

TECHNICAL MANUAL
OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT,
AND GENERAL SUPPORT
MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS)

FOR

OSCILLOSCOPE, TEKTRONIX, MODEL 212
NSN 6625-01-061-5519

MULTIPLE LAUNCH ROCKET SYSTEM

DEPARTMENT OF THE ARMY

JUNE 1984

WARNING**DANGEROUS VOLTAGE**

is used in the operation of this equipment

DEATH ON CONTACT

may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

WARNING

Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

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

For Artificial Respiration, refer to FM 21-11.

EXTREMELY DANGEROUS POTENTIALS
greater than 500 volts exist in the following units:

1. CRT Power Supply
2. Horizontal Deflection System
3. Vertical Deflection System

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Technical Manual
 No. 9-6625-646-14&P

HEADQUARTERS
 DEPARTMENT OF THE ARMY
 Washington, D.C., 8 June 1984

**Operator's, Organizational, Direct Support, and
 General Support Maintenance Manual
 (Including Repair Parts)
 for
 OSCILLOSCOPE, TEKTRONIX, MODEL 212
 (NSN 6625-01-061-5519)
 MULTIPLE LAUNCH ROCKET SYSTEM**

REPORTING OF ERRORS

You can help improve this bulletin by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 2028, Recommended Changes to Publications, should be mailed directly to Commander, U.S. Army Missile Command, ATTN: DRSMI-SNPM, Redstone Arsenal, AL 35898. A reply will be furnished to you.

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This manual is, in part, authenticated manufacturer's commercial literature. A Maintenance Allocation Chart and Recommended Spare Parts List has been added to supplement the commercial literature. The format of this manual has not been structured to consider levels of maintenance.

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SECTION 0 GENERAL INFORMATION

O-1. Scope. This manual contains instructions for the operator, organizational, direct support, and general support maintenance of and calibration procedures for Tektronix Oscilloscope, Model 212. Throughout this manual, Tektronix Oscilloscope, Model 212 is referred to as the 212.

O-2. Indexes of Publications. *a. DA Pam 310-4.* Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to Tektronix Oscilloscope, Model 212.

b. DA Pam 310-7. Refer to the latest issue of DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to Tektronix Oscilloscope, Model 212.

O-3. Forms, Records, and Reports. Department of Army forms and procedures used for equipment maintenance and calibration are those prescribed by TM 38-750, The Army Maintenance Management System. Accidents involving injury to personnel or damage to materiel will be reported on DA Form 285, Accident Report, in accordance with AR 385-40.

O-4. Reporting Equipment Improvement Recommendations (EIR). If your 212 needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, U.S. Army Missile Command, ATTN: DRSMI-SNEM, Redstone Arsenal, AL 35898. We'll send you a reply.

O-5. Administrative Storage. To prepare the Tektronix Oscilloscope, Model 212 for placement into and removal from administrative storage, refer to Section 3, Chapter 4, AR 750-25-1, Maintenance of Equipment and Supplies. Temporary storage should be accomplished in accordance with TB 750-25-1, Section 2, Maintenance of Supplies and Equipment.

O-6. Destruction of Army Electronics Materiel. Destruction of Tektronix Oscilloscope, Model 212 to prevent enemy use shall be in accordance with TM 43-0002-26, Organizational Maintenance Manual, Destruction of Equipment to Prevent Enemy Use for Launcher, Rocket, Armored Vehicle Mounted: XM270, Multiple Launch Rocket System.

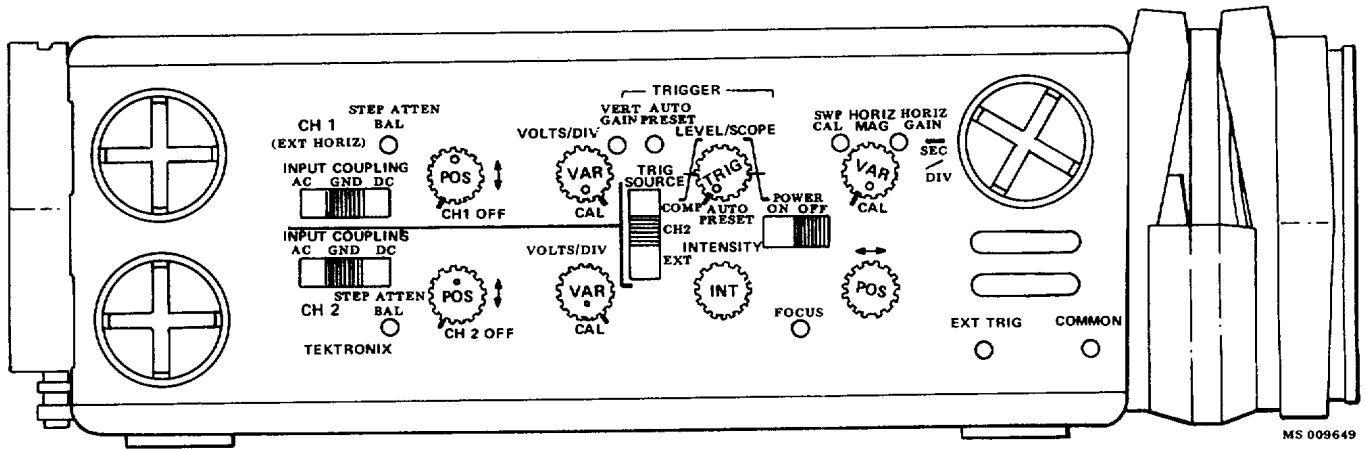


Figure 1-1. 212 Oscilloscope.

SECTION 1 INTRODUCTION

The 212 Oscilloscope is a dual-channel portable oscilloscope using all solid state and integrated circuitry (except the CRT). The small size of the 212 makes it an extremely portable oscilloscope for on-location maintenance in many fields of application.

The 500 kilohertz vertical system provides vertical deflection factors from one millivolt (at a reduced bandwidth) to 50 volts/division at the tip of either of the two integral high-impedance probes. Both single-trace and dualtrace modes of operation are offered. Single-trace displays are achieved by turning off either vertical channel with its position control. In the dual-trace mode, the instrument automatically chops or alternates, depending upon the sweep rate. The trigger circuits provide stable triggering over the full bandwidth capabilities of the vertical system.

The horizontal deflection system provides calibrated sweep rates from 500 milliseconds to five microseconds/division. It also provides uncalibrated sweep rates, via a variable sweep magnifier, to at least five times the indicated sweep rate for a maximum of at least one microsecond/division. In addition, X-Y operation is provided. Channel 1 supplies the horizontal (X) deflection, with a range from less than one millivolt to 50 volts/division (at a reduced bandwidth of 50 kilohertz), and Channel 2 the vertical (Y) deflection. The resultant CRT display is presented on a 6 X 10 division graticule (each division equals 0.203 inch).

The 212 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.

This instrument will meet the following electrical characteristics after complete instrument calibration. These characteristics apply over an ambient temperature of -15°C to $+55^{\circ}\text{C}$ ($+5^{\circ}\text{F}$ to $+131^{\circ}\text{F}$), except as otherwise indicated. Warmup time for given accuracies is five minutes.

VERTICAL DEFLECTION SYSTEM

DEFLECTION FACTOR:

Calibrated Range: One millivolt to 50 volt/division. 15 steps in 1-2-5 sequence.

Accuracy: Within 5% with VOLTS/DIV VAR control in CAL position and gain correctly set at 5 mV/div.

Uncalibrated (variable) Range: Continuously variable between calibrated settings. Extends maximum deflection factor to at least 125 volts/division.

BANDWIDTH (with six-division reference):

10 mV/DIV to 50 V/DIV: DC to at least 500 kilohertz.

5 mV/DIV: DC to at least 400 kilohertz.

2 mV/DIV: DC to at least 200 kilohertz.

1 mV/DIV: DC to at least 100 kilohertz.

Lower Bandwidth Limit, AC (capacitively) Coupled: about 2 hertz at all deflection factors.

INPUT RESISTANCE:

Approximately one megohm.

INPUT CAPACITANCE:

1 mV/DIV to 50 mV/DIV: Approximately 160 picofarads.

100 mV/DIV to 50 V/DIV: Approximately 140 picofarads.

MAXIMUM USABLE INPUT VOLTAGE:

50 V/DIV to .1 V/DIV: 600 volts (DC + peak AC). 600 volts peak-to-peak AC (five megahertz or less).

50 mV/DIV to 1 mV/DIV: 600 volts (DC + peak AC). AC not over 2 kilohertz or risetime not less than 100 nanoseconds.

CHOPPED MODE:

From 500 ms/DIV to 2 ms/DIV of time base at approximately 50 kilohertz.

ALTERNATE MODE:

From 1 ms/DIV to 5ps/DIV of time base.

INPUT IMPEDANCE MATCHING:

Matched to within approximately 10%.

GAIN ACCURACY BETWEEN CHANNELS:

Within 5% with both VOLTS/DIV VAR controls in CAL position and gain correctly set at 5 mV/DIV.

TRIGGERING

TRIGGER SENSITIVITY:

Internal: COMP: 0.2 division from DC to 500 kilohertz.

CH 2: 0.2 division from 2 hertz to 500 kilohertz.

External:

1.0 volt from DC to 500 kilohertz.

PRESET TRIGGER LEVEL:

Triggered at preset level on positive slope of triggering signal. Sensitivity same as stated above.

DISPLAY JITTER:

0.5 microsecond or less at 500 kilohertz.

EXTERNAL TRIGGER:

Input Resistance: Approximately one megohm.

Input Capacitance: Approximately 30 picofarads.

Maximum Usable Input Voltage: 8 volts (DC + peak AC) 16 volts peak-to-peak AC (one megahertz or less).

HORIZONTAL DEFLECTION SYSTEM

SWEEP RATE:

Calibrated Range: 500 milliseconds to five microseconds/ division. 16 steps in 1-2-5 sequence.

Accuracy (over center eight divisions): Within 5% with HORIZ MAG control in CAL position and timing correctly set at 1 ms/DIV (disregard first 0.5 microsecond of total sweep length).

Linearity (any two division portion within center eight divisions): Within 5% (disregard first 10% of total sweep length).

Variable Magnifier: Continuously variable between

calibrated settings. Extends maximum sweep rate to at least 1.0 microsecond/division.

CH 1 HORIZONTAL INPUT:

Calibrated Deflection Factor: 1 millivolt to 50 volts/ division.

Variable: At least five times (using HORIZ MAG).

Accuracy: Within 10% (with HORIZ MAG control in CAL position).

X-Y Phasing: Less than 3° at five kilohertz.

Maximum Input Voltage: 600 volts (DC + peak AC); 600 volts (peak-to-peak AC).

DISPLAY

GRATICULE:

Type: Internal black line, non-illuminated.

Area: Six divisions vertical by 10 divisions horizontal. Each division equals 0.203 inch.

PHOSPHOR:

P31 Standard.

ISOLATION

PROBE COMMON TO 212 CASE EXTERIOR: (When battery operated with AC power plug secured in the insulated cover.) Maximum safe potential between probe common (floating circuit ground) and 212 case exterior not to exceed 500 V RMS sinusoidal, or 700 V (DC + peak AC).

PROBE COMMON TO AC LINE: Maximum safe potential between probe common (floating circuit ground) and the AC power line is not to exceed 250 V RMS sinusoidal minus the AC power line RMS voltage. (i.e., when the AC power line RMS voltage is 117 V, the maximum allowable potential on the probe common is 250 - 117 = 133 V RMS.)

**AC OPERATION
CAUTION**

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

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%

LINE VOLTAGE RANGE: 110 to 126 volts, AC. Batteries can not be charged during AC operation. Instrument can be operated between 104 and 110 volts with resulting slow discharge of internal batteries.

LINE FREQUENCY: 58 to 62 hertz.

NOTE

Refer to Option and Corrective Maintenance information for other line voltages and frequencies.

MAXIMUM POWER CONSUMPTION: Three watts or less at 126 volts, 60 hertz.

INTERNAL BATTERY OPERATION

BATTERIES: 10 rechargeable A nickel-cadmium cells.

CHARGE TIME (from AC line): 16 hours for full charge (instrument off during charge cycle).

POWER (BATTERY) INDICATOR: When extinguished, indicates less than 10 minutes of scope operating life left in the batteries.

BATTERY EXCESSIVE DISCHARGE PROTECTION: Instrument operation automatically interrupted when battery charge drops to 10 volts +0.5 volt.

TYPICAL OPERATING TIME (at maximum trace intensity after full charge cycle at +20°C to +30°C): Three to five hours. Longest operating time provided at lower trace intensity.

TYPICAL CHARGE CAPACITY (reference to charge/discharge at +20°C to +30°C):

GENERAL

ENVIRONMENT:

Temperature:

Operating from Batteries, -15°C to +55°C (+5°F to +131°F).

Charging or operating from AC line, 0°C to +40°C (+32°F to +104°F).

Storage, -40°C to +60°C (-40°F to +140°F).

Altitude:

Operating, to 25, 000 feet (maximum operating temperature decreased by 10C per 1, 000 feet above 15, 000 feet).

Non-operating, to 50, 000 feet.

Humidity (operating and non-operating): 5 cycles (120 hours) to 95% relative humidity referenced to MIL-E-16400F.

Shock (operating and non-operating): Tested with two shocks at 150 g, one-half sine, two millisecond duration each direction along three major axes.

WEIGHT (without accessories):

3.4 pounds (1.5 kilograms)

DIMENSIONS (measured at maximum points):

Height: 3.0 inches (7.6 centimeters).

Width: 5.25 inches (13.2 centimeters).

Depth: 8.9 inches (22.6 centimeters).

OPTION INFORMATION

Your instrument may be equipped with one or more options. This section describes those options or directs the reader to where the option is documented.

OPTION 1

Option 1 equips the 212 for operation from a 220 to 250 V ac 48 to 52 Hz power line source. Option 1 parts values that differ from the standard 212 are listed here. A power cord cable assembly, for adapting to appropriate power plugs, is included with Option 1 instruments. Refer to the Corrective Maintenance and Diagrams sections of this manual for additional information concerning Option 1.

ELECTRICAL PARTS LIST DIFFERENCES FOR OPTION 1

A3	670-2405-21*	POWER SUPPLY Circuit Board Assembly (Option 1)
C204	283-0279-00	0.001 UF, 20%, 3 KV
C210	285-0932-00	1.0 UF, 10%, 400V
C212	285-0933-00	2.0 UF, 10%, 400V
C215	283-0279-00	0.001 UF, 20%, 3 KV

ADDITIONAL STANDARD ACCESSORIES FOR OPTION 1

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

*In some Option 1 instruments, the suffix number on the board may not be marked -21.

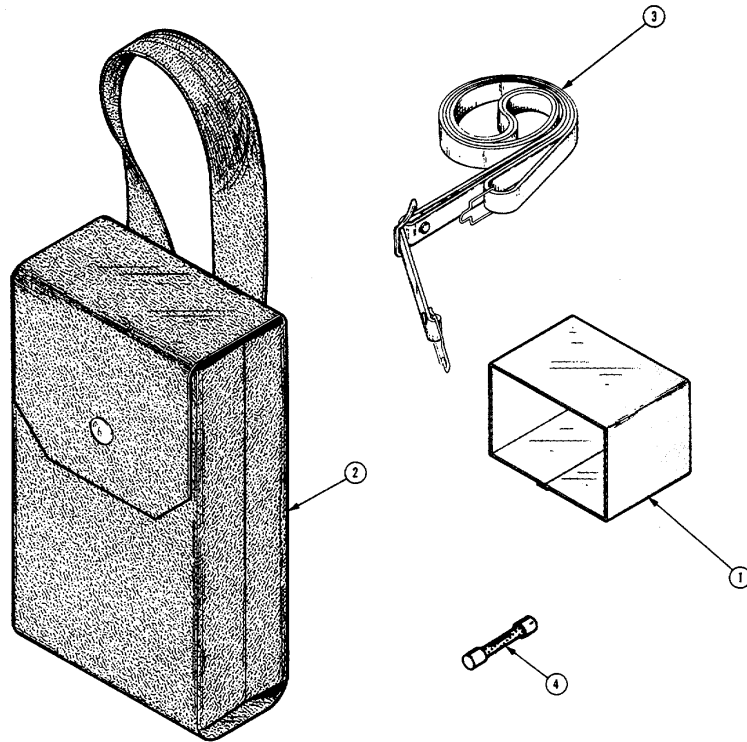
OPTION 2

Option 2 equips the 212 for operation from a 90 to 110 V ac 48 to 52 Hz power line source. Option 2 parts values that differ from the standard 212 are listed here. Refer to the Corrective Maintenance and Diagrams sections of this manual for additional information concerning Option 2.

ELECTRICAL PARTS LIST DIFFERENCES FOR OPTION 2

A3	670-2405-31 **	POWER SUPPLY Circuit Board Assembly (Option 2)
C210	285-0934-00	2.2 UF, 10%, 200V
C212	285-0935-00	4.4 UF, 10%, 200V

**In some Option 2 instruments, the suffix number on the board may not be marked -31.



**Fig. &
Index
No.**

	Tektronik Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
-1	015-0199-01	1							VISOR, CRT:	80009	016-0199-01
-2	016-0512-00	1							CASE, CARRYING:	80009	016-0512-00
-3	346-0104-00	1							STRAP, CARRYING:	17516	4188-BA
-4	159-0121-00	2							FUSE, CARTRIDGE :DIN, 0.4A, 250V,5 SEC	75915	212.400
	070-1375-00	1							MANUAL, TECH: OPERATORS	80009	070-1375-00
	070-1376-00	1							MANUAL, TECH: INSTRUCTION	80009	070-1376-00

Figure 1-2. 212 Oscilloscope Accessories

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

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

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or compromise the performance or reliability of this instrument. They are installed when necessary to ensure prompt delivery to the customer. Order replacement parts from the Replaceable Electrical Parts List.

CALIBRATION TEST EQUIPMENT REPLACEMENT


Calibration Test Equipment Chart

This chart compares TM 500 product performance to that of older Tektronix equipment. Only those characteristics where significant specification differences occur, are listed. In some cases the new instrument may not be a total functional replacement. Additional support instrumentation may be needed or a change in calibration procedure may be necessary.

Comparison of Main Characteristics

DM 501 replaces 7D13			
PG 501 replaces	107	PG 501 - Risetime less than 3.5 ns into 50Ω.	107 - Risetime less than 3.0 ns into 50Ω.
	108	PG 501 - 5 V output pulse; 3.5 ns Risetime.	108 - 10 V output pulse; 1 ns Risetime.
	111	PG 501 - Risetime less than 3.5 ns; 8 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger Pulse delay.
	114	PG 501 ± 5 V output.	114 - ±10 V output. Short proof output.
	115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode; ±5 V dc Offset. Has ±5 V output.	115 - Paired, Burst, Gated, and Delayed pulse mode; ±10 V output. Short-proof output.
PG 502 replaces	107		
	108	PG 502 - 5 V output	108 - 10 V output.
	111	PG 502 - Risetime less than 1 ns; 10 ns Pretrigger pulse delay.	111 - Risetime 0.5 ns; 30 to 250 ns Pretrigger pulse delay.
	114	PG 502 ±5 V output	114 - 10 V output. Short proof output.
	115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode; Has ±5 V output.	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode; ±10 V output. Short-proof output.
	2101	PG 502 - Does not have Paired or Delayed pulse. Has ±5 V output.	2101 - Paired and Delayed pulse; 10 V output.
PG 506 replaces	106	PG 506 - Positive-going trigger output signal at least 1 V; High Amplitude output, 60 V.	106 - Positive and Negative-going trigger output signal, 50 ns and 1 V; High Amplitude output, 100 V.
	067-0502-01	PG 506 - Does not have chopped feature.	0502-01 - Comparator output can be alternately chopped to a reference voltage.
SG 503 replaces 190, 190A, 190B			
	191	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
	067-0532-01	SG 503 - Frequency range 250 kHz to 250 MHz.	191 - Frequency range 350 kHz to 100 MHz.
		SG 503 - Frequency range 250 kHz to 250 MHz.	0532-01 - Frequency range 65 MHz to 500 MHz.
TG 501 replaces 180, 180A			
	181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	180A - Marker outputs, 5 sec to 1 us. Sinewave available at 20, 10, and 2 ns. Trigger pulses 1, 10, 100 Hz; 1, 10, and 100 kHz. Multiple time-marks can be generated simultaneously.
	184	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	181 - Marker outputs, 1, 10, 100, 1000, and 10, 000 us, plus 10 ns sinewave.
	2901	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns. Trigger output - slaved to marker output from 5 sec through 100 ns. One time-mark can be generated at a time.	184 - Marker outputs, 5 sec to 2 ns. Sinewave available at 50, 20, 10, 5, and 2 ns. Separate trigger pulses of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 /s. Marker amplifier provides positive or negative time marks of 25 V min. Marker intervals of 1 and .1 sec; 10, 1, and .1 ms; 10 and 1 us.
			2901 - Marker outputs, 5 sec to 0.1 us. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 us. Multiple time-marks can be generated simultaneously.

