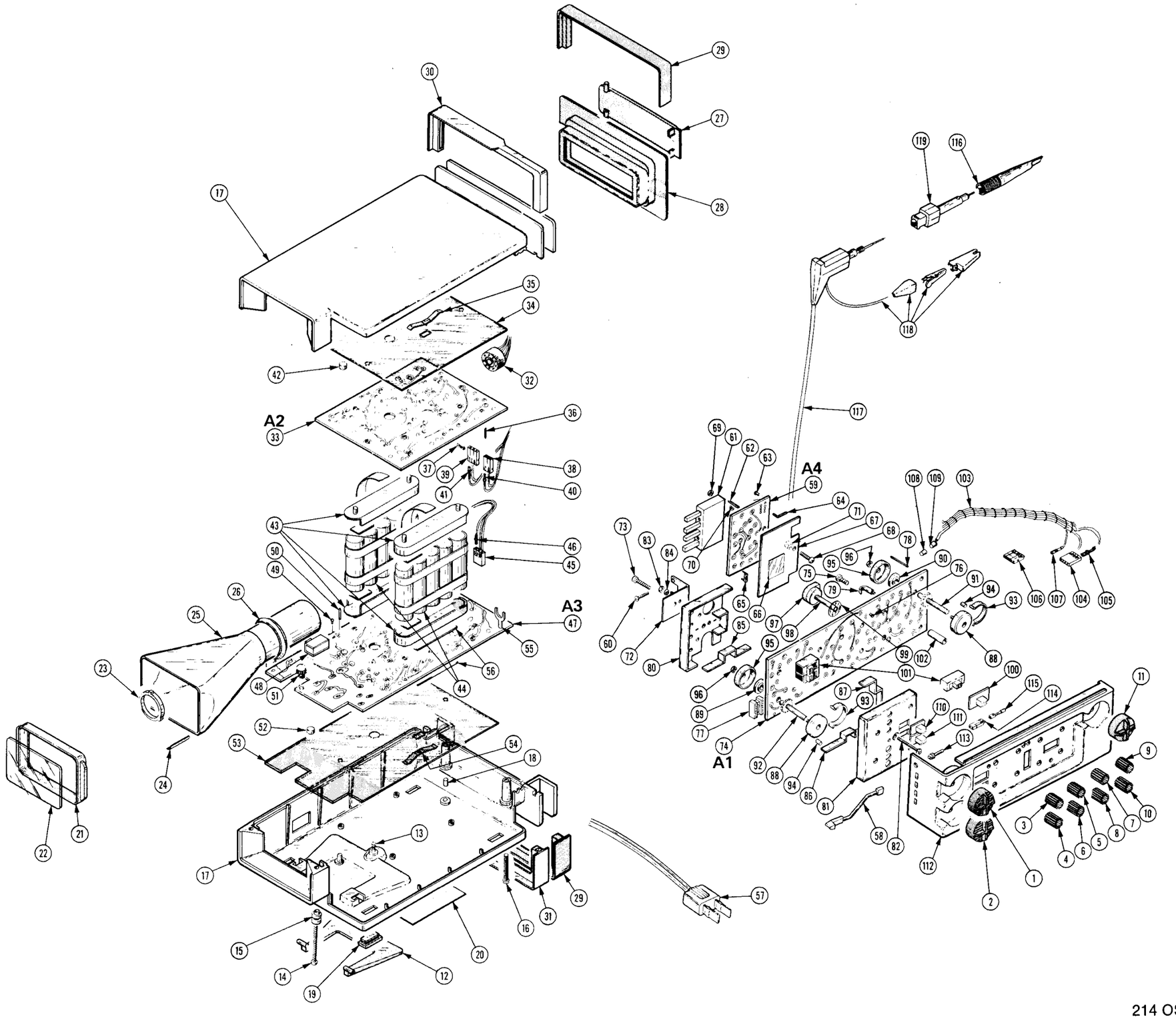

A1
A2
A3
A4

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
2-						STANDARD ACCESSORIES		
-1	016-0199-01			1		VISOR,CRT:	TK2165	ORDER BY DESCR
-2	016-0512-00			1		CASE,CARRYING:	TK0174	016-0512-00
-3	346-0104-00			1		STRAP,CARRYING:	80009	346-0104-00
	070-5054-00			1		MANUAL,TECH:OPERATORS,214	80009	070-5054-00
	070-5055-00			1		MANUAL,TECH:SERVICE,214	80009	070-5055-00