NOTE: All TM 500 generator outputs are short-proof. All TM 500 plug-in instruments require TM 500-Series Power Module.

 <p>TEKTRONIX committed to technical excellence</p>	MANUAL CHANGE INFORMATION	
	PRODUCT <u>212</u> <u>070-1376-00</u>	CHANGE REFERENCE <u>M30261</u> DATE <u>1-17-77</u>
CHANGE:	DESCRIPTION	
EFF SN B055577 ELECTRICAL PARTS LIST, SCHEMATIC, AND MECHANICAL PARTS LIST CHANGES CHANGE TO: DS310 150-1031-01 DIODE:LIGHT EMITTING 352-0360-01 HOLDER,LED DS310 is the POWER SUPPLY indicator lamp and is mounted on the front panel. It is shown on POWER SUPPLY diagram 4.		

SECTION 2 FUNCTIONS OF CONTROLS AND CONNECTORS

The controls and connectors necessary for operation of the 212 are located on the right side of the instrument. (See Fig. 2-1.) The POWER (BATTERY) indicator is on the front panel. A brief description of each control and connector is given here.

VOLTS/DIV-selects vertical deflection factor (vertical VARIABLE control must be in CAL position for indicated deflection).

INPUT COUPLING-selects the method used to couple the channel input signal to the vertical amplifier system.

AC-the DC component of input signal is blocked.

GND-vertical amplifier input circuit is grounded. The applied input signal is connected to ground through a one megohm resistor to provide a precharge path for the AC input coupling capacitor.

DC-all components of the input signal are passed to the vertical amplifier system input.

STEP ATTEN BALANCE-a screwdriver adjustment to balance the vertical amplifier system for minimum trace shift when switching deflection factors.

Vertical POSition-controls the vertical position of the appropriate trace. OFF detent turns the channel off.

VOLTS/DIV VARIABLE-provides a continuously variable deflection factor between the calibrated settings of the VOLTS/DIV switch for the appropriate vertical channel.

VERTical GAIN-screwdriver adjustment to set the gain of the vertical amplifier system.

AUTO PRESET-screwdriver adjustment to set the AUTO PRESET trigger point for automatic trigger operation.

Trigger SOURCE-selects the source of the trigger signal.

COMP-the sweep is triggered from a sample of the vertical deflection signal after the vertical switching.

CH 2-the sweep is triggered from a sample of the vertical deflection signal before the vertical switching and only from CH 2.

EXT-the sweep is triggered from the signal applied to the EXT TRIG banana jack.

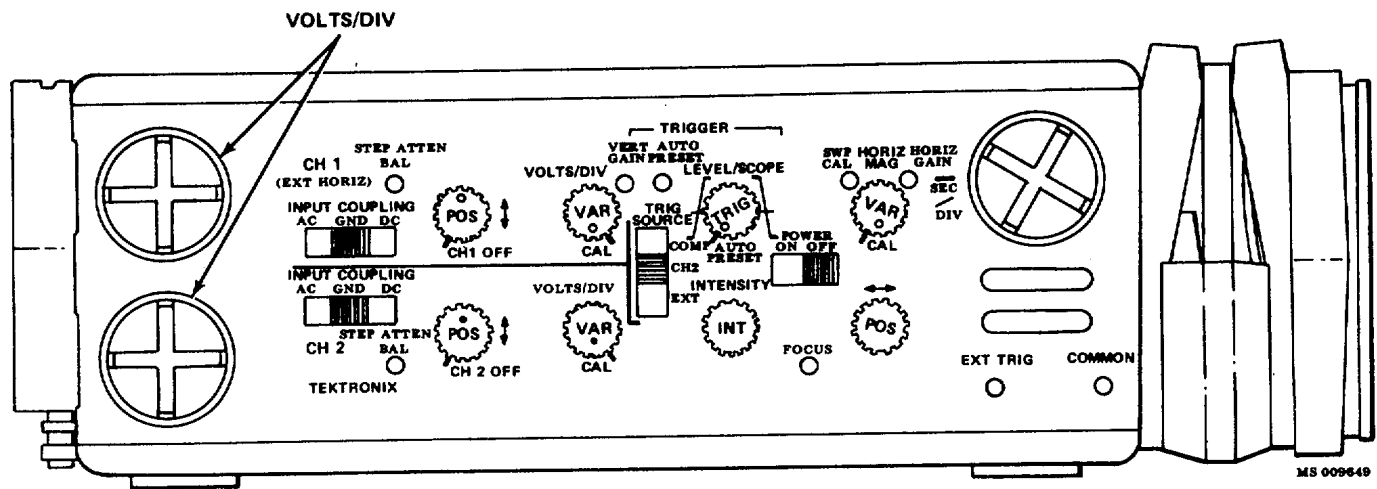


Figure 2-1. Side Panel controls and connectors.

LEVEL/SLOPE-selects the amplitude point and the 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 control is set to the AUTO PRESET detent, the sweep is automatically triggered at a preset level on the positive-going slope.

INTENSITY-controls brightness of CRT display.

SWP CAL-screwdriver adjustment to provide calibrated sweep timing.

POWER-controls power to the instrument. Does not interrupt charging current to the internal batteries when the instrument is connected to an AC line voltage.

FOCUS-screwdriver adjustment to obtain a well-defined display.

HORIZontal MAGnifier-provides continuously variable sweep magnification to a maximum of approximately five times the sweep rate indicated by the SEC/DIV switch.

HORIZontal GAIN-screwdriver adjustment to set the basic gain of the horizontal amplifier system.

Horizontal POSition-controls the horizontal position of the trace.

SEC/DIV-selects horizontal sweep rate (HORIZ MAG must be in CAL position for indicated sweep rate) X-Y position allows for X-Y operation; CH 2 supplies the vertical deflection and CH 1 the horizontal deflection.

EXT TRIG-banana jack for input of an external trigger signal.

COMMON-banana jack to establish common ground between the 212 and the external signal source or equipment under test.

WARNING

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

POWER (BATTERY) Indicator-red light to indicate when the instrument is on. When light extinguishes, less than 10 minutes of operating life remain.

SECTION 3 PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of this instrument. The severity of environment to which the 212 is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

Disassembly

To gain access to the interior of the instrument, unwind both the probe cords and the power cord from the rear of the instrument. Remove the five screws in the bottom cover of the instrument. See Fig. 3-1. Gently separate the bottom cover from the instrument and lay aside. The Power Supply circuit board with the batteries can be lifted up and pivoted out of the way. Most of the internal workings of the instrument are now accessible.

If it is necessary to have access to the front of the Input circuit board, remove the knobs from all of the external control shafts. Remove the four screws securing the side panel to the Input circuit board and remove the instrument side panel.

Cleaning

The 212 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause component breakdown.

The high impact plastic covers provide protection against dust in the interior of the instrument. Loose dust accumulated on these covers can be removed with a soft cloth or small brush. The brush is also useful for dislodging dirt on and around the side-panel controls. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

It should be only occasionally necessary to clean the interior. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air. A softbristle brush or a cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate circuit components.

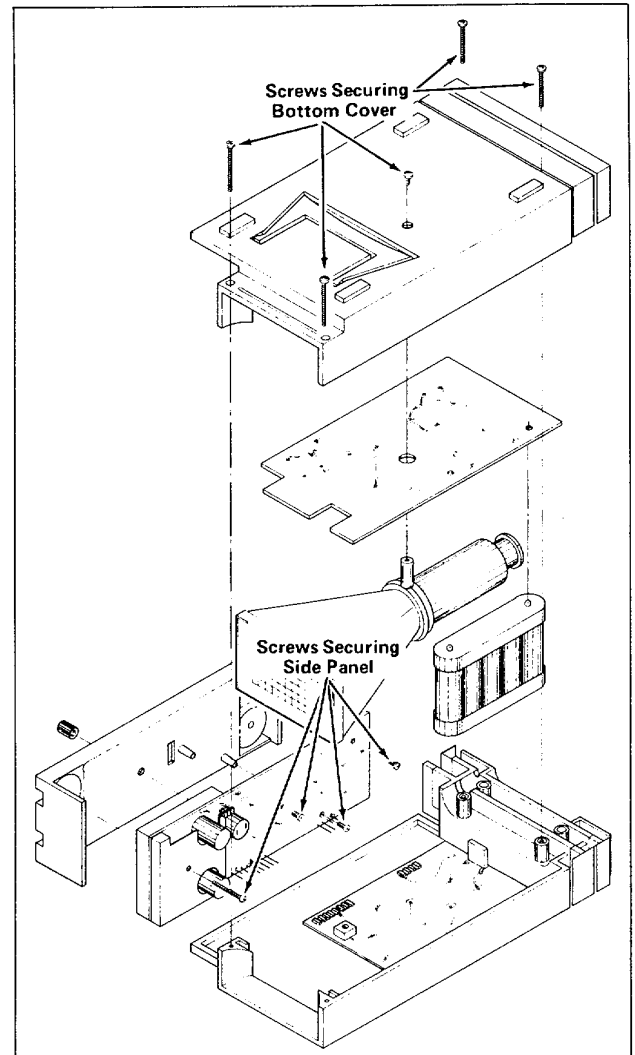


Figure 3-1. Location of screws securing bottom cover and side panel.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain hydrochloric acid, sodium hydroxide, or sulfuric acid.

Visual Inspection

The 212 should be inspected occasionally for such defects as broken connections, improperly seated transistors, damaged circuit boards, and heat-damaged parts.

parts. The corrective procedure for most visible defects is apparent; 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 the overheating be corrected to prevent recurrence of the damage.

Semiconductor Checks

Periodically checking the semiconductors in the 212 is not recommended. The best check of semiconductor performance is actual operation in the instrument. If it is desired to check the performance of a semiconductor out of the instrument, a dynamic checker such as a TEKTRONIX Type 576 Transistor Curve Tracer is recommended. Lead configurations of the semiconductors used in the 212 are shown in Fig. 5-2.

An extracting tool should be used to remove the 14-, and 16-pin flat integrated circuits to prevent damage to the pins. If an extracting tool is not available when removing one of these integrated circuits, pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as the pins may be damaged. When replacing semiconductors, key the semiconductor's index with that of its socket. Failure to do so can result in damaged components.

Recalibration

To assure accurate measurements, check the calibration of this instrument after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. The calibration procedure can also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles may be revealed or corrected by recalibration.

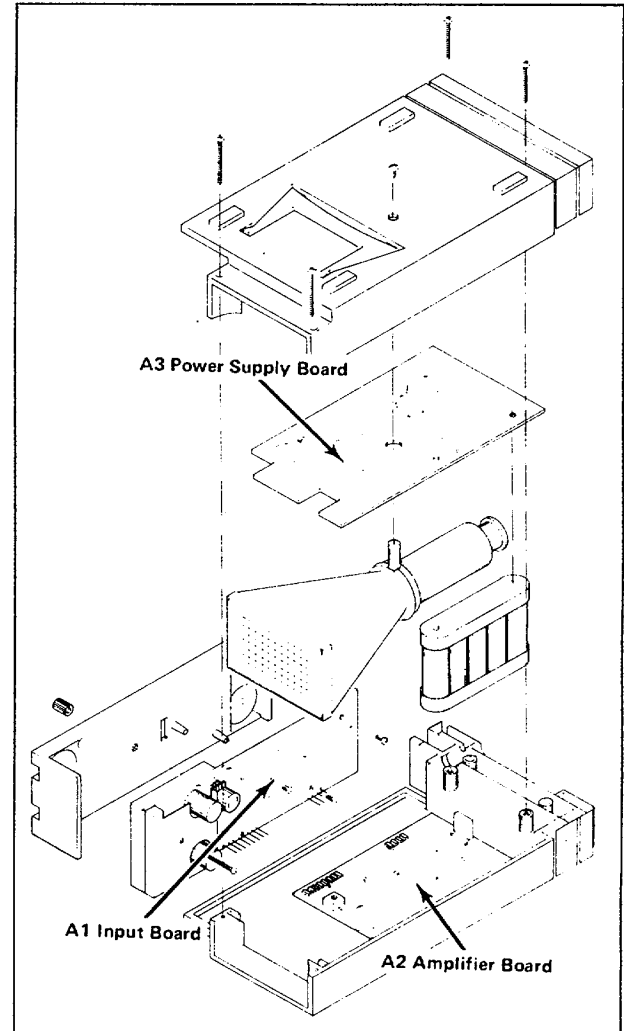


Figure 3-2. Location of circuit boards within the 212.

**SECTION 4
CALIBRATION**

General

To assure instrument accuracy, check the calibration of the 212 every 1000 hours of operation, or every six months if used infrequently. Before complete calibration, thoroughly clean and inspect this instrument as outlined in the Preventive Maintenance section.

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

To aid in locating a step in this procedure, an index is given prior to the complete procedure. Completion of each step in the Calibration procedure ensures that this instrument meets the electrical specifications given in the Introduction of this manual. Where possible, instrument performance is checked before an adjustment is made. For best overall instrument performance, make each adjustment to the exact setting even if the CHECK- step is within the allowable tolerances.

TEST EQUIPMENT REQUIRED

The following test equipment and accessories, or their equivalent, are required for complete calibration of the 212. Given specifications for the test equipment are the minimum necessary for accurate calibration. Therefore, the specifications of any test equipment must either meet or exceed those listed below. All test equipment is assumed to be correctly calibrated and operating within the listed specifications. Detailed operating instructions for the test units are not given in this procedure. Refer to the instruction manual for the test equipment if more information is needed.

Special Calibration Fixtures

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

TABLE 4-1.

TEST EQUIPMENT

Description	Minimum Specifications	Usage	Example
1. Time-Mark Generator	Marker outputs, 5 microseconds to 0.1 second; marker accuracy, within 0.1%.	Horizontal timing check and adjustment.	a. TEKTRONIX 2901 Time-Mark Generator. b. TEKTRONIX 184 Time-Mark Generator.
2. Standard Amplitude Calibrator	Amplitude accuracy, 0.25%; signal amplitude, 5 millivolts to 100 volts; output signal one-kilohertz square wave.	Vertical and horizontal amplifier gain checks and adjustments.	a. TEKTRONIX calibration fixture Part Number 067-0502-01.
3. Square-Wave Generator	Frequency, one kilohertz; risetime, 100 nanoseconds or less; output amplitude, 0.4 volt to 40 volts.	Vertical amplifier compensation checks and adjustments.	a. TEKTRONIX Type 106 Square-Wave Generator.
4. Low-Frequency Constant-Amplitude Signal Generator	Frequency, one kilohertz to 500 kilohertz; output amplitude, at least 200 millivolts.	Vertical Amplifier bandwidth check. Trigger	a. General Radio 1310-B Oscillator. operation checks.
5. DC Voltmeter	Range, zero to 1000 volts; accuracy, within 3%; input impedance, 20, 000Ω/volt.	Power supply output level checks. Vertical and horizontal centering adjustment. CRT grid bias adjustment.	a. Triplett Model 630-NA. b. Simpson Model 262.

TABLE 4-1 (cont)

Description	Minimum Specifications	Usage	Example
6. Cable	Impedance, 50 ohms; type, RG-58/U; length, 42 inches; connectors, BNC.	External trigger operation check. Horizontal gain check and adjustment.	a. TEKTRONIX Part Number 012-0057-01.
7. Adapter	Connectors, BNC female and dual banana plug.	External trigger checks.	a. TEKTRONIX Part Number 103-0090-00.
8. Adapter	Connectors, GR874 and BNC female.	Vertical Amplifier compensation checks and adjustment.	a. TEKTRONIX Part Number 017-0063-00.
9. Termination	Impedance, 50 ohms; accuracy, 2%; connectors, BNC.	Vertical amplifier compensation checks and adjustment.	a. TEKTRONIX Part Number 011-0049-01.
10. Attenuator	Ratio, 10X; connectors, BNC; impedance, 50 ohms.	Vertical amplifier bandwidth check.	a. TEKTRONIX Part Number 011-0059-01.
11. Adapter	Connectors, probe tip to BNC.	Used throughout procedure for signal interconnection.	a. TEKTRONIX Part Number 013-0084-01.
12. T-Connector	Connectors, BNC.	External trigger operation checks.	a. TEKTRONIX Part Number 103-0030-00.
13. Screwdriver	Three-inch shaft, 3/32 inch bit.	Used throughout Procedure to adjust variable resistors.	a. Xcelite R-3323.
14. Low-Capacitance Screwdriver	1 1/2-inch shaft.	Used to adjust variable capacitors.	a. TEKTRONIX Part Number 003-0000-00.

INDEX TO CALIBRATION PROCEDURE

Power Supply and Display

1. Check Power Supply DC Levels
2. Adjust CRT Grid Bias (internal adjustment of R273)
3. Adjust FOCUS (external side panel adjustment of R398)
4. Adjust Trace Rotation (internal adjustment of R141)

Vertical System Adjustment

5. Adjust Vertical DC Centering (internal adjustment of R101)
6. Adjust CH 1 STEP ATTENUATION BALANCE (external

side panel adjustment of R415)

7. Adjust CH 2 STEP ATTENUATION BALANCE (external side panel adjustment of R315)
8. Adjust VERTICAL GAIN (external side panel adjustment of R470)
9. Check CH 2 VARIABLE VOLTS/DIV Range
10. Check CH 2 VOLTS/DIV Accuracy VOLTS/DIV Range
11. Check CH 1 VOLTS/DIV Accuracy and VARIABLE
12. Adjust CH 1 VOLTS/DIV Switch Compensation (internal side panel adjustment of C407, C408, C409)
13. Adjust CH 2 VOLTS/DIV Switch Compensation (internal side panel adjustment of C307, C308, C309)
14. Check CH 2 Vertical Amplifier Bandwidth

15. Check CH 1 Vertical Amplifier Bandwidth

Trigger Circuit Adjustment

16. Adjust AUTO PRESET (external side panel adjustment of R375)
17. Check Trigger Circuit Operation

Horizontal System Adjustment

18. Adjust Horizontal Centering (internal adjustment of R366)
19. Adjust HORIZONTAL GAIN (external side panel adjustment of R475)
20. Adjust SWEEP CALibration (external side panel adjustment of R370)
21. Check HORIZ MAG Range
22. Check SEC/DIV Accuracy

PRELIMINARY PROCEDURE

This instrument should be adjusted at an ambient temperature of +25°C (+ 50°C) for best overall accuracy.

1. Remove the instrument covers as described in the Disassembly Instructions in the Preventive Maintenance section.
2. Connect the instrument to a 117 VAC 60 Hz line source. If the batteries are not fully charged, leave the 212 connected to the line with the power switch turned off for a period of approximately one hour before continuing with calibration.
3. Set the instrument controls as given under Preliminary Control Settings. Allow at least five minutes of warmup before proceeding.

NOTE

Titles for external controls of this instrument are fully capitalized in this procedure (e.g., INTEASITY). Internal adjustments are initial capitalized only (e.g., Grid Bias).

PRELIMINARY CONTROL SETTINGS

Preset the instrument controls to the settings given below when starting a calibration procedure.

Channel 1 Controls

VOLTS/DIV	5 m
VOLTS/DIV VAR	CAL
POS	Midrange
INPUT COUPLING	GND

Channel 2 Controls

VOLTS/DIV	5 m
VOLTS/DIV VAR	CAL
POS	OFF
INPUT COUPLING	GND

Trigger Controls

SOURCE	COMP
LEVEL/SOURCE	AUTO PRESET

Sweep Controls

SEC/DIV	1 m
HORIZ MAG	CAL
POS	Midrange

Display Controls

POWER	ON
INTENSITY	Fully Counterclockwise

**CALIBRATION PROCEDURE
POWER SUPPLY and DISPLAY**

Equipment Required

- 1. DC Voltmeter

- 2. Three-inch Screwdriver

Control Setting

Preset instrument controls to the settings given under Preliminary Control Settings.

1. Check Power Supply DC Levels

NOTE

If the instrument has been operating satisfactorily prior to recalibration, proceed with step 2.

- a. Using the DC voltmeter, measure the DC level of the power supplies given in Table 4-2. Observe proper meter polarity. See Fig. 4-1 for test point locations.

TABLE 4-2.
Power Supply Accuracy

Supply	Measurement
-5.6 volt	-5.6 volts ± 0.4 volt
+5.6 volt	+5.6 volts ± 0.4 volt
+65 volt	+65 volts ± 4 volts
-1000 volt	-960 volts ± 40 volts (due to meter loading)

2. Adjust CRT Grid Bias

- a. Connect the DC voltmeter between pin 5 and pin

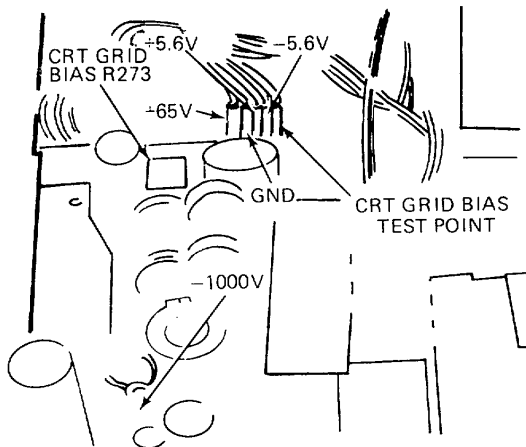


Figure 4-1. Location of power supply test points and CRT Grid Bias adjustment.

- 2 of plug P3 (negative meter lead to pin 2) on the Power Supply Board. See Fig. 4-1.

- b. Turn the INTENSITY control fully clockwise.
- c. CHECK-Meter reading of +1.9 volts.
- d. ADJUST-CRT Grid Bias, R273 (see Fig. 4-1) for a meter reading of +1.9 volts.
- e. Disconnect all test equipment. Turn the INTENSITY control fully counterclockwise.

3. Adjust FOCUS

- a. Turn CH 2 POS midrange and CH 1 POS to the OFF detent.
- b. Set the SEC/DIV switch to X-Y and adjust the INTENSITY control for a nominal display intensity.
- c. ADJUST-FOCUS, R398 (located on the 212 side panel) for a well-defined dot.

4. Adjust Trace Rotation

- a. Set the SEC/DIV switch to 1 m.
- b. CHECK-Free-running sweep is parallel with a horizontal graticule line.
- c. ADJUST-Trace Rotation, R141 (see Fig. 4-2) so the trace is parallel with the center horizontal graticule line.

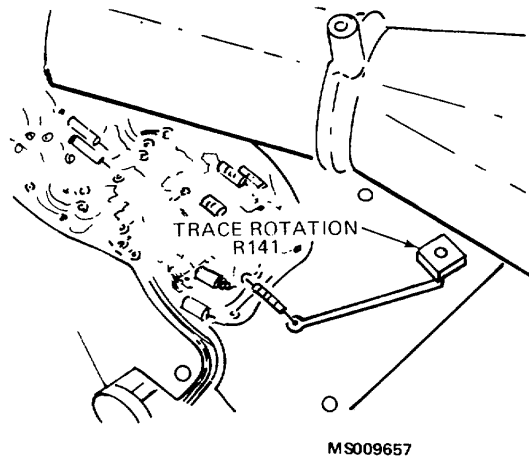


Figure 4-2. Location of Trace Rotation adjustment.

VERTICAL SYSTEM ADJUSTMENT

Equipment Requested

- | | |
|--|---------------------------------|
| 1. Standard Amplitude Calibrator | 6. Probe Tip-to-BNC Adapter |
| 2. Square-Wave Generator | 7. 50-Ohm BNC Termination |
| 3. Low Frequency Constant Amplitude Signal Generator | 8. 10X 50-Ohm Attenuator |
| 4. DC Voltmeter | 9. Three-inch Screwdriver |
| 5. GR-to-BNC Female Adapter | 10. Low-Capacitance Screwdriver |

Control Settings

Preset instrument controls to the settings given under Preliminary Control Settings, except as follows:

INTENSITY	Visible Display
INPUT COUPLING	DC
(both)	

5. Adjust Vertical DC Centering

- Connect the DC voltmeter between pin 11 of U105 (positive meter lead to pin 11) and ground (see Fig. 4-3).
- Adjust CH 1 Vertical POS control for a 0 volt meter reading.
- CHECK-Trace should be within approximately 0.4 division of graticule center.
- ADJUST-Vertical Centering, R101 (see Fig. 4-3) to position the trace to the center horizontal graticule line.
- Disconnect all test equipment.

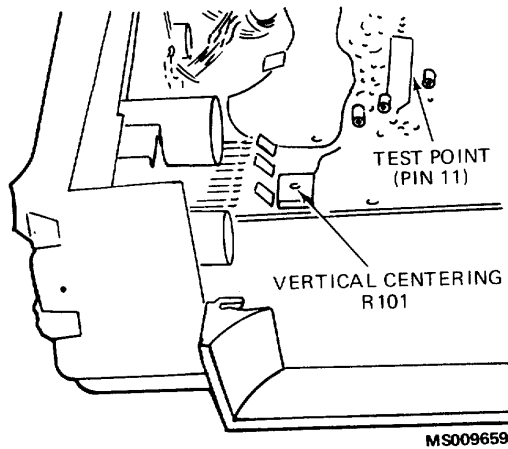


Figure 4-3. Location of Vertical Centering adjustment and test point.

6. Adjust CH 1 STEP ATTENUATOR BALANCE

- Rotate the CH 1 VOLTS/DIV switch from 50 m to 1 m.
- CHECK-The CRT display for 0.1 division or less of trace shift between adjacent switch positions when rotating the VOLTS/DIV switch from 50 m to 1 m.
- ADJUST-CH 1 STEP ATTEN BAL, R415 (located on the side panel) for minimum trace shift when rotating the CH 1 VOLTS/DIV switch from 50 m to 1 m.

7. Adjust CH 2 STEP ATTENUATOR BALANCE

- Turn the CH 1 POS control to the OFF detent and the CH 2 POS control to midrange.
- Rotate the CH 2 VOLTS/DIV switch from 50 m to 1 m.
- CHECK-The CRT display for 0.1 division or less of trace shift between adjacent switch positions when rotating the VOLTS/DIV switch from 50 m to 1 m.
- ADJUST-CH 2 STEP ATTEN BAL, R315 (located on the side panel) for minimum trace shift rotating the CH 2 VOLTS/DIV switch from 50 m to 1 m.

8. Adjust VERTICAL GAIN

- Set the CH 2 VOLTS/DIV switch to 5 m.
- Connect the CH 2 probe tip to the output of the Standard Amplitude Calibrator via a probe tip-to-BNC adapter.
- Set the Standard Amplitude Calibrator for a 20 millivolts output signal.
- CHECK-The CRT display for four divisions of deflection within 0.2 division.
- ADJUST-VERT GAIN, R470 (located on the side panel) for exactly four divisions of deflection.

9. Check CH 2 VARIABLE VOLTS/DIV Range

- a. Rotate the CH 2 VOLTS/DIV VAR control fully clockwise.
- b. CHECK-The CRT display for 1.6 divisions or less of deflection. 1.6 divisions of deflection indicates a VARIABLE VOLTS/DIV range of at least 2.5: 1.
- c. Set the VARIABLE VOLTS/DIV control to CAL.

10. Check CH 2 VOLTS/DIV Accuracy

- a. CHECK-Using the CH 2 VOLTS/DIV switch and Standard Amplitude Calibrator settings given in Table 4-3, check that the deflection factor accuracy for CH 2 is within 5% at each position.

TABLE 4-3.
Vertical Deflection Accuracy

VOLTS/DIV Switch Setting	Standard Amplitude Calibrator Output	Vertical Deflection in Divisions	Maximum Error For ±5% Accuracy
1 m	5 millivolts	5	±0.25 division
2 m	10 millivolts	5	±0.25 division
5 m	20 millivolts	4	Previously set in step 8.
10 m	50 millivolts	5	±0.25 division
20 m	0.1 volt	5	±0.25 division
50 m	0.2 volt	4	±0.2 division
.1	0.5 volt	5	±0.25 division
.2	1 volt	5	±0.25 division
.5	2 volts	4	±0.2 division
1	5 volts	5	±0.25 division
2	10 volts	5	±0.25 division
5	20 volts	4	±0.2 division
10	50 volts	5	±0.25 division
20	100 volts	5	±0.25 division
50	100 volts	2	±0.1 division

- b. Disconnect the CH 2 probe tip from the Standard Amplitude Calibrator.

11. Check CH 1 VOLTS/DIV Accuracy and VARIABLE VOLTS/DIV Range

- a. Turn CH 2 POS to the OFF detent and the CH 1 POS to midrange.
- b. Connect the CH 1 probe tip to the output of the Standard Amplitude Calibrator via a probe tip-to-BNC adapter.
- c. CHECK-Using the CH 1 VOLTS/DIV switch and Standard Amplitude Calibrator settings given in Table 4-3, that the deflection factor accuracy of CH 1 at each position is within 5%.
- d. Set the Standard Amplitude Calibrator for a 20 millivolts output signal.
- e. Set the CH 1 VOLTS/DIV switch to 5 m.
- f. Rotate the CH 1 VARIABLE VOLTS/DIV control fully clockwise.
- g. CHECK-The CRT display for 1.6 divisions or less of deflection. 1.6 divisions of deflection indicates a VARIABLE VOLTS/DIV range of at least 2.5: 1.
- h. Set the VARIABLE VOLTS/DIV control to CAL.

12. Adjust CH 1 VOLTS/DIV Switch Compensation

- a. Set the CH 1 VOLTS/DIV switch to 0.1 V.
- b. Connect the CH 1 probe tip to the high amplitude output of the Type 106 Square-Wave generator via a GR-to-BNC female adapter, a 50-ohm BNC termination, and a probe tip-to-BNC adapter.
- c. Adjust the Square-Wave generator for a four-division display of a one kilohertz square wave.
- d. Adjust the Triggering controls 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 aberration.

NOTE

If C307, C308, C309, C407, C408, or C409 require adjustment, it will be necessary to remove the instrument side panel from the Input Board. Refer to the Disassembly Instructions for removal procedure.

- f. ADJUST-C407 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration. (Use a low-capacitance screwdriver.)
- g. Set the CH 1 VOLTS/DIV switch to 1 and adjust the Square-Wave generator for a four-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 aberration.
- i. ADJUST-C408 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- j. Set the VOLTS/DIV switch to 10, remove the 50-ohm BNC termination from the test setup, and adjust the Square-Wave generator for a four-division display.
- k. CHECK-The CRT display for a flat-top waveform with no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- l. ADJUST-C409 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- m. Disconnect CH 1 probe tip from the test setup.

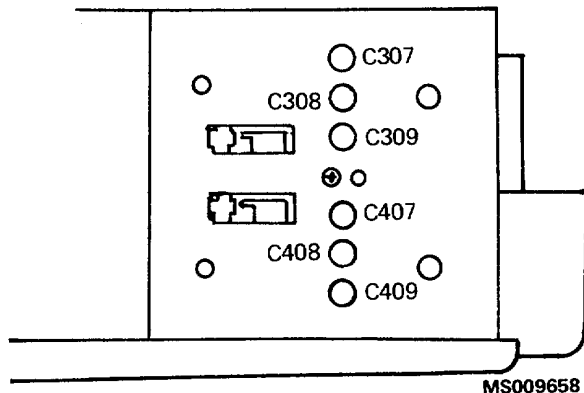


Figure 4-4. Location of attenuator compensation capacitors.

13. Adjust CH 2 VOLTS/DIV Switch Compensation

- a. Turn CH 1 POS control to the OFF detent and turn CH 2 POS control to midrange.
- b. Set the CH 2 VOLTS/DIV switch to 0.1 V/div.
- c. Connect the CH 2 probe tip to the high amplitude output of the Type 106 Square-Wave generator via a GR-to-BNC female adapter, a 50-ohm BNC termination, and a probe tip-to-BNC adapter.
- d. Adjust the Square-Wave generator for a four-division display of a one-kilohertz square wave.
- 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 aberration.
- f. ADJUST-C307 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- g. Set the CH 2 VOLTS/DIV switch to 1 and adjust the Square-Wave generator for a four-division display.
- h. CHECK-The CRT display for a flat-top waveform with no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- i. ADJUST-C308 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- j. Set the CH 2 VOLTS/DIV switch to 10, remove the 50-ohm BNC termination from the test setup, and adjust the Square-Wave generator for a four-division display.
- k. CHECK-The CRT display for a flat-top waveform with no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- l. ADJUST-C309 (see Fig. 4-4) for no more than +0.2 division, -0.1 division, or a total of 0.2 division of aberration.
- m. Disconnect all test equipment, and re-install the instrument side panel.

14. Check CH 2 Vertical Amplifier Bandwidth

- a. Set the CH 2 VOLTS/DIV switch to 1 m.
- b. Connect the CH 2 probe tip to the output of the Low Frequency Constant-Amplitude signal generator via a 50-ohm BNC 10X attenuator and a probe tip-to-BNC adapter.
- c. Adjust the signal generator for a six-division display for a one-kilohertz signal.
- d. Without adjusting the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.
- e. CHECK-The signal generator output must be at least 100 kilohertz.
- f. Set the VOLTS/DIV switch to 2m and adjust the signal generator for a six-division display of a one-kilohertz signal.
- g. Without adjusting the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.
- h. CHECK-The signal generator output must be at least 200 kilohertz.
- i. Set the VOLTS/DIV switch to 5m and adjust the signal generator for a six-division display of a one-kilohertz signal.

- j. Without adjusting the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.
- k. CHECK-The signal generator output frequency must be at least 400 kilohertz.
- l. Set the VOLTS/DIV switch to 10 m and adjust the signal generator for a six-division display of a one-kilohertz signal.
- m. Without adjusting the output amplitude, increase the output frequency until the display is reduced in amplitude to 4.2 divisions.
- n. CHECK-The signal generator output frequency must be at least 500 kilohertz.
- o. Remove CH 2 probe tip from the test setup.

15. Check CH 1 Vertical Amplifier Bandwidth

- a. Connect CH 1 probe tip to the test setup.
- b. Turn CH 2 POS to the OFF detent and CH 1 POS to midrange.
- c. Set the CH 1 VOLTS/DIV switch to 1 m.
- d. Repeat steps 14-c through 14-n.

TRIGGER CIRCUIT ADJUSTMENT

Equipment Required

- | | |
|-----------------------------------|-------------------------------|
| 1. Low Frequency Signal Generator | 4. BNC to Banana Plug Adapter |
| 2. 42-inch 50-Ohm BNC Cable | 5. Three-inch Screwdriver |
| 3. BNC-T Connector | 6. Probe tip-to-BNC Adapter |

Control Settings

Preset instrument controls to the settings given under Preliminary Control Settings except as follows:

INTENSITY	Visible Display
SEC/DIV	.1 m
CH 1 INPUT COUPLING	DC
CH 1 POS	OFF
CH 2 POS	Midrange
Trigger SOURCE	CH 2

16. Adjust AUTO PRESET

- a. Connect the CH 2 probe tip to the output of the Low Frequency signal generator via a BNC-T connector and a probe tip-to-BNC adapter.
- b. Adjust the signal generator for a 0.2 division display of a five-kilohertz signal.
- c. CHECK-For a stable display.
- d. ADJUST-AUTO PRESET, R375 (located on the side panel) for a stable display.

17. Check Trigger Circuit Operation

- a. Set the CH 2 VOLTS/DIV switch to 1 V.
- b. Adjust the signal generator for a one-division display of a 500 kilohertz signal.
- c. Set the CH 2 VOLTS/DIV switch to 5 V.
- d. 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.
- e. Return the LEVEL/SLOPE control to the AUTO PRESET detent.
- f. Set the Trigger SOURCE switch to COMP.
- g. 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.
- h. Set the Trigger SOURCE switch to EXT and the LEVEL/SLOPE control to the AUTO PRESET detent.
- i. Connect the unused output of the BNC-T connector to the 212 EXT TRIG input via a 42-inch BNC cable and a BNC-to-banana plug adapter.
- j. 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.

HORIZONTAL SYSTEM ADJUSTMENT

Equipment Required

- | | |
|----------------------------------|-------------------------------|
| 1. Standard Amplitude Calibrator | 5. BNC-to-Banana Plug Adapter |
| 2. Time-Mark Generator | 6. Probe Tip-to-BNC Adapter |
| 3. DC Voltmeter | 7. Three-inch Screwdriver |
| 4. 42-inch 50-ohm BNC Cable | |

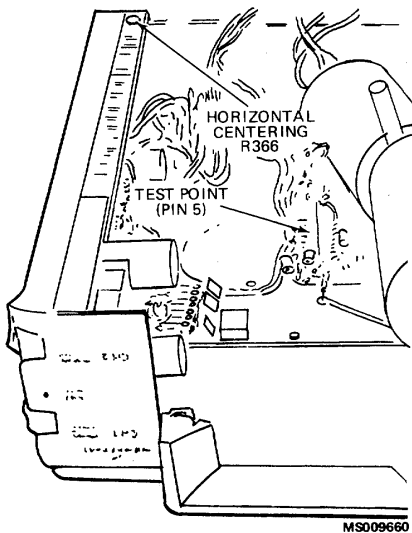
Control Settings

Preset instrument controls to the settings given under Preliminary Control Settings except as follows:

INTENSITY	Visible Display
SEC/DIV	X-Y
CH 2 POS	Midrange

18. Adjust Horizontal Centering

- Align dot to graticule center using HORIZ POS and CH 2 VERT POS control.
- Connect the DC voltmeter between pin 5 of U105 (positive meter lead to pin 5) and ground. (See Fig. 4-5 for test point and adjustment location.)



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Figure 4-5. Location of Horizontal Centering adjustment and test point.

- CHECK-For a reading of 0 volts, +0.2 volt.
- ADJUST-Horizontal Centering, R366 for a meter reading of 0 volts +0.1 V.

19. Adjust HORIZONTAL GAIN

- Connect the CH 1 probe tip to the output of the Standard Amplitude Calibrator via a probe tip-to-BNC adapter.
- Set the Standard Amplitude Calibrator for a 20 millivolts output.
- Set CH 1 INPUT COUPLING switch to DC.
- CHECK-The CRT display for two dots separated horizontally by four divisions, +0.2 division.
- ADJUST-Horiz Gain, R475 (located on the side panel) for four divisions of deflection between dots.
- Disconnect all test equipment.

20. Adjust SWEEP CALibration

- Connect the CH 1 probe tip to the output of the Time-Mark generator via a probe tip-to-BNC adapter.
- Set the SEC/DIV switch to 1 m and the Time-Mark generator for 1 millisecond markers.
- Set CH 2 POS to the OFF detent.
- Adjust the CH 1 VOLTS/DIV switch for a display approximately three divisions in amplitude.

e. CHECK-The CRT display for one time mark per division. With the second time mark aligned with the second vertical graticule line, the tenth time mark should align with the tenth vertical graticule line within 0.4 division.

f. ADJUST-SWEEP CAL, R370 (located on the side panel) for exactly eight divisions of deflection between the second and tenth time marks.

21. Check Horizontal Magnification Range

- a. Rotate the HORIZ MAG control fully clockwise.
- b. CHECK-The CRT display for at least five divisions between adjacent time marks. Five-division

spacing indicates a HORIZ MAG control range of at least 5:1.

c. Return the HORIZ MAG control to the CAL detent.

22. Check SEC/DIV Accuracy

a. CHECK-Apply the appropriate time marks and check each position of the SEC/DIV switch for proper timing over the center eight division portion of each sweep, within 0.4 division.

SECTION 5
TROUBLESHOOTING AIDS

TROUBLESHOOTING AIDS

Complete circuit diagrams are given in the rear of this manual. The component number and electrical value of each component in this instrument are shown on the diagrams along with important voltages. The portions of the circuit mounted on circuit boards are enclosed with blue lines.

Figure 3-2 shows the location of the circuit boards within the instrument along with the assembly (A) numbers. The assembly numbers are also used on the diagrams to aid in locating the boards. Pictures of the circuit boards are shown in the Diagrams section, on the back of the page opposite the circuit diagram, to aid cross-referencing between the diagrams and the circuit board pictures. Each electrical component on the boards is identified by its circuit number as well as the interconnecting wires and/or connectors.

Component Color Coding

The resistors used in this instrument are either composition resistors or precision resistors. The resistance values are color-coded on the components with EIA color-code (some precision resistors may have the value printed on the body). The color-code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes which consist of two significant figures, a multiplier, and a tolerance value (see Fig. 5-1). Precision resistors have five stripes consisting of three significant figures, a multiplier, and a tolerance value.

The capacitance values of common disc capacitors and small tubular electrolytics are marked in microfarads on the side of the component body. The molded electrolytic capacitors are color-coded in picofarads (see Fig. 5-1).

The cathode end of each glass-encased diode is indicated by a stripe, a series of stripes, or a dot.