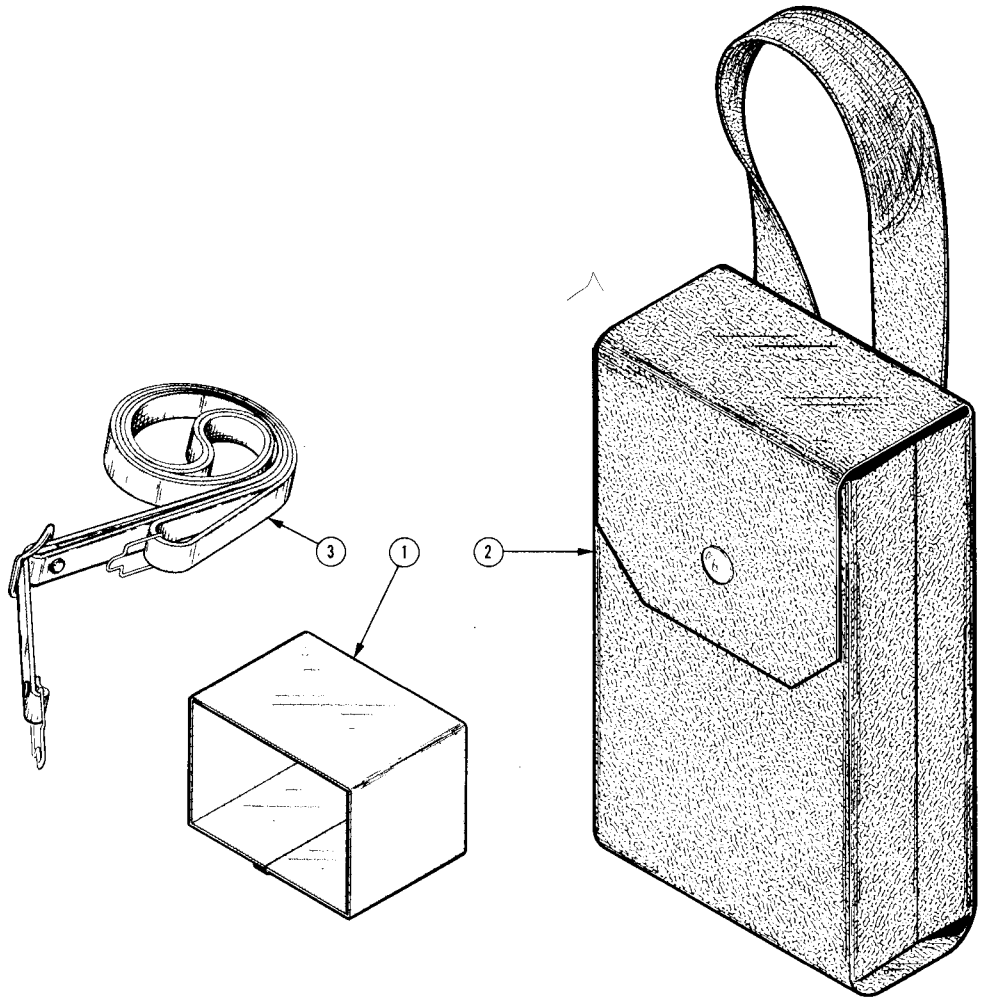


Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
2-						STANDARD ACCESSORIES		
-1	016-0199-01			1		VISOR,CRT:	80009	016-0199-01
-2	016-0512-00			1		CASE,CARRYING:	TK0174	016-0512-00
-3	346-0104-00			1		STRAP,CARRYING:	80009	346-0104-00
	070-5054-00			1		MANUAL,TECH:OPERATORS,214	80009	070-5054-00
	070-5055-00			1		MANUAL,TECH:SERVICE,214	80009	070-5055-00