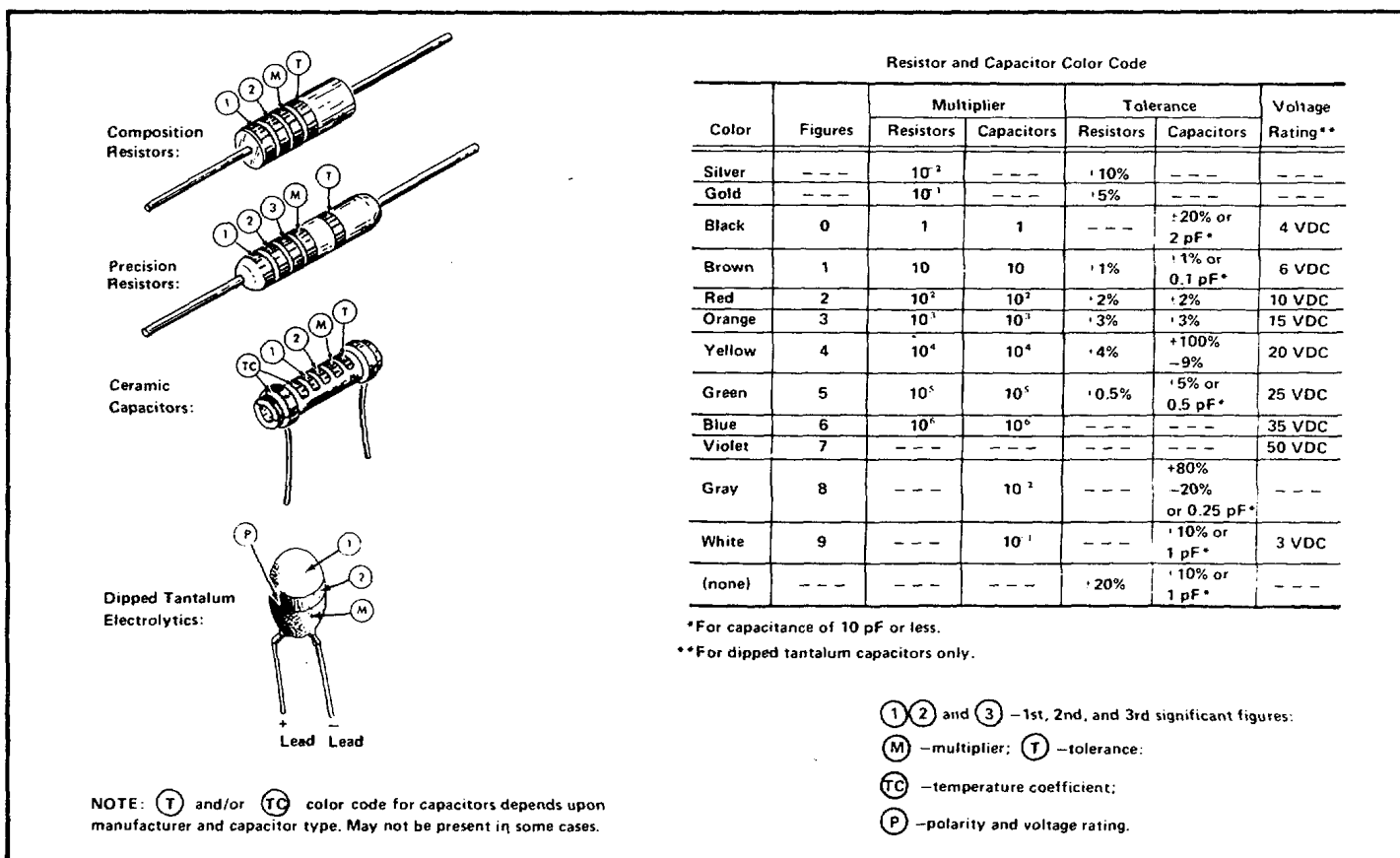


Figure 5-1. Color code for resistors, ceramic capacitors, and dipped tantalum electrolytic capacitors.

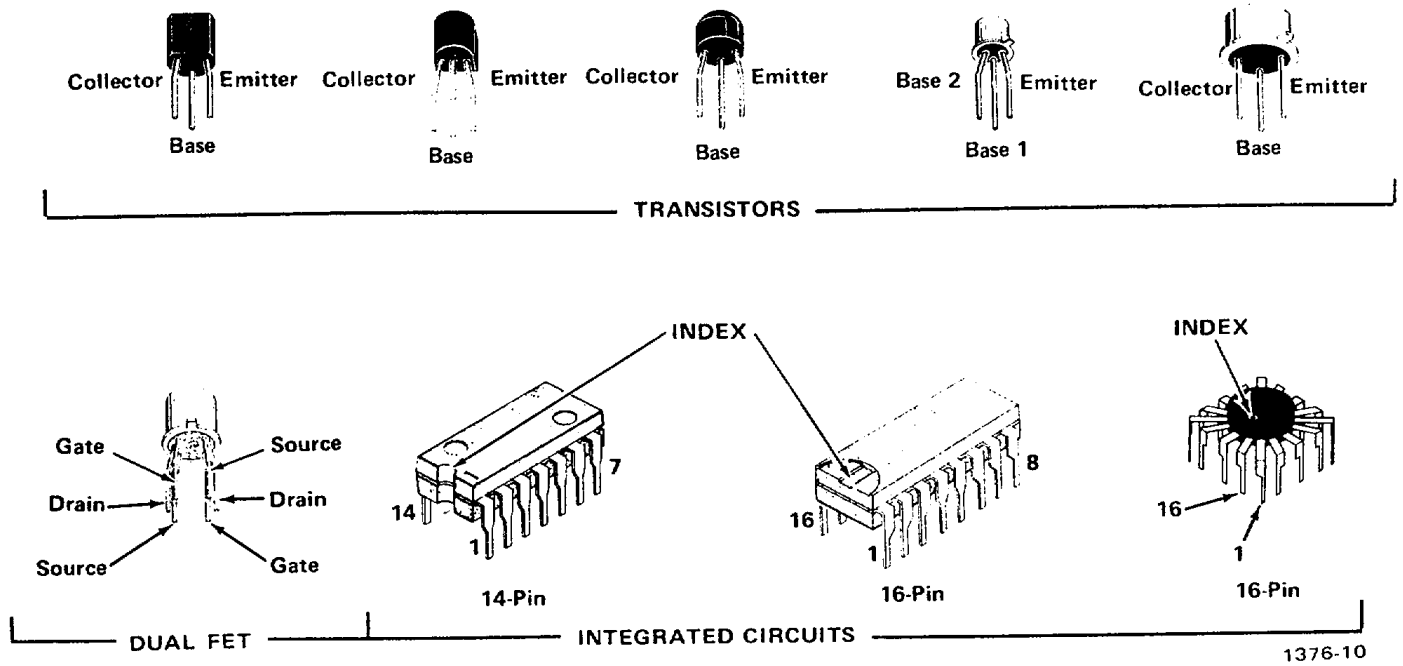


Figure 5-2. Lead configuration of semiconductors used in this instrument.

Semiconductor Lead Configuration

Figure 5-2 shows the lead configurations of the semiconductors used in this instrument.

Troubleshooting Equipment

The majority of troubleshooting to be done on the 212 can be accomplished with a 20, 000 ohms/volt VOM

such as a Triplett Model 630-NA or a Simpson Model 262. Use a dynamic transistor tester such as a TEKTRONIX Type 576 Transistor-Curve Tracer to check the semiconductor devices used in the 212. To check waveform(s) in this instrument, use a test oscilloscope with a DC to 500 kilohertz frequency response and one millivolt to 50 volts/division deflection factor.

SECTION 6 CIRCUIT DESCRIPTION

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

Block Diagram

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, position (with channel on-OFF), 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 COMPOSITE signal of the Feedback Amplifier. The Trigger Generator input signal can also be selected from the external signal applied to the EXT TRIG 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 signal is controlled by the SEC/DIV switch. The Sweep Generator circuit also produces an unblanking gate signal coincident with the sawtooth waveform. This gate signal unblanks the CRT to permit display presentation.

The output of U370 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 Power Supply and CRT circuits provide all the voltages necessary for operation of this instrument.

Circuit Operation

In the following description of the electrical operation and relationship of the circuits in the 212, circuitry commonly used by TEKTRONIX is only briefly explained. If more information is desired on the commonly used circuits, refer to the following textbooks:

Phillip Cutler, "Semiconductor Circuit Analysis", McGraw-Hill, New York, 1964.

Lloyd P. Hunter (Ed.), "Handbook of Semiconductor Electronics", second edition, McGraw-Hill, New York, 1962.

Jacob Millman and Herbert Taub, "Pulse, Digital, and Switching Waveforms", McGraw-Hill, New York, 1965.

Vertical Input Amplifiers

Input signals for vertical deflection of the CRT of the 212 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 (with channel on-OFF) for the appropriate channel. Figure 6-1 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 .1 V/DIV, the correct deflection factor is achieved by changing the gain of Feedback Amplifiers U320-A and U320-B. In switch

positions .1 V/DIV and up, precision attenuators are used (in addition to changing the gain of U320-A and U320-B) to achieve the correct deflection factors. When the VOLTS/DIV VAR control is rotated, the signal is attenuated across R320 or R420. This offers variable (uncalibrated) deflection factors between the calibrated settings of the VOLTS/DIV switch. The STEP ATTEN BALANCE adjustments (R315 and R417) control the trace shift when switching between deflection factors.

The 212 can be operated single trace by turning either vertical POSITION control to the OFF detent; this disables that channel in the last feedback stage of the Input Amplifier through the operation of the Vertical Mode Multivibrator U440. The CH 2 trigger signal is present regardless of the CH 2 POS control setting. In the dual-trace mode, the instrument will automatically chop or alternate, depending upon the sweep rate.

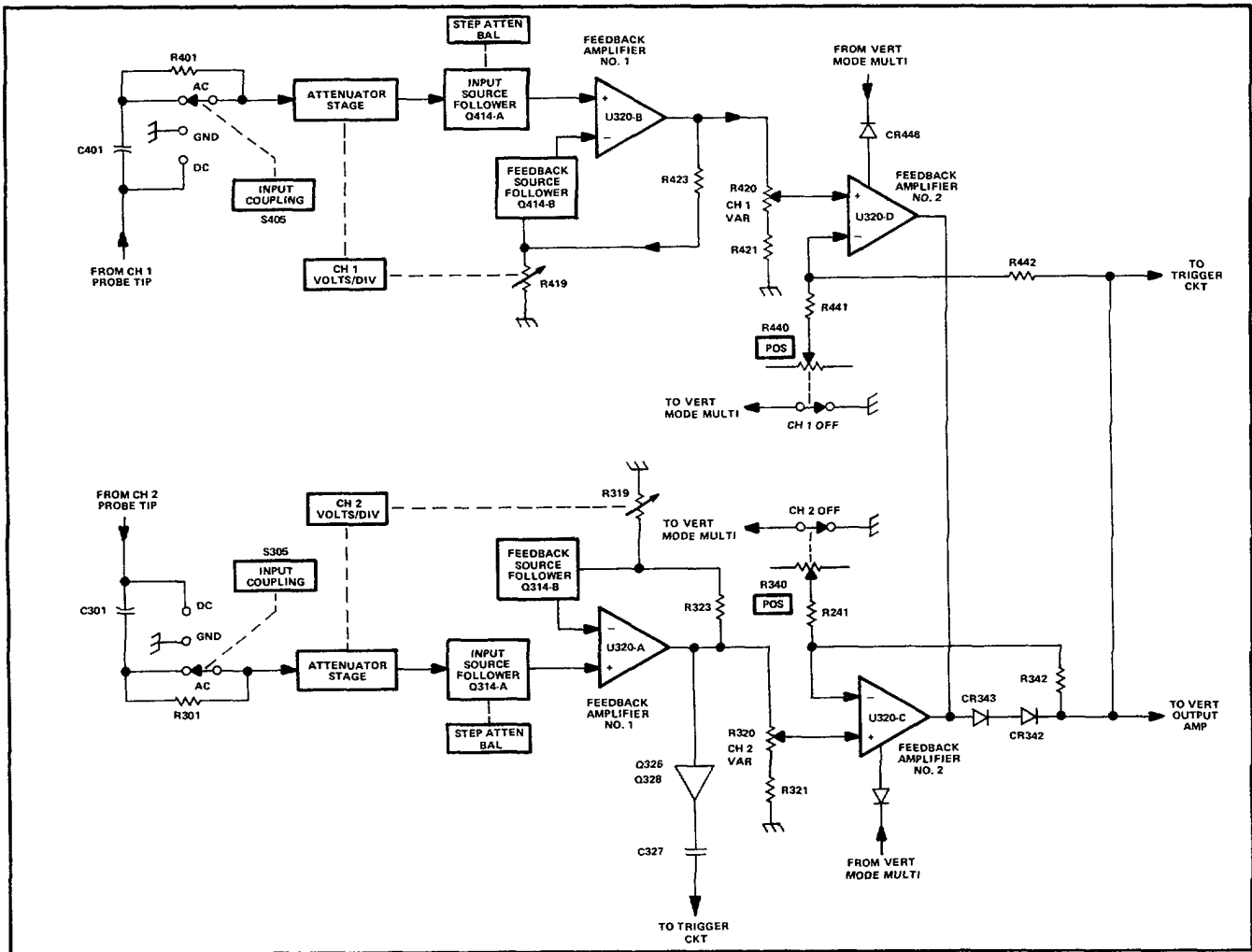


Figure 6-1. Vertical input amplifiers detailed block diagram.

Vertical and Horizontal Output Amplifiers

The Vertical and Horizontal Output Amplifiers provide the final amplification for the deflection signals. Figure 6-2 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, U105-A and U105-B, to convert the signal into

push-pull output signals. The Vertical Paraphase Amplifier stage contains the VERT GAIN adjustment (R470) that sets the over-all 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 (R475), the HORIZ MAG control (R476), and the Horizontal POSition control (R480). The output signals from the Paraphase Amplifiers receive final amplification in the common base Output Amplifier stages.

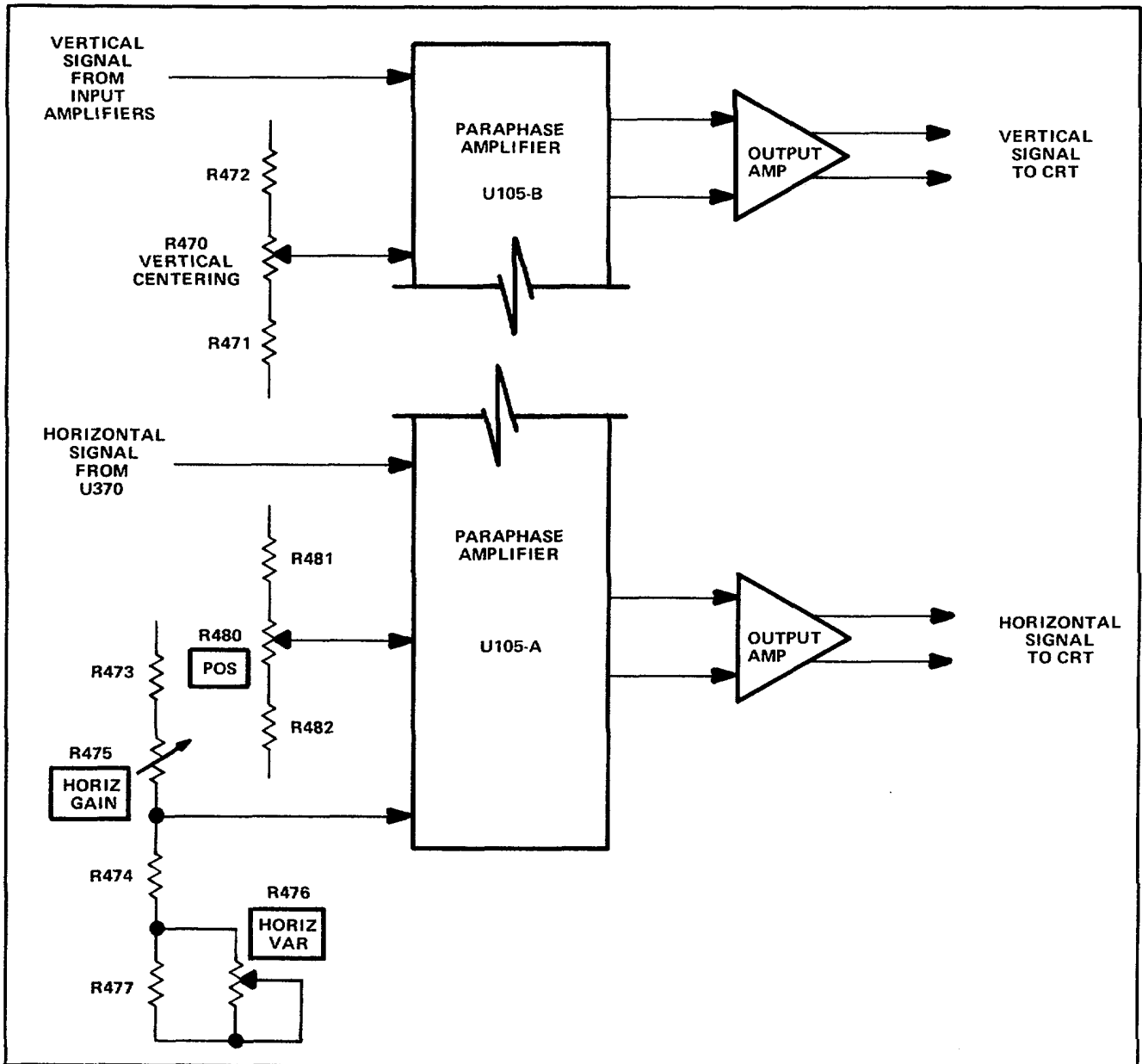


Figure 6-2. Vertical and Horizontal output amplifiers detailed block diagram.

Trigger/Sweep 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 COMPOSITE signal from the input of the Vertical Output Amplifier. The Trigger portion can also select signals from an external signal applied to the EXT TRIG banana jack. Controls are provided in this circuit to select trigger level, slope, and source. Figure 6-3 shows a detailed block diagram of the Trigger/Sweep Generator circuit. A schematic of this circuit is on diagram 2.

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 slope of the sawtooth voltage is controlled by the setting of the SEC/DIV switch. U370 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 for alternate switching between channels. In the X-Y position, the Sweep Generator section becomes a feedback amplifier to amplify the signal applied to the probe tip of CH 1.

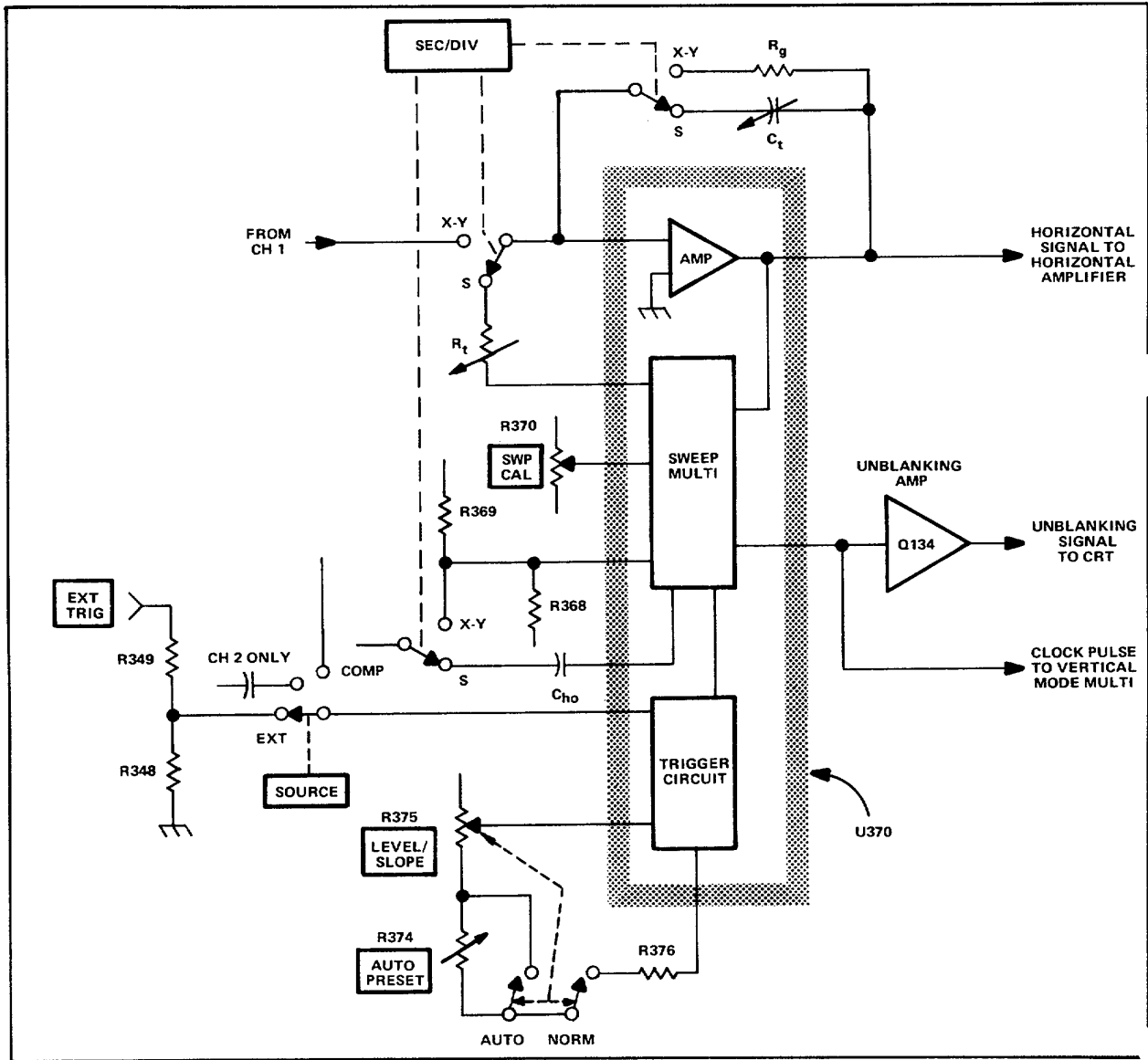


Figure 6-3. Trigger/Sweep Generator detailed block diagram.

Power Supply

The Power Supply provides the power necessary to operate this instrument or, if the instrument is turned off, to recharge the batteries. Figure 6-4 shows a detailed block diagram of this circuit. A schematic of this circuit is shown on diagram 4.

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 recharge the internal batteries. The batteries act as a large filter capacitor for the Input Rectifier in the AC line mode of TM 9-6625-646-14&P 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 212 is operating from line voltage or adequately charged batteries. When about 10 minutes of operating time remains, the battery charge drops to a point where DS310 will extinguish. The Discharge Protection circuit (Q231, Q235) prevents the Converter Multivibrator (Q242, Q249) from functioning, and thereby overdischarging the batteries, when the charge level of the batteries falls below approximately 10 volts. The Converter Multivibrator changes DC into AC, which is applied across T250 and then rectified into the appropriate DC voltages in the Rectifier circuit.

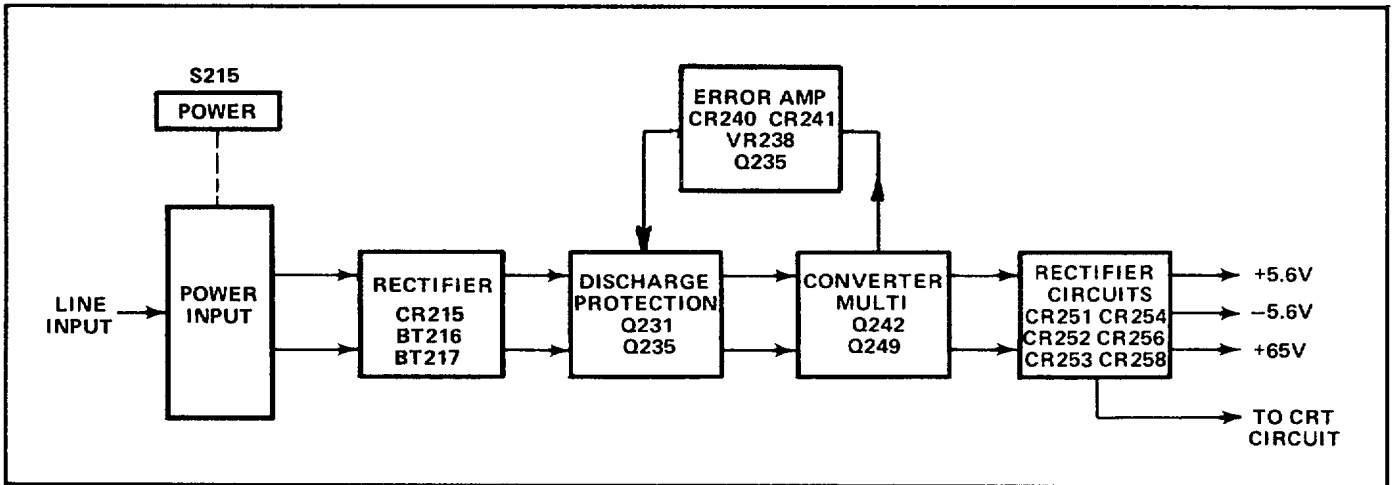


Figure 6-4. Power Supply detailed block diagram.

CRT Circuit

The CRT circuit provides the high voltage and control circuits necessary for operation of the cathode-ray tube (CRT). Figure 6-5 shows a detailed block diagram of the CRT circuit. A schematic of this circuit is given on diagram 3.

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 the power transformer. Display intensity and focus are controlled by R395 and R398 respectively. The Trace Rotation adjustment controls the current through L300 and affects both the vertical and horizontal alignment of the CRT beam.

Rectifiers CR261 through CR268 provide the negative

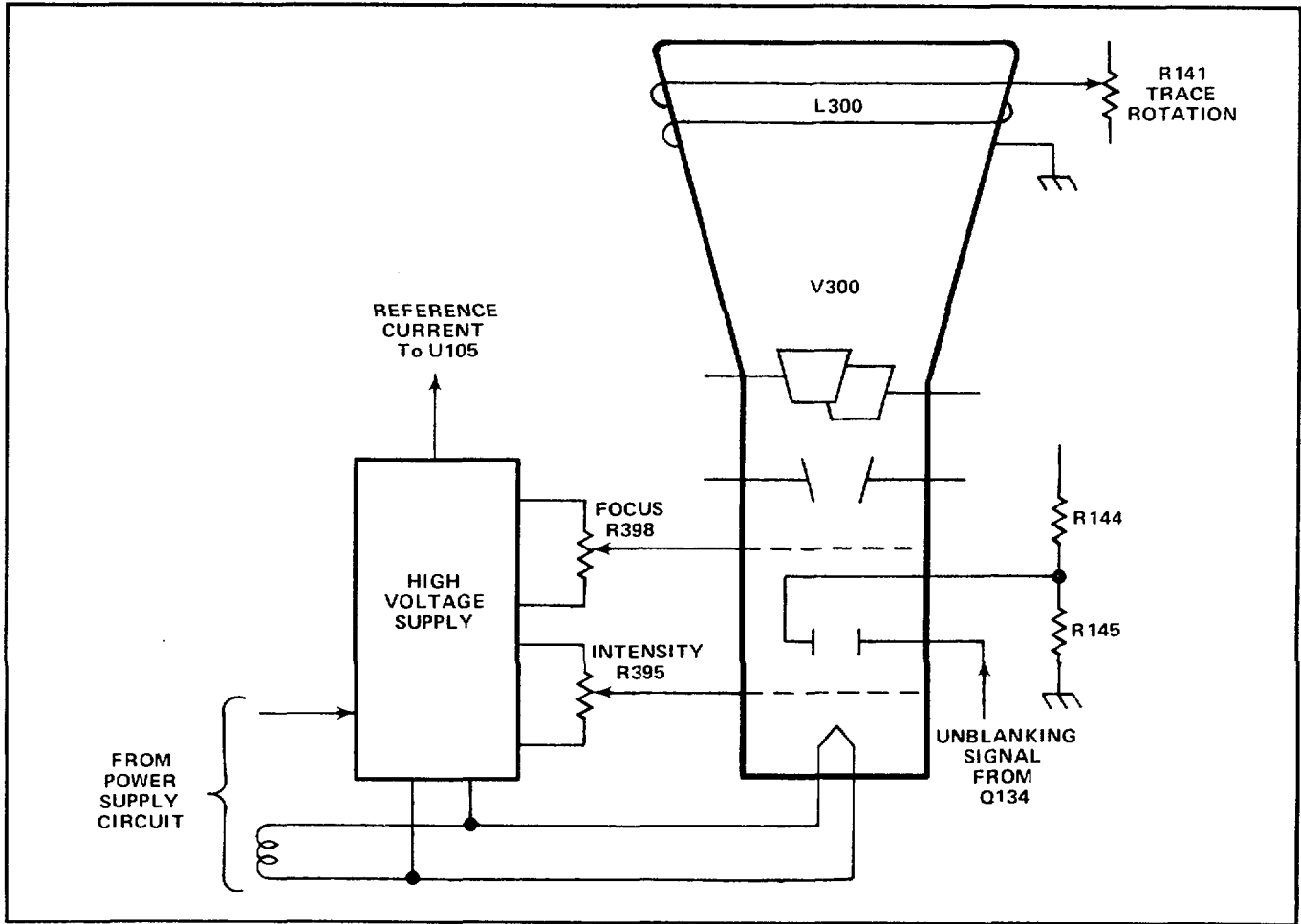


Figure 6-5. CRT Circuit detailed block diagram.

SECTION 7 CORRECTIVE MAINTENANCE

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical part replacements for the 212 can be obtained through your local TEKTRON IX Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the instrument. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect the instruments performance.

Special Parts. In addition to the standard electronic components, some special components are used in the 212. 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. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local TEKTRONIX Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., include the following information:

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

Component Replacement

WARNING

Disconnect the instrument from any power source before replacing components.

Circuit Board Replacement. If a circuit board is damaged beyond repair, the entire assembly including all soldered-on components can be replaced. Part numbers are given in the Mechanical Parts List for the completely wired board.

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

Replacement semiconductors should be of the original type or a direct replacement. Figure 5-2 shows the lead configurations of the semiconductors used in this instrument. Some plastic case transistors have lead configurations which do not agree with those shown here. If a replacement transistor is made by a manufacturer other than that of the original, check the replacement manufacturer's basing diagram for correct basing. All transistor sockets in the 212 are wired for the basing used for metal-cased transistors.

When re-inserting an integrated circuit, key the socket's index with that of the integrated circuit's. Failure to do so can result in damaged 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 four capacitors (C204, C215, C210, and C212) in the instruments power input circuitry. Refer to Table 7-1 for the correct values of capacitance for three of the more commonly used line voltage/line frequency combinations.

NOTE

Power line for this instrument must be sinusoidal.

TABLE 7-1.
Power Supply Capacitors

Power Line	C210	Capacitor Values C212	C204 & C215
110 to 126 VAC 58 to 62 Hz	1.7 μ f, \pm 10% 200 V DC TEKTRONIX 285-0924-00	3.3 μ f, \pm 10% 200 V DC TEKTRONIX Part No. 285-0925-00	No change Part No.
90 to 110 VAC 48 to 52 Hz (Option 2)	2 μ f, \pm 10% 200 V DC TEKTRONIX 285-0934-00	4.0 μ f, \pm 10% 200 V DC TEKTRONIX Part No. 285-0935-00	No change Part No.
220 to 250 VAC 48 to 52 Hz (Option 1)	1 μ f, \pm 10% 400 V DC TEKTRONIX Part No. 285-0932-00	2.0 μ f, \pm 10% 400 V DC TEKTRONIX Part No. 285-0933-00	.001 μ f, 3 k V DC TEKTRONIX Part No. 283-0279-00

If the instrument is to be operated on some line voltage/line frequency combination other than one of the above three examples, refer to Fig. 7-1 and Fig. 7-2 to select the correct values of capacitance for C210 and C212. For example, if the instrument is to be operated on a 60 hertz line that will vary in voltage from 210 VAC to 230 VAC, refer to Fig. 7-2. Trace across the graph on the line representing 210 VAC to the point where that line crosses the first curve. This point represents the minimum values of capacitance that can be used for correct operation. Now trace across the graph on the line representing 230 VAC to the point where that line crosses the second curve. This point represents the maximum values of capacitance that can be used for correct operation. Read off the numbers directly under these points at the bottom of the graph to find the value of capacitance required for C210. Read off the numbers directly above these points for the value of capacitance required for C212. Thus, C210 can be a value between 0.75 μ f and 0.92 μ f and C212 can be a value between 1.54 μ f and 1.87 μ f. The voltage ratings of these capacitors should be at least 1.414 times the RMS value of the applied line voltage.

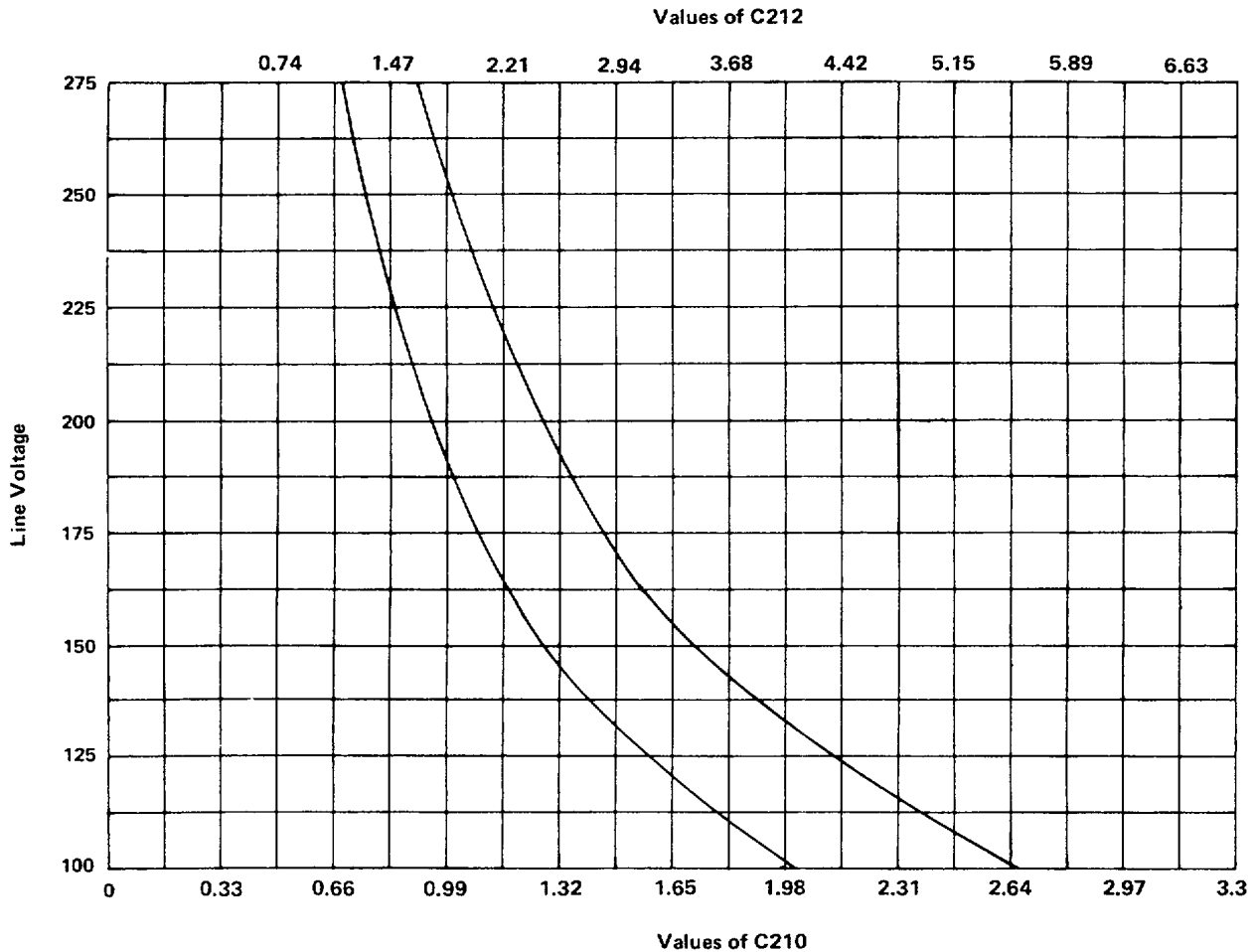


Figure 7-1. Selecting C210 and C212 capacitance values for 48 to 52 Hz operation.

When replacing C210 and C212, be certain the foam pad is under the replacement capacitor.

Rotary Switches. Individual parts of the VOLTS/DIV and SEC/DIV rotary switches are replaceable. Refer to the Parts List for the applicable part numbers for replacement parts.

Selectable Components. Resistor R388 value is selected for a switching unblanked trace height of no more than 1.5 divisions for each channel and minimum intensity change when changing sweep speed from 5 ms to 2 ms. The value of R388 is selected from a range of 270, 300, or 330 ohms as follows:

1. Install a 270 ohm resistor for R388, turn the 212 on, set SEC/DIV to .5 s, and set INTENSITY to maximum (fully clockwise).

2. The traces will show as dots. Set CH 1 POS to place the CH 1 dot to the top horizontal graticule line and set CH 2 POS to place the CH 2 dot to the bottom horizontal graticule line.

3. Check that no more than 1.5 divisions of unblanked trace extends vertically from each dot.

4. If each unblanked trace exceeds 1.5 vertical divisions, turn off the 212, install the next larger size for R388, recheck and repeat steps 2 through 4 until unblanked traces are no more than 1.5 divisions high while maintaining minimum intensity change when switching sweep speed from 5 ms to 2 ms.

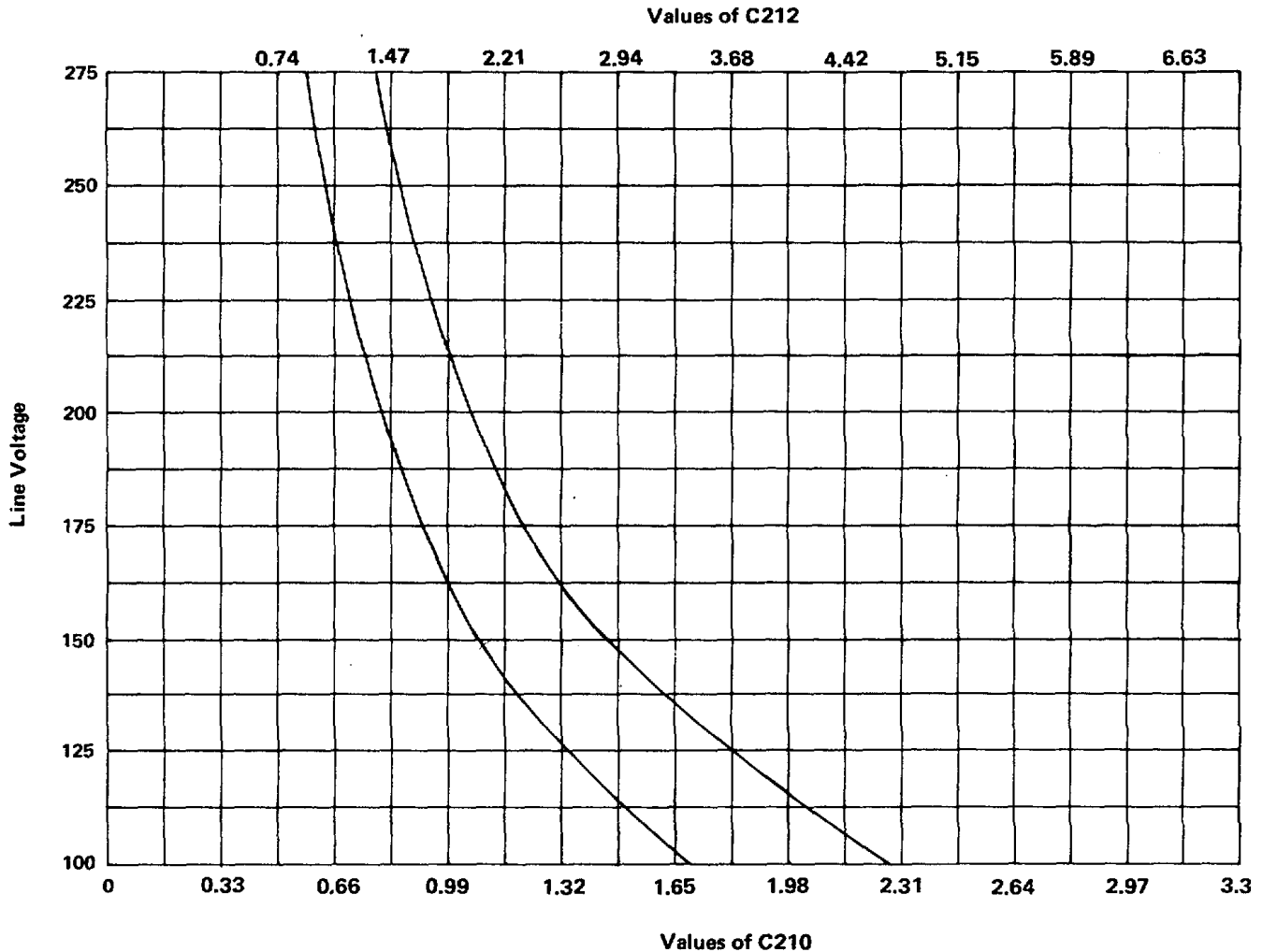


Figure 7-2. Selecting C210 and C212 capacitance values for 58 to 62 Hz operation.

Repackaging For Shipment

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

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

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

The carton test strength for your instrument is 200 pounds.

**SECTION 8
PARTS LISTS, DIAGRAMS AND
CIRCUIT BOARD ILLUSTRATIONS**

Symbols and Reference Designators

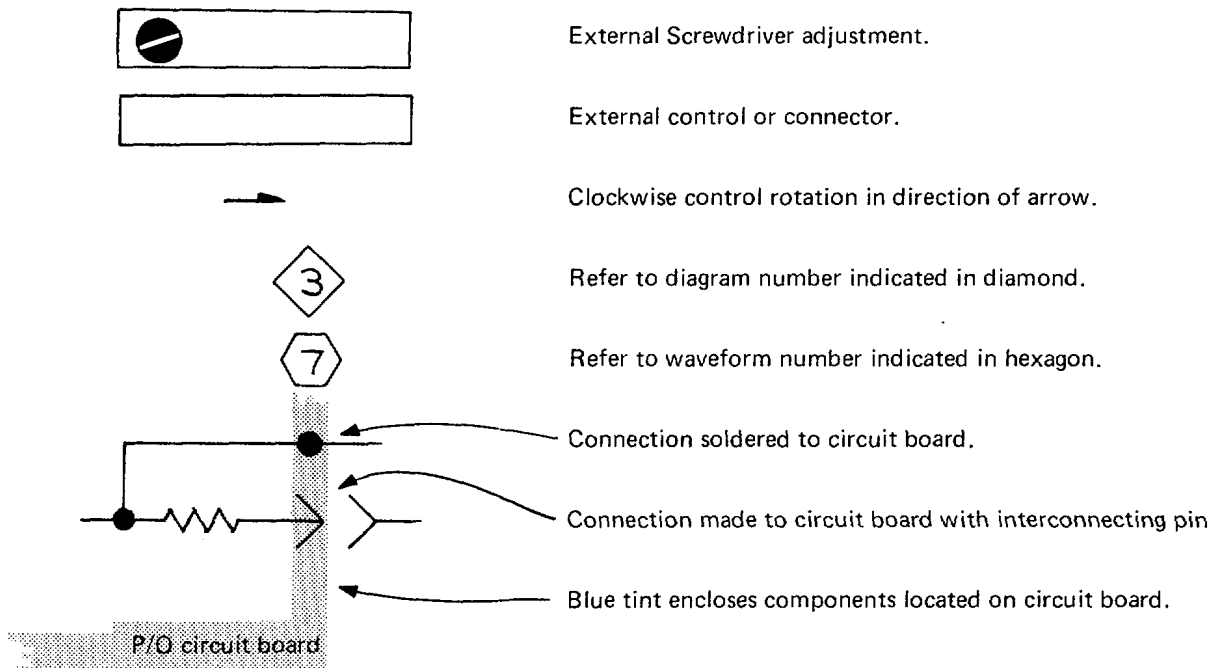
Electrical components shown on the diagrams are in the following units unless noted otherwise:

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

Symbols used on the diagrams are based on USA Standard Y32.2-1967.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



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.)	LR	Inductor/resistor combination
AT	Attenuator, fixed or variable	M	Meter
B	Motor	Q	Transistor or silicon-controlled rectifier
BT	Battery	P	Connector, movable portion
C	Capacitor, fixed or variable	R	Resistor, fixed or variable
CR	Diode, signal or rectifier	RT	Thermistor
DL	Delay line	S	Switch
DS	Indicating device (lamp)	T	Transformer
F	Fuse	TP	Test point
FL	Filter	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
H	Heat dissipating device (heat sink, heat radiator, etc.)	V	Electron tube
HR	Heater	VR	Voltage regulator (zener diode, etc.)
J	Connector, stationary portion	Y	Crystal
K	Relay		
L	Inductor, fixed or variable		

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
03888	KDI PYROFILM CORPORATION	60 S JEFFERSON ROAD	WHIPPANY, NJ 07981
04099	CAPCO, INC.	FORESIGHT INDUSTRIAL PARK, PO BOX 2164	GRAND JUNCTION, CO 81501
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
15238	ITT SEMICONDUCTORS, A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP.	P.O. BOX 168, 500 BROADWAY	LAWRENCE, MA 01841
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
71450	CTS CORP.	905 N. WEST BLVD	ELKHART, IN 46514
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
76493	BELL INDUSTRIES, INC., MILLER, J. W., DIV.	19070 REYES AVE., P O BOX 5825	COMPTON, CA 90224
79727	C-W INDUSTRIES	550 DAVISVILLE RD., P O BOX 96	WARMINSTER, PA 18974
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80031	ELECTRA-MIDLAND CORP., MEPCO DIV.	22 COLUMBIA ROAD	MORRISTOWN, NJ 07960
84411	TRW ELECTRONIC COMPONENTS, TRW CAPACITORS	112 W. FIRST ST.	OGALLALA, NE 69153
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET	INDIANAPOLIS, IN 46206
	91637 DALE ELECTRONICS, INC.	P.O. BOX 372	COLUMBUS, NE 68601
		P.O. BOX 609	

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-2353-00	B010100	B056848	CKT BOARD ASSY:INPUT	80009	670-2353-00
A1	670-2353-02	B056849	B079999	CKT BOARD ASSY:INPUT	80009	670-2353-02
A1	670-2353-04	B080000	B089999	CKT BOARD ASSY:INPUT	80009	670-2353-04
A1	670-2353-06	B090000		CKT BOARD ASSY:INPUT	80009	670-2353-06
A2	670-1505-01			CKT BOARD ASSY:AMPLIFIER	80009	670-1505-01
A3	670-2405-00	B010100	B039999	CKT BOARD ASSY:POWER SUPPLY	80009	670-2405-00
A3	670-2405-11	B040000		CKT BOARD ASSY:POWER SUPPLY	80009	670-2405-11
A3	670-2405-21			CKT BOARD ASSY:POWER SUPPLY (OPTION 1 ONLY)	80009	670-2405-21
A3	670-2405-31			CKT BOARD ASSY:POWER SUPPLY (OPTION 2 ONLY)	80009	670-2405-31
BT216 } BT217 }	146-0031-00 146-0031-00	B010100 B010100	B056119 B056119	BATTERY ASSY:2 SETS OF 5 BATTERY ASSY:2 SETS OF 5 (BT216, BT217 SEE MPL FOR SUB-PARTS.)	80009 80009	146-0031-00 146-0031-00
BT216 } BT217 }	146-0033-00 146-0033-00	B056120 B056120		BATTERY ASSY:2 SETS OF 5 BATTERY ASSY:2 SETS OF 5 (BT216, BT217 SEE MPL FOR SUB-PARTS.)	80009 80009	146-0033-00 146-0033-00
C101	283-0111-00			CAP., FXD, CER DI:0.IUF, 20%, 50V	72982	8121-N088Z5U104M
C103	283-0111-00			CAP., FXD, CER DI:0.1UF, 20X, 50V	72982	8121-N088Z5U104M
C104	281-0591-00	B010100	B057908	CAP., FXD, CER DI:5600PF, 20%, 200V	72982	393001%5V0562Z
C104	283-0180-00	B057909		CAP., FXD, CER DI:5600PF, 20%, 200V	72982	8121N204 E 562M
C113	283-0111-00			CAP., FXD, CER DI:0.IUF, 20%, 50V	72982	8121-N088Z5U104M
C115	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C125	290-0524-00			CAP., FXD, ELCTLT:4.7UF, 20%, 10V	90201	TDC475MO10EL
C127	290-0524-00			CAP., FXD, ELCTLT:4.7UF, 20%, 10V	90201	TDC475M01OEL
C129	290-0534-00			CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1
C145	290-0522-00			CAP., FXD, ELCTLT:IUF, 20%, 50V	56289	196D105X0050HA1
C150	281-0591-00	B010100	B057908	CAP., FXD, CER DI:5600PF, 20%, 200V	72982	393001%5V0562Z
C150	283-0180-00	B057909		CAP., FXD, CER DI:5600PF, 20%, 200V	72982	8121N204 E 562M
C153	281-0591-00	B010100	B057908	CAP., FXD, CER DI:5600PF, 20%, 200V	72982	393001%5V0562Z
C153	283-0180-00	B057909		CAP., FXD, CER DI:5600PF, 20%, 200V	72982	8121N204 E 562M
C204	283-0280-00	BO010100	B039999	CAP., FXD, CER DI:2200PF, 10%, 2000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE AND (FREQUENCY. SEE OPTION INFORMATION.)	56289	562CBA202EH222KA
C204	283-0263-00	B040000		CAP., FXD, CER DI:0.0022UF, 20%, 3000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE AND (FREQUENCY. SEE OPTION INFORMATION.)	56289	33C319
C204	283-0279-00			CAP., FXD, CER DI:0.OOIUF, 20%, 3000V (OPTION 1 ONLY)	56289	55C153
C206	283-0057-00	B010100	B042499	CAP., FXD, CER DI:0.1UF, +80-20%, 200V	56289	274C10
C206	285-1065-00	B042500		CAP., FXD, PLSTC:O.O1UF, 20%, 600V	14752	230B1F103
C207	283-0057-00	B010100	B042499	CAP., FXD, CER DI:0.1UF, +80-20%, 200V	56289	274C10
C207	285-1065-00	B042500		CAP., FXD, PLSTC:O.O1UF, 20%, 600V	14752	230BIF103
C210	285-0924-00			CAP., FXD, PLSTC:1.7UF, 10%, 200V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE AND (FREQUENCY. SEE OPTION INFORMATION.)	04099	C703C175K
C210	285-0932-00			CAP., FXD, PLSTC:IUF, 10%, 400V 14752 A-1478 (OPTION 1 ONLY)		
C210	285-0934-00			CAP., FXD, PLSTC:2.2UF, 10%, 200V (OPTION 2 ONLY)	56289	430P238
C212	285-0925-00			CAP., FXD, PLSTC:3.3UF, 10%, 200V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE AND (FREQUENCY. SEE OPTION INFORMATION.)	84411	TEK121-33592
C212	285-0933-00			CAP., FXD, PLSTC:2UF, 10%, 400V 14752 A-1480 (OPTION 1 ONLY)		
C212	285-0935-00			CAP., FXD, PLSTC:4.4UF, 10%, 200V (OPTION 2 ONLY)	56289	430P179

Ckt No.	Tektronix		Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
	Part No.	Eff	Dscont				
C215	283-0280-00	B010100	B039999		CAP., FXD, CER DI:2200PF, 10%, 2000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE AND (FREQUENCY. SEE OPTION INFORMATION.)	56289	562CBA202EH222KA
C215	283-0263-00	B040000			CAP., FXD, CER DI:0.0022UF, 20%, 3000V (NOMINAL VALUE, SELECTED FOR LINE VOLTAGE AND (FREQUENCY. SEE OPTION INFORMATION.)	56289	33C319
C215	283-0279-00				CAP., FXD, CER DI:0.001UF, 20%, 3000V (OPTION 1 ONLY)	56289	55C153
C216	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C236	283-0001-00				CAP., FXD, CER DI:0.005UF, +100-0%, 500V	72982	831-559E502P
C238	290-0534-00				CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1
C239	290-0283-00				CAP., FXD, ELCTLT:0.47UF, 10%, 35V	56289	162D474X9035BC2
C241	283-0028-00				CAP., FXD, CER DI:0.0022UF, 20%, 50V	56289	19C606
C247	290-0519-00				CAP., FXD, ELCTLT:100UF, 20%, 20V	90201	TDC107M020WLD
C251	290-0535-01				CAP., FXD, ELCTLT:33UF, 20%, 100V	56289	196D336X0010KA1
C253	290-0535-01				CAP., FXD, ELCTLT:33UF, 20%, 10V	56289	196D336X0010KAI
C256	290-0517-00				CAP., FXD, ELCTLT:6.8UF, 20%, 35V	56289	196D685X0035KA1
C257	283-0057-00				CAP., FXD, CER DI:0.1UF, +80-20%, 200V	56289	274C10
C258	290-0517-00				CAP., FXD, ELCTLT:6.8UF, 20%, 35V	56289	196D685X0035KA1
C260	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C261	283-0177-00				CAP., FXD, CER DI:1UF, +80-20%, 25V	56289	273C5
C262	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C263	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C264	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C265	283-0068-00				CAP., FXD, CER DT:0.01UF, +100-0%, 500V	56289	19C241
C266	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C267	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C268	283-0068-00				CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241
C269	283-0001-00				CAP., FXD, CER DI:0.005F, +100-0%, 500V	72982	831-559E502P
C273	283-0105-00				CAP., FXD, CER DI:0.01UF, +80-20%, 2000V	56289	41C316
C301	285-0697-06				CAP., FXD, PLSTC:0.1UF, +5-15%, 600V	80009	285-0697-06
C306B	307-0307-00				NTWK, HYB CKT: 80009 307-0307-00 (FURNISHED AS A UNIT WITH R306A-F)		
C306D							
C306F							
C307	281-0178-00				CAP., VAR, PLSTC:1-3.5PF, 500V	80031	2805D013R5BH02FO
C308	281-0178-00				CAP., VAR, PLSTC:1-3.SPF, 500V	80031	2805D013R5BH02FO
C309	281-0178-00				CAP., VAR, PLSTC:1-3.5PF, 500V	80031	2805D013R5BH02FO
C313	283-0000-00				CAP., FXD, CER DI:0.00t1UF, +100-0%, 500V	72982	831-516E102P
C321	283-0168-00				CAP., FXD, CER DI:12PF, 5%, 100V	72982	8101B121COG0120J
C323	281-0613-00	B010100	B010167		CAP., FXD, CER DI:10PF, +/-1PF, 200V	72982	374001COG100F
C323	281-0645-00	B010168	B053776		CAP., FXD, CER DI:8.2PF, +/-0.25PF, 500V	72982	374018COH0829C
C323	281-0645-00	B053777			CAP., FXD, CER DI:8.2PF, +/-0.25PF, 500V	72982	374018COH0829C
C327	283-0111-00				CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088ZSU104I
C329	290-0530-00				CAP., FXD, ELCTLT:68UF, 20%, 6V	90201	TDC686M006NLF
C348	283-0084-00				CAP., FXD, CER DI:270PF, 5%, 100OV	72982	838-533B271J
C349	283-0076-00				CAP., FXD, CER DI:27PF, 110%, 500V	56289	40C287A2
C353	290-0524-00				CAP., FXD, ELCTLT:4.7UJF, 20%, 10V	90201	TDC475MOIOEL
C362	295-0144-00				CAP SET, MATCHED:1UF, 0.001UF, MATCHED (C362, C363, C364, INDIVIDUAL TIMING CAPACITORS IN THIS ASSEMBLY MUST BE ORDERED BY THE 9-DIGIT PART NUMBER, LETTER SUFFIX PRINTED ON THE TIMING CAPACITOR TO BE REPLACED. THE LETTER SUFFIX AND TOLERANCE SHOULD BE THE SAME FOR ALL THE TIMING CAPACITORS IN THE ASSEMBLY. EXAMPLE: 285-XXXX-XX F)	84411	TEK101-0009R5
C363							
C364							

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C368	283-0204-00			CAP., FXD, CER DI:0.01UF, 20%, 50V	72982	8121N061%5U0103M
C370	283-0251-00	XB056849		CAP., FXD, CER DI:87 PF, 5%, 100V	72982	8121B145COG0870J
C371	290-0523-00			CAP., FXD, ELCTLT:2.2UF, 20%, 20V	56289	196D225X0020HA1
C372	-----			(PART OF CIRCUIT BOARD)		
C373	283-0068-00			CAP., FXD, CER DI:0.001UF, +100-0%, 500V	56289	19C241
C374	290-0523-00			CAP., FXD, ELCTLT:2.2UF, 20%, 20V	56289	196D225X0020HA1
C376	290-0534-00		CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1	
C378	283-0068-00		CAP., FXD, CER DI:0.01UF, +100-0%, 500V	56289	19C241	
C381	283-0000-00		CAP., FXD, CER DI:0.001UF, +100-0%, 500V	72982	831-516E102P	
C382	283-0000-00		CAP., FXD, CER DI:0.001UF, +100-0%, 500V	72982	831-516E102P	
C383	283-0111-00		CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-NO88Z5U104M	
C385	283-0103-00		CAP., FXD, CER DI:180PF, 5%, 500V	56289	40C638	
C392	283-0087-00		CAP., FXD, CER DI:300PF, 10%, 1000V	56289	403637	
C395	283-0013-00		CAP., FXD, CER DI:0.01UF, +100-0%, 1000V	56289	33C29A7	
C401	285-0697-06		CAP., FXD, PLSTC:0.1UF, +5-15%, 600V	80009	285-0697-06	
C406B	307-0307-00			NTWK, HYB CKT: 80009 307-0307-00 (FURNISHED AS A UNIT WITH R406A-F)		
C406D						
C406F						
C407	281-0178-00			CAP., VAR, PLSTC:1-3.5PF, 500V	80031	2805D013R5BH02FO
C408	281-0178-00			CAP., VAR, PLSTC:1-3.5PF, 500V	80031	2805D013R5BH02FO
C409	281-0178-00			CAP., VAR, PLSTC:1-3.5PF, 500V	80031	2805D013R5BH02FO
C413	283-0000-00			CAP., FXD, CER DI:0.001UF, +100-0%, 500V	72982	831-516E102P
C421	283-0168-00			CAP., FXD, CER DI:12PF, 5%, 100V	72982	8101B121COG0120J
C423	281-0645-00	B010100	B010167	CAP., FXD, CER DI:8.2PF, +/-0.25PF, 500V	72982	374018COH0829C
C423	281-0612-00	B010168	B053776	CAP., FXD, CER DI:5.6PF, +/-0.5PF, 500V	72982	374-001COH0569D
C423	281-0612-00	B053777		CAP., FXD, CER DI:5.6PF, +/-0.5PF, 500V	72982	374-001COH0569D
C453	290-0524-00			CAP., FXD, ELCTLT:4.7UF, 20%, 10V	90201	TDC475MO10EL
C491	290-0535-01			CAP., FXD, ELCTLT:33UF, 20%, 10V	56289	196D336X0010KAI
C493	290-0535-01			CAP., FXD, ELCTLT:33UF, 20%, 10V	56289	196D336X0001KA1
CR215	152-0488-00			SEMICONV DEVICE:SILICON, 200V, 1500MA	04713	3N55 FAMILY
CR240	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR241	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR251	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR252	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR253	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR254	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR156	152-0333-00			SEMICONV DEVICE:SILICON, 55V, 200MA	07263	FDH-6012
CR258	152-0333-00			SEMICONV DEVICE:SILICON, 55V, 200MA	07263	FDH-6012
CR261	152-0107-00	B010100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR261	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR262	152-0107-00	B010100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR262	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR263	152-0107-00	B010100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR263	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR264	152-0107-00	B010100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR364	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR265	152-0107-00	B010100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR265	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR266	152-0107-00	B010100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR266	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR267	152-0107-00	B810100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR267	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR268	152-0107-00	B010100	B039999	SEMICONV DEVICE:SILICON, 400V, 400MA	01295	G727
CR268	152-0107-03	B040000		SEMICONV DEVICE:SILICON, 375V, 400MA, SEL	80009	152-0107-03
CR313	152-0246-00			SEMICONV DEVICE:SW, SI, 40V, 200MA	03508	DE140
CR342	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR343	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R

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CR346	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR370	152-0141-02	XB030000		SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR389	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
CR413	152-0246-00			SEMICONV DEVICE:SW, SI, 40V, 200MA	03508	DE140
CR446	152-0141-02			SEMICONV DEVICE:SILICON, 30V, 150MA	01295	1N4152R
DS310	150-1004-02	B010100	B055576	LT EMITTING DIO:RED, 15MA, W/HOLDER & LEADS	80009	150-1004-02
DS310	150-1031-01	B055577		LAMP, LED:W/DIODE, WIRE AND CONN	80009	150-1031-01
DS320	150-1061-00	XB080000		LT EMITTING DIO:RED, 660NM, 50MA MAX	27014	SJ62775
DS420	150-1061-00	XB080000		LT EMITTING DIO:RED, 660NM, 50MA MAX	27014	SJ62775
F201	159-0103-00	B010100	B029999	FUSE, CARTRIDGE:0.4A, 125V, 0.25SEC, 1.0 LEAD	75915	279.400
	-----			(USED FOR ALL LINE VOLT & FREQ APPLICATIONS.)		
F201	159-0121-00	B030000		FUSE, CARTRIDGE:DIN, 0.4A, 250V, 5 SEC	75915	212.400
	-----			(USED FOR ALL LINE VOLT & FREQ APPLICATIONS.)		
L108	108-0691-00			COIL, RF:1.8MH	76493	02279
L111	108-0691-00			COIL, RF:1.8MH	76493	02279
L257	108-0654-00			COIL, RF:2.2MH	76493	01872
L300	-----			(FURNISHED AS A UNIT WITH CRT.)		
Q107	153-0601-00	B010100	B019999	SEMICONV DEVICE:2N3565, SEL	80009	153-0601-00
Q107	151-0432-00	B020000		TRANSISTOR:SILICON, NPN	80009	151-0432-00
Q110	153-0601-00	B010100	B019999	SEMICONV DEVICE:2N3565, SEL	80009	153-0601-00
Q110	151-0432-00	B020000		TRANSISTOR:SILICON, NPN	80009	151-0432-00
Q119	151-0601-00	B010100	B019999	TRANSISTOR:SILICON, MATCHED	80009	151-0601-00
Q119	151-0432-00	B020000		TRANSISTOR:SILICON, NPN	80009	151-0432-00
Q122	153-0601-00	B010100	B019999	SEMICONV DEVICE:2N3565, SEL	80009	153-0601-00
Q122	151-0432-00	B020000		TRANSISTOR:SILICON, NPN	.80009	151-0432-00
Q134	153-0601-00	B010100	B019999	SEMICONV DEVICE:2N3565, SEL	80009	153-0601-00
Q134	151-0432-00	B020000		TRANSISTOR:SILICON, NPN	80009	151-0432-00
Q231	151-0341-00			TRANSISTOR:SILICON, NPN	07263	S0400b5
Q235	151-0220-00			TRANSISTOR:SILICON, PNP	07263	S036228
Q242	151-0136-00			TRANSISTOR:SILICON, NPN	02735	35495
Q249	151-0136-00			TRANSISTOR:SILICON, NPN	02735	35495
Q314A, B	151-1072-00	B010100	B079999	TRANSISTOR:SILICON, JFE, P-CHAN, DUAL	80009	151-1072-00
Q314A, B	151-1057-00	B080000		TRANSISTOR:SILICON, FE, N-CHANNEL, DUAL	80009	151-1057-00
Q326	151-0341-00			TRANSISTOR:SILICON, NPN	07263	S040065
Q328	151-0341-00			TRANSISTOR:SILICON, NPN	07263	S040065
Q380	151-0341-00			TRANSISTOR:SILICON, NPN	07263	S040065
Q388	151-0504-00			TRANSISTOR:SILICON, N-CHAN, UNIJUNCTION	04713	2N4851
Q392	153-0601-00	B0010100	B019999	SEMICONV DEVICE:2N3565, SEL	80009	153-0601-00
Q392	151-0432-00	B020000		TRANSISTOR:SILICON, NPN	80009	151-0432-00
Q414A, B	151-1072-00	B010100	B079999	TRANSISTOR:SILICON, JFE, P-CHAN, DUAL	80009	151-1072-00
Q414A, B	151-1057-00	B080000		TRANSISTOR:SILICON, FE, N-CHANNEL, DUAL	80009	151-1057-00
Q454	151-0341-00			TRANSISTOR:SILICON, NPN	07263	S040065
R101	311-1235-00			RES., VAR, NONWIR:100K OHM, 20%, 0.50W	32997	3386F-T04-104
R105	321-0218-00			RES., FXD, FILM:1.82K OHM, 1%, 0.125W	91637	MFF1816GI8200F
R106	316-0471-00			RES., FXD, CMPSN:470 OHM, 10%, 0.25W	01121	CB4711
R107	322-0331-00			RES., FXD, FILM:27.4K OHM, 1%, 0.25W	01121	OBD
R108	316-0223-00			RES., FXD, CMPSN:22K OHM, 10%, 0.25W	01121	CB2231
R109	316-0471-00			RES., FXD, CMPSN:470 OHM, 10%, 0.25W	01121	CB4711
R110	322-0331-00			RES., FXD, FILM:27.4K OHM, 1%, 0.25W	01121	OBD
R111	316-0223-00			RES., FXD, CMPSN:22K OHM, 10%, 0.25W	01121	CB2231
R117	321-0260-00			RES., FXD, FILM:4.99K OHM, 1%, 0.125W	91637	MFF1816G49900F
R118	316-0471-00			RES., FXD, CMPSN:470 OHM, 10%, 0.25W	01121	CB4711
R119	321-0373-00			RES., FXD, FILM:75K OHM, 1%, 0.125W	91637	MFF1816G75001F
R121	316-0471-00			RES., FXD, CMPSN:470 OHM, 10%, 0.25W	01121	CB4711
R122	321-0373-00			RES., FXD, FILM:75K OHM, 1%, 0.125W	91637	MFF1816G75001F

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	Part No.	Eff	Dscont				
R125	316-0150-00				RES., FXD, CMPSN:15 OHM, 10%, 0.25W	01121	CB1501
R127	316-0150-00				RES., FXD, CMPSN:15 OHM, 10%, 0.25W	01121	CB1501
R129	321-0169-00				RES., FXD, FILM:562 OHM, 1%, 0.125W	91637	MFF1816G562ROF
R132	315-0123-00				RES., FXD, CMPSN:12K OHM, 5%, 0.25W	01121	CB1235
R134	321-0354-00				RES., FXD, FILM:47.5K OHM, 1X%, 0.125W	91637	MFF1816G47501F
R135	321-0377-00				RES., FXD, FILM:82.5K OHM, 1%, 0.125W	91637	MFF1816G82501F
R136	315-0332-00				RES., FXD, CMPSN:3.3K OHM, 5%, 0.25W	01121	CB3325
R137	315-0202-00				RES., FXD, CMPSN:2K OHM, 5%, 0.25W	01121	CB2025
R141	311-1232-00				RES., VAR, NONWIR:50K OHM, 20%, 0.50W	32997	3386F-T04-503
R144	321-0354-00				RES., FXD, FILM:47.5K OHM, 1%, 0.125W	91637	MFF1816G47501F
R145	321-0377-00				RES., FXD, FILM:82.5K OHM, 1%, 0.125W	91637	MFF1816G82501F
R150	316-0470-00				RES., FXD, CMPSN:47 OHM, 10%, 0.25W	01121	CB4701
R151	315-0153-00				RES., FXD, CMPSN:15K OHM, 5%, 0.25W	01121	CB1535
R153	316-0470-00				RES., FXD, CMPSN:47 OHM, 10%, 0.25W	01121	CB4701
R154	315-0473-00				RES., FXD, CMPSN:47K OHM, 5%, 0.25W	01121	CB4735
R155	316-0392-00				RES., FXD, CMPSN:3.9K OHM, 10%, 0.25W	01121	CB3921
R204	316-0225-00	B010100	B039999		RES., FXD, CMPSN:2.2M OHM, 10%, 0.25W	01121	CB2251
R204	316-0475-00	B040000			RES., FXD, CMPSN:4.7M OHM, 10%, 0.25W	01121	CB4751
R205	316-0225-00	B010100	B039999		RES., FXD, CMPSN:2.2M OHM, 10%, 0.25W	01121	CB2251
R205	316-0475-00	B040000			RES., FXD, CMPSN:4.7M OHM, 10%, 0.25W	01121	CB4751
R208	316-0225-00				RES., FXD, CMPSN:2.2M OHM, 10%, 0.25W	01121	CB2251
R209	316-0225-00				RES., FXD, CMPSN:2.2M OHM, 10%, 0.25W	01121	CB2251
R210	302-0154-00				RES., FXD, CMPSN:150K OHM, 10%, 0.50W	01121	EB1541
R211	302-0120-00				RES., FXD, CMPSN:12 OHM, 10%, 0.50W	01121	EB1201
R212	302-0154-00				RES., FXD, CMPSN:150K OHM, 10%, 0.50W	01121	EB1541
R213	302-0120-00				RES., FXD, CMPSN:12 OHM, 10X%, 0.50W	01121	EB1201
R225	315-0271-00				RES., FXD, CMPSN:270 OHM, 5%, 0.25W	01121	CB2715
R227	316-0103-00				RES., FXD, CMPSN:10K OHM, 10%, 0.25W	01121	CB1031
R229	316-0102-00				RES., FXD, CMPSN:1K OHM, 10%, 0.25W	01121	CB1021
R230	315-0222-00				RES., FXD, CMPSN:2.2K OHM, 5%, 0.25W	01121	CB2225
R231	316-0472-00				RES., FXD, CMPSN:4.7K OHM, 10%, 0.25W	01121	CB4721
R232	316-0393-00				RES., FXD, CMPSN:39K OHM, 10%, 0.25W	01121	CGB3931
R235	315-0222-00				RES., FXD, CMPSN:2.2K OHM, 5%, 0.25W	01121	CB2225
R236	315-0181-00	B010100	B053859		RES., FXD, CMPSN:180 OHM, 5%, 0.25W	01121	CB1815
R236	315-0391-00	B053860			RES., FXD, CMPSN:390 OHM, 5%, 0.25W	01121	CB3915
R238	316-0102-00				RES., FXD, CMPSN:1K OHM, 10%, 0.25W	01121	CB1021
R239	315-0121-00	XB060000			RES., FXD, CMPSN:120 OHM, 5%, 0.25W	01121	CB1215
R241	315-0131-00	B010100	B053859		RES., FXD, CMPSN:130 OHM, 5%, 0.25W	01121	CB1315
R241	315-0910-00	B053860			RES., FXD, CMPSN:91 OHM, 5%, 0.25W	01121	CB9105
R264	315-0104-00				RES., FXD, CMPSN:100K OHM, 5%, 0.25W	01121	CB1045
R268	315-0274-00				RES., FXD, CMPSN:270K OHM, 5%, 0.25W	01121	CB2745
R271	316-0274-00				RES., FXD, CMPSN:270K OHM, 10%, 0.25W	01121	CB2741
R272	315-0125-00	BO10100	B039999		RES., FXD, CMPSN:1.2M OHM, 5%, 0.25W	01121	CB1255
R272	315-0105-00	B040000			RES., FXD, CMPSN:1M OHM, 5%, 0.25W	01121	CB1055
R273	311-1252-00				RES., VAR, NONWIR:500K OHM, 20%, 0.50W	32997	3386F-T04-504
R278	316-0100-00				RES., FXD, CMPSN:10 OHM, 10%, 0.25W	01121	CB1001
R279	316-0100-00				RES., FXD, CMPSN:10 OHM, 10%, 0.25W	01121	CB101
R301	315-0105-00				RES., FXD, CMPSN:1M OHM, 5%, 0.25W	01121	CB1055
R306A-F	307-0307-00				NTWK, HYB CKT: (FURNISHED AS A UNIT WITH C306B, D, F)	80009	307-0307-00
R311	315-0107-00				RES., FXD, CMPSN:100M OHM, 5%, 0.25W	01121	CB1075
R312	315-0474-00				RES., FXD, CMPSN:470K OHM, 5%, 0.25W	01121	CB4745
R313	315-0273-00				RES., FXD, CMPSN:27K OHM, 5%, 0.25W	01121	CB2735
R314	321-0164-00	XBO80000			RES., FXD, FILM:499 OHM, 1%, 0.125W	91637	MFF1816G499ROF
R315	311-0634-00	B010100	B079999		RES., VAR, NONWIR:TRMR, 500 OHM, 0.5W	32997	3326H-G48-501
R315	311-0622-00	B080000			RES., VAR, NONWIR:100 OHM, 10%, 0.50W	32997	3329H-G48-101
R316	321-0318-02	BO10100	B079999		RES., FXD, FILM:20K OHM, 0.5%, 0.125W	91637	MFF1816D20001D

Ckt No.	Tektronix		Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
	Part No.	Eff	Dscont				
R316	321-0776-03	B080000			RES., FXD, FILM:3.501K OHM, 0.25%, 0.125W	91637	MFF1816D35010C
R317	315-0271-00	B001100	B079999		RES., FXD, CMPSN:270 OHM, 5%, 0.25W	01121	CB2715
R317	321-0168-00	B080000			RES., FXD, FILM:549 OHM, 1%, 0.125W	91637	MFF1816G549ROF
R318	321-0318-02	B010100	B079999		RES., FXD, FILM:20K OHM, 0.5%, 0.125W	91637	MFF1816D20001D
R318	321-0776-03	B080000			RES., FXD, FILM:3.501K OHM, 0.25%, 0.125W	91637	MFF1816D35010C
R319A-E	307-0395-00				RES., FXD, FILM:5 RES NETWORK	80009	307-0395-00
R320	311-1406-00				RES., VAR, NONWIR:20K OHM, 0.25W, W/SW (FURNISHED AS A UNIT WITH S326)	771450	200-YA5557
R371	317-0391-00				RES., FXD, CMPSN:390 OHM, 5%, 0.125W	01121	BB3915
R321	315-0103-00				RES., FXD, CMPSN:10K OHM, 5%, 0.25W	01121	CB1035
R322	315-0512-00				RES., FXD, CMPSN:5.1K OHM, 5%, 0.25W	01121	CB5125
R323	321-0306-00				RES., FXD, FILM:15K OHM, 5%, 0.125W	91637	MFF1816G15001F
R324	315-0271-00				RES., FXD, CMPSN:270 OHM, 5%, 0.25W	01121	CB2715
R326	315-0473-00				RES., FXD, CMPSN:47K OHM, 5%, 0.25W	01121	CB4735
R327	315-0822-00				RES., FXD, CMPSN:8.2K OHM, 5%, 0.25W	01121	CB8225
R328	315-0162-00				RES., FXD, CMPSN:1.6K OHM, 5%, 0.25W	01121	CB1625
R329	315-0183-00				RES., FXD, CMPSN:18K OHM, 5%, 0.25W	01121	CB1835
R340	311-1422-00				RES., VAR, NONWIR:20K OHM, 20%, 0.25W (FURNISHED AS A UNIT WITH S340)	71450	OBD
R341	315-0393-00				RES., FXD, CMPSN:39K OHM, 5%, 0.25W	01121	CB3935
R342	321-0309-00				RES., FXD, FILM:16.2K OHM, 1%, 0.125W	91637	MFF1816G16201F
R343	321-0251-00				RES., FXD, FILM:4.02K OHM, 1%, 0.125W	91637	MFF1816G40200F
R344	315-0682-00				RES., FXD, CMPSN:6.8K OHM, 5%, 0.25W	01121	CB6825
R346	315-0104-00				RES., FXD, CMPSN:100K OHM, 5%, 0.25W	01121	CB1045
R348	315-0114-00				RES., FXD, CMPSN:110K OHM, 5%, 0.25W	01121	CB1145
R349	315-0914-00				RES., FXD, CMPSN:910K OHM, 5%, 0.25W	01121	CB9145
R351	315-0912-00				RES., FXD, CMPSN:9.1K OHM, 5%, 0.25W	01121	CB9125
R352	315-0222-00				RES., FXD, CMPSN:2.2K OHM, 5%, 0.25W	01121	CB2225
R355	315-0273-00				RES., FXD, CMPSN:27K OHM, 5%, 0.25W	01121	CB2735
R361A, R361B, R361C, R361D, R361E, R361F	307-0308-00				RES., FXD, FILM:TIMING, HYBRID CKT	80009	307-0308-00
R362	325-0118-00				RES., FXD, FILM:3M OHM, 1%, 0.125W	03888	PME55-G30003F
R364	315-0104-00				RES., FXD, CMPSN:100K OHM, 5%, 0.25W	01121	CB1045
R365	315-0204-00				RES., FXD, CMPSN:200K OHM, 5%, 0.25W	01121	CB2045
R366	311-1243-00				RES., VAR, NONWIR:500K OHM, 10%, 0.50W	73138	72-34-0
R368	315-0223-00				RES., FXD, CMPSN:22K OHM, 5%, 0.25W	01121	CB2235
R369	315-0273-00				RES., FXD, CMPSN:27K OHM, 5%, 0.25W	01121	CB2735
R370	311-1272-00				RES., VAR, NONWIR:100K OHM, 10%, 0.50W	32997	3329P-L58-104
R371	317-0391-00				RES., FXD, CMPSN:390 OHM, 5%, 0.125W	01121	BB3915
R372	315-0105-00				RES., FXD, CMPSN:1M OHM, 5%, 0.25W	01121	CB1055
R374	311-1269-00				RES., VAR, NONWIR:20K OHM, 10%, 0.50W	32997	3329P-L58-203
R375	311-1173-00				RES., VAR, NONWIR:20K OHM, 20%, 0.25W (FURNISHED AS A UNIT WITH S375)	71450	200-YA5541
R376	315-0103-00				RES., FXD, CMPSN:10K OHM, 5%, 0.25W	01121	CB1035
R380	315-0102-00				RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
R381	315-0183-00				RES., FXD, CMPSN:18K OHM, 5%, 0.25W	01121	CB1835
R383	315-0471-00				RES., FXD, CMPSN:470 OHM, 5%, 0.25W	01121	CB4715
R383	315-0122-00				RES., FXD, CMPSN:1.2K OHM, 5%, 0.25W	01121	CB1225
R385	315-0224-00				RES., FXD, CMPSN:220K OHM, 5%, 0.25W	01121	CB2245
R388	315-0271-00				RES., FXD, CMPSN:270 OHM, 5%, 0.25W	01121	CB2715
R388	315-0301-00				RES., FXD, CMPSN:300 OHM, 5%, 0.25W	01121	CB3015
R390	315-0682-00				RES., FXD, CMPSN:6.8K OHM, 5%, 0.25W	01121	CB6825
R391	315-0102-00				RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
R392	315-0333-00				RES., FXD, CMPSN:33K OHM, 5%, 0.25W	01121	CB3335

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R393	315-0104-00			RES., FXD, CMPSN:100K OHM, 5%, 0.25W	01121	CB1045
R394	311-1275-00			RES., VAR, NONWIR:IM OHM, 10%, 0.50W	32997	3329P-L58-105
R395	311-1169-00			RES., VAR, NONWIR:PNL, 2M OHM, 0.2W	71450	OBD
R396	316-0225-00			RES., FXD, CMPSN:2.2M OHM, 10%, 0.25W	01121	CB2251
R401	315-0105-00			RES., FXD, CMPSN:IM OHM, 5%, 0.25W	01121	CB1055
R406A-F	307-0307-00			NTWK, HYB CKT: (FURNISHED AS A UNIT WITH C406B, D, F)	80009	307-0307-00
R411	315-0107-00			RES., FXD, CMPSN:IOOM OHM, 5%, 0.25W	01121	CB1075
R412	315-0474-00			RES., FXD, CMPSN:470K OHM, 5%, 0.25W	01121	CB4745
R413	315-0273-00			RES., FXD, CMPSN:27K OHM, 5%, 0.25W	01121	CB2735
R414	321-0164-00	XB080000		RES., FXD, FILM:499 OHM, 1%, 0.125W	91637	MFF1816G499R0F
R415	315-0271-00	B010100	B079999	RES., FXD, CMPSN:270 OHM, 5%, 0.25W	01121	CB2715
R415	321-0168-00	B080000		RES., FXD, FILM:549 OHM, 1%, 0.125W	91637	MFF1816G549R0F
R416	321-0318-02	B010100	B079999	RES., FXD, FILM:20K OHM, 0.5%, 0.125W	91637	MFF1816D20001D
R416	321-0776-03	B080000		RES., FXD, FILM:3.501K OHM, 0.25%, 0.125W	91637	MFF1816D35010C
R417	311-0634-00	B010100	B079999	RES., VAR, NONWIR:TRMR, 500 OHM, 0.5W	32997	3326H-G48-501
R417	311-0622-00	B080000		RES., VAR, NONWIR:100 OHM, 10%, 0.50W	32997	3329H-G48-101
R418	321-0318-02	B010100	B079999	RES., FXD, FILM:20K OHM, 0.5%, 0.125W	91637	MFF1816D20001D
R418	321-0776-03	B080000		RES., FXD, FILM:3.501K OHM, 0.25%, 0.125W	91637	MFF1816D35010C
R419A-E	307-0395-00			RES., FXD, FILM:5 RES NETWORK	80009	307-0395-00
R420	311-1406-00			RES., VAR, NONWIR:20K OHM, 0.25W, W/SW (FURNISHED AS A UNIT WITH S420)	71450	200-YA5557
R421	315-0103-00			RES., FXD, CMPSN:IOK OHM, 5%, 0.25W	01121	CB1035
R422	315-0512-00	XB080000		RES., FXD, CMPSN:5.IK OHM, 5%, 0.25W	01121	CB5125
R423	321-0306-00			RES., FXD, FILM:15K OHM, 1%, 0.125W	91637	MFF1816GI5001F
R424	315-0561-00			RES., FXD, CMPSN:560 OHM, 5%, 0.25W	01121	CB5615
R425	315-0243-00			RES., FXD, CMPSN:24K OHM, 5%, 0.25W	01121	CB2435
R440	311-1422-00			RES., VAR, NONWIR:20K OHM, 20%, 0.25W (FURNISHED AS A UNIT WITH S440)	71450	OBD
R441	315-0393-00			RES., FXD, CMPSN:39K OHM, 5%, 0.25W	01121	CB3935
R442	321-0309-00			RES., FXD, FILM:16.2K OHM, 1%, 0.125W	91637	MFF1816G16201F
R443	321-0251-00			RES., FXD, FILM:4.02K OHM, 1%, 0.125W	91637	MFF1816G40200F
R446	315-0104-00			RES., FXD, CMPSN:100K OHM, 5%, 0.25W	01121	CB1045
R451	315-0912-00			RES., FXD, CMPSN:9.1K OHM, 5%, 0.25W	01121	CB9125
R452	315-0222-00			RES., FXD, CMPSN:2.2K OHM, 5%, 0.25W	01121	CB2225
R454	315-0102-00			RES., FXD, CMPSN:IK OHM, 5%, 0.25W	01121	CB1025
R470	311-1269-00			RES., VAR, NONWIR:20K OHM, IOZ%, .50W	32997	3329P-L58-203
R471	315-0223-00			RES., FXD, CMPSN:22K OHM, 5%, 0.25W	01121	CB2235
R472	315-0223-00			RES., FXD, CMPSN:22K OHM, 5%, 0.25W	01121	CB2235
R473	315-0472-00			RES., FXD, CMPSN:4.7K OHM, 5%, 0.25W	01121	CB4725
R474	315-0103-00			RES., FXD, CMPSN:10K OHM, 5%, 0.25W	01121	CB1035
R475	311-1269-00			RES., VAR, NONWIR:20K OHM, 10i, 0.50W	32997	3329P-L58-203
R476	311-1172-00			RES., VAR, NONWIR:PNL, 50K OHM, 0.2W, W/SW (FURNISHED AS A UNIT WITH S476)	71450	200-YA5540
R477	315-0333-00			RES., FXD, CMPSN:33K OHM, 5%, 0.25W	01121	CB3335
R480	311-1171-00			RES., VAR, NONWIR:PNL, IOOK OHM, 0.25W	71450	FX9406
R481	315-0333-00			RES., FXD, CMPSN:33K OHM, 5%, 0.25W	01121	CB3335
R482	315-0683-00			RES., FXD, CMPSN:68K OHM, 5%, 0.25W	01121	CB6835
R485	315-0224-00			RES., FXD, CMPSN:220K OHM, 5%, 0.25W	01121	CB2245
R491	315-0150-00			RES., FXD, CMPSN:15 OHM, 5%, 0.25W	01121	CB1505
R493	315-0150-00			RES., FXD, CMPSN:15 OHM, 5%, 0.25W	01121	CB1505
S215	260-0723-00			SWITCH, SLIDE:DPDT, 0.5A, 125VAC	79727	GF126-0028
S305	260-0984-00	B010100	B043699	SWITCH, SLIDE:DP3T, 0.5A, 125V	79727	G-128-S-0012
S305	260-0984-01	B043700		SWITCH, SLIDE:DP3T W/PLASTIC PLATE (SEE RMPL FOR REPLACEMENT PARTS)	79727	G-128SPC/
S310	-----			(FURNISHED AS A UNIT WITH R340)		
S340	-----					
S345	260-0984-00	B010100	B034699	SWITCH, SLIDE:DP3T, 0.5A, 125V	79727	G-128-S-0012

Ckt No.	Tektronix	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
	Part No.	Eff	Dscont			
S345	260-0984-01	B043700		SWITCH, SLIDE:DP3T W/PLASTIC PLATE	79727	G-128SPC/
S360	-----			(SEE RMPL FOR REPLACEMENT PARTS)		
S375	-----			(FURNISHED AS A UNIT WITH R375)		
S405	260-0984-00	B010100	B043699	SWITCH, SLIDE:DP3T, 0.5A, 125V	79727	G-128-S-0012
S405	260-0984-01	B043700		SWITCH, SLIDE:DP3T W/PLASTIC PLATE	79727	G-128SPC/
S410	-----			(SEE RMPL FOR REPLACEMENT PARTS)		
S440	-----			(FURNISHED AS A UNIT WITH R440)		
S476	-----			(FURNISHED AS A UNIT WITH R476)		
T207	120-0738-00	B010100	B054497	TRANSFORMER, CMR:	80009	120-0738-00
T207	120-1043-00	B054498	B055929	TRANSFORMER, RF:COMMON MODE REJ,	80009	120-1043-00
				POT CORE		
T207	120-1103-00	B055930		XFMR, RF:POT CORE	80009	120-1103-00
T250	120-0735-00			XFMR, PWR, SDN&SU:	80009	120-0735-00
T270	108-0395-00			COIL, RF:64UH	80009	108-0395-00
U105	155-0047-00			MICROCIRCUIT, LI:OUTPUT AMPLIFIER	80009	155-0047-00
U320	155-0083-00			MICROCIRCUIT, LI:DUAL OPNL AMPL & CHAN SW	80009	155-0083-00
U370	155-0048-01			MICROCIRCUIT, DI:TRIGGER AND SWEEP, SEL	80009	155-0048-01
U440	156-0280-00			MICROCIRCUIT, DI:J-K MASTER-SLAVE FLIP-FLOP	80009	156-0280-00
V300	154-0699-00			ELECTRON TUBE:CRT, P31, INT SCALE	80009	154-0699-00
VR228	152-0306-00			SEMICONDD DEVICE:ZENER, 0.4W, 9.1V, 5%	15238	Z5409
VR238	152-0514-00			SEMICONDD DEVICE:ZENER, 0.4W, 10V, 1%	80009	152-0514-00

**REPLACEABLE
MECHANICAL PARTS**

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTE S AND SYMBOLS

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

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

- 1 2 3 4 5 *Name & Description*
- Assembly and/or Component*
- Attaching parts for Assembly and/or Component*
- *---
- Detail Part of Assembly and/or Component*
- Attaching parts for Detail Part*
- *---
- Parts of Detail Part*
- Attaching parts for Parts of Detail Part*
- *---

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

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, state, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
08530	RELIANCE MICA CORP.	342-39TH ST.	BROOKLYN, NY 11232
17516	MOORE, MAYNARD H., JR., INC.	430 MAIN ST.	STONEHAM, MA 02180
18121	WILSHIRE FOAM PRODUCTS, INC.	2665 COLUMBIA ST.	TORRANCE, CA 90503
19209	GENERAL ELECTRIC CO., ELECTRONIC CAPACITOR AND BATTERY PRODUCTS DEPT. BATTERY PRODUCTS SEC.	P.O. BOX 114	GAINESVILLE, FL 32601
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
23050	PRODUCT COMPONENTS CORP	30 LORRAINE AVE.	MT VERNON, NY 10553
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
76545	MUELLER ELECTRIC CO.	1583 EAST 31ST ST.	CLEVELAND, OH 44114
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79727	C-W INDUSTRIES	550 DAVISVILLE RD., P O BOX 96	WARMINISTER, PA 18974
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80710	ALLEGHENY LUDLUM STEEL CORP., A DIVISION OF ALLEGHENY LUDLUM INDUSTRIES, INC.	BRACKENRIDGE WORKS, RIVER AVE.	BRACKENRIDGE, PA 15014
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
98278	MALCO A MICRODOT COMPANY, INC. CONNECTOR AND CABLE DIVISION	220 PASADENA AVE.	SOUTH PASADENA, CA 91030

Fig. & Index Ckt No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont					
1-1	366-1468-01			1		KNOB:DARK GRAY	80009	366-1468-01
-2	366-1469-01			1		KNOB:LIGHT GRAY	80009	366-1469-01
-3	366-1322-05			1		KNOB:DARK GRAY--POS	80009	366-1322-05
-4	366-1466-02			1		KNOB:LT GRAY--POS	80009	366-1466-02
-5	366-1322-02			1		KNOB:DARK GRAY--VAR	80009	366-1322-02
-6	366-1466-01			1		KNOB:LT GRAY--VAR	80009	366-1466-01
-7	366-1467-03			1		KNOB:DARK GRAY--TRG	80009	366-1467-03
-8	366-1467-02			1		KNOB:DARK GRAY--INT	80009	366-1467-02
-9	366-1467-01			1		KNOB:DARK GRAY--VAR	80009	366-1467-01
-10	366-1467-04			1		KNOB:DARK GRAY--POS	80009	366-1467-04
-11	366-1470-01			1		KNOB:MEDIUM GRAY	80009	366-1470-01
	-----			1		LAMP, LED:ASSY(SEE DS310 EPL)		
	352-0360-00	B010100	B055576	1		.HOLDER, LED:0.086 ID X 0.20 I OD, PLSTC	80009	352-0360-00
	352-0360-01	B055577		1		HOLDER, LED:212/214	80009	352-0360-01
-12	348-0285-00			1		FLIP-STAND, CAB:1.94 H X 3.424 INCH WIDE	80009	348-0285-00
-13	211-0018-00			1		SCREW, MACHINE:4-40 X 0.875 PNH, STL	83385	OBD
	437-0147-01			1		CABINET, SCOPE:	80009	437-0147-01
-14	-----			PR		.CABINET, HALVES:		
	337-1703-00			1		.SHIELD, ELEC:UPPER	80009	337-1703-00
	337-1704-00			1		.SHIELD, ELEC:LOWER	80009	337-1704-00
-15	214-1850-00			4		.PIN, ALIGNMENT:CIRCUIT BOARD	80009	214-1850-00
-16	348-0254-00	B010100	B024221	4		.FOOT, CABINET:0.344 H X 0.285 W X 0.8"L	80009	348-0254-00
	348-0254-01	B024222		4		.FOOT, CABINET:BLACK RUBBER (ATTACHING PARTS FOR CABINET)	80009	348-0254-01
-17	211-0213-00			1		SCREW, MACHINE:4-40 X 0.312 INCH, PNH NYLON	23050	OBD
-18	211-0166-00			2		SCREW, MACHINE:4-40 X 1.750, PNH, STL, CD PL	83385	OBD
	355-0181-00			2		STUD, CRYG, HDL:0.312 DIA X 0.50 INCH LONG	80009	355-0181-00
-19	211-0019-00			2		SCREW, MACHINE:4-40 X 1.0 INCH, PNH STL	83385	OBD
-20	334-1859-00			1		MARKER, IDENT:STANDARD	80009	334-1859-00
	334-1920-00			1		MARKER, IDENT:90-110V	80009	334-1920-00
	334-1921-00			1		MARKER, IDENT:220-260V	80009	334-1921-00
	-----			-		(OPTION 1 ONLY)		
-21	386-1999-00			1		SUPPORT, CRT:FRONT	80009	386-1999-00
	331-0445-00	XB056450		1		MASK, CRT SCALE:	80009	331-0445-00
-22	378-0691-00			1		FILTER, LT, CRT:BLUE	80009	378-0691-00
-23	354-0423-00			1		RING, SPRT, CRT:RUBBER	80009	354-0423-00
-24	253-0153-00			IN		TAPE, PRESS.SENS:0.25 W X 0.125"THK FOAM	18121	P7/PVC
-25	337-1458-00			1		SHLD, ELECTRON T:CATHODE RAY TUBE	80710	337-1458-00-D
-26	386-2185-00			1		SPRT, CRT SHIELD:REAR	80009	386-2185-00
-27	200-1400-00			1		COVER, PLUG:POWER CORD	80009	200-1400-00
-28	214-1805-00			1		SPOOL, CORD WRAP:	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, UPPER	80009	200-1470-00
-31	200-1467-00			1		COVER, CORD WRAP:PROBE, LOWER	80009	200-1467-00
-32	-----			1		CKT BOARD ASSY:AMPLIFIER(SEE A2 EPL)		
-33	131-0608-00	B010100	B020749	8		.TERMINAL, PIN:0.365 L X 0.25 PH, BRZ, GOLD PL	22526	47357
	131-0608-00	B020750		9		.TERMINAL, PIN:0.365 L X 0.25 PH, BRZ, GOLD PL	22526	47357
-34	131-1172-00			1		.CONTACT, ELEC:CKT CARD GROUND	80009	131-1172-00
-35	136-0252-04			31		.SOCKET, PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-36	136-0328-03			12		.SOCKET, PIN TERM:HORIZ, SQ PIN RCPT	22526	47710
	136-0521-00			1		.SOCKET, PLUG-IN:CRT ASSY	80009	136-0521-00
-37	136-0453-00			1		.SOCKET, PLUG-IN:11 PIN, CRT	80009	136-0453-00
-38	352-0169-00			1		.HLDR, TERM CONN:2 WIRE BLACK	80009	352-0169-00
-39	352-0199-00			1		..CONN BODY, PL, EL:3 WIRE BLACK	80009	352-0199-00
-40	131-0707-00	B010100	B055769	2		..CONNECTOR, TERM.:22-26 AWG, BRS& CU BE GOLD	22526	47439
	131-0707-00	B055770		9		..CONNECTOR, TERM.:22-26 AWG, BRS& CU BE GOLD	22526	47439
-41	131-0621-00			3		..CONNECTOR, TERM:22-26 AWG, BRS& CU BE GOLD	22526	46231
	131-0371-00	B010100	B055769	7		..CONTACT, ELEC:FOR NO.26 AWG WIRE	98278	122-0182-019
	131-1109-00	B010100	B041759	11		..CONNECTOR, PLUG:CRIMP ON, FOR 0.4" OD PIN	00779	42869-6
	131-1109-00	B041760		9		..CONNECTOR, PLUG:CRIMP ON, FOR 0.4" OD PIN	00779	42869-6
	131-1109-02	B041760		2		..CONNECTOR, TERM:CRIMP ON, FOR 0.4" OD PIN	00779	P73-7444
-42	253-0154-00			4		.TAPE, PRESS.SENS:0.125"THK	18121	MT8
-43	342-0113-00			1		.INSULATOR, PLATE:CKT CARD, FILM	80009	342-0113-00
	-----			2		BATTERY ASSY:(SEE BT216/BT217 EPL)		

Fig. & Index Ckt No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont					
1-44	200-1238-00	B010100	B056119	4		COVER, BTRY PACK:	80009	200-1238-00
	200-1238-01	B056120		4		.COVER, BAT SET:PLASTIC, BLACK	80009	200-1238-01
-45	146-0016-00	B010100	B056119	2		.BATTERY SET:6V, 660 MAH, A CELL	19209	41B906FD01-G1
	146-0026-00	B056120	PK			.BATTERY SET:6V, 660 MAH, 5ACELL	19209	41B906FD02-G1
	198-2129-00	B010100	B056119	1		.WIRE SET, ELEC:	80009	198-2129-00
	198-3183-00	B056120		1		.WIRE SET, ELEC:	80009	198-3183-00
-46	352-0161-00			1		..HLDR, TERM CONN:3 WIRE BLACK	80009	352-0161-00
-47	131-0707-00			3		..CONNECTOR, TERM.:22-26 AWG, BRS& CU BE GOLD	22526	47439
	253-0153-00			FT		..TAPE, PRESS.SENS:0.25 W X 0.125"THK FOAM	18121	P7/PVC
-48	-----			1		CKT BOARD ASSY:POWER SUPPLY(SEE A3 EPL)		
-49	131-0589-00			27		.TERM, PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
-50	131-1172-00			1		.CONTACT, ELEC:CKT CARD GROUND	80009	131-1172-00
-51	136-0252-04			14		.SOCKET, PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
	344-0255-00	XB030000		2		.CLIP, ELECTRICAL:FUSE MOUNT	80009	344-0255-00
-52	161-0078-01			1		.CABLE ASSY, PWR:	80009	161-0078-01
-53	166-0548-00			1		..FERRULE, RF CA:0.144 ID X 0.227 OD, GND	80009	166-0548-00
-54	253-0154-00			4		.TAPE, PRESS.SENS:0.125"THK	18121	MT8
-55	342-0176-00			1		.INSULATOR, FILM:CIRCUIT CARD	80009	342-0176-00
-56	334-1926-00			2		.MARKER, IDENT:DANGER	80009	334-1926-00
-57	348-0089-00			1		.BUMPER, PLASTIC:BLACK VINYL	80009	348-0089-00
-58	-----			1		CKT BOARD ASSY:INPUT(SEE AI EPL)		
-59	136-0252-04			74		.SOCKET, PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
-60	131-0590-00			12		.CONTACT, ELEC:0.71 INCH LONG	22526	47351
-61	337-1734-00			1		.SHIELD, ELEC:ATTENUATOR, REAR	80009	337-1734-00
-62	337-1735-00			1		.SHIELD, ELEC:ATTENUATOR, FRONT (ATTACHING PARTS)	80009	337-1735-00
	211-0091-00			1		.SCREW, MACHINE:2-56 X 0.875, OVH, SST	83385	OBD
	210-0001-00			1		.WASHER, LOCK:INTL, 0.092 ID X 0.18"OD, STL	78189	1202-00-00-0541C
	210-0405-00			1		.NUT, PLAIN, HEX.:2-56 X 0.188 INCH, BRS	73743	2X12157-402
-63	337-1767-00			1		.SHIELD, ELEC:ATTENUATOR, REAR CENTER	80009	337-1767-00
-64	337-1768-00			1		.SHIELD, ELEC:ATTENUATOR, FRONT CENTER	80009	337-1768-00
-65	337-1766-00			1		.SHIELD, ELEC:ATTENUATOR, PERTPHERAL	80009	337-1766-00
-66	343-0213-00			1		.CLAMP, LOOP:PRESS MT, PLASTIC	80009	343-0213-00
-67	380-0244-00			3		.HOUSING, SWITCH:POLYCARBONATE	80009	380-0244-00
-68	401-0127-01			2		.ROTOR, ELEC SW:W/CONTACTS	80009	401-0127-01
-69	401-0127-02			1		.ROTOR-CONT ASSY:DELRIN, W/O CONTACTS	80009	401-0127-02
-70	214-1576-01			1		.DTT-CONT ASSY:3 CONTACT	80009	214-1576-01
-71	214-1577-01			2		.DTT-CONT ASSY:2 CONTACT	80009	214-1577-01
-72	214-1579-00			3		.SPRING, DETENT:0.59 ID X 0.08 W X 0.01 THK	80009	214-1579-00
-73	214-1127-00			3		.ROLLER, DETENT:0.125 DIA X 0.125 INCH L	80009	214-1127-00
-74	200-1232-00			3		.COVER, RTRY SW:CIRCUIT BOARD (ATTACHING PARTS)	80009	200-1232-00
-75	210-0405-00			9		.NUT, PLAIN, HEX.:2-56 X 0.188 INCH, BRS	73743	2X12157-402
	200-2262-00	XB057515		2		.COVER, VAR RES:	80009	200-2262-00
-76	-----			8		.RESISTOR, VAR:(SEE R320, R340, R375, R395, R420, R440, R476, R480 EPL) (ATTACHING PARTS)		
-77	210-0933-00			8		.WASHER, NONMETAL:0.625"DIA, 0.002 MICA	08530	OBD
-78	260-0723-00			1		.SWITCH, SLIDE:DPDT, 0.5A, 125VAC	79727	GF126-0028
-79	260-0984-00	B010100	B043699	3		.SWITCH, SLIDE:DP3T, 0.5A, 125V	79727	G-128-S-0012
	260-0984-01	B043700		3		.SWITCH, SLIDE:DP3T W/PLASTIC PLATE	79727	G-128SPC/
-80	129-0398-00			2		.POST, CONTACT:FOR JACK TIP	80009	129-0398-00
-81	179-1846-00			1		.WIRING HARNESS, :CHASSIS	80009	179-1846-00
-82	131-0707-00			14		..CONNECTOR, TERM.:22-26 AWG, BRS& CU BE GOLD	22526	47439
-83	131-0621-00			5		..CONNECTOR, TERM.:22-26 AWG, BRS& CU BE GOLD	22526	46231
	131-0622-00			1		..CONTACT, ELEC:0.577"L, 28-32 AWG WIRE	22526	46241
-84	210-0774-00			1		..EYELET, METALLIC:0.152 OD X 0.245 INCH L, BRS	80009	210-0774-00
-85	210-0775-00			1		..EYELET, METALLIC:0.126 OD X 0.23 INCH L, BRS	80009	210-0775-00
-86	352-0162-00			1		..HLDR, TERM CONN:4 WIRE BLACK	80009	352-0162-00
-87	352-0163-00	B010100	B055318	2		..CONN BODY, PL, EL:5 WIRE BLACK	80009	352-0163-00
	352-0164-00	B055319		1		..CONN BODY, PL, EL:6 WIRE BLACK	80009	352-0164-00
	352-0165-00	B055319		1		..CONN BODY, PL, EL:7 WIRE BLACK	80009	352-0165-00

Fig. & Index Ckt No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont					
1-88	352-0202-00			1		..HLDR, TERM CONN:6 WIRE BLACK (ATTACHING PARTS FOR CKT BD)	80009	352-0202-00
-89	211-0008-00			3		SCREW, MACHINE:4-40 X 0.25 INCH, PNH STL	83385	OBD
-90	200-1480-00			1		COVER, SLIDE SW:DARK GRAY PLASTIC	80009	200-1480-00
-91	200-1480-02			1		COVER, SLIDE SW:LIGHT GRAY PLASTIC	80009	200-1480-02
-92	200-1480-01			2		COVER, SLIDE SW:MEDIUM GRAY PLASTIC	80009	200-1480-01
	-----			1		LAMP ASSY:(SEE DS310 EPL)		
	352-0360-00	B010100	B055576	1		HOLDER, LED:0.086 ID X 0.20 I OD, PLSTC	80009	352-0360-00
	352-0360-01		B055577	1		HOLDER, LED:212/214	80009	352-0360-01
-93	333-1655-00			1		PANEL, SIDE:	80009	333-1655-00
	010-0262-01	B010100	B054369	1		PROBE, VOLTAGE:212, 48.55 L, PROBE ONLY	80009	010-0262-01
	010-0262-05		B054370	1		PROBE, VOLTAGE:1 MEG OHM/1 MEG OHM, DARK	80009	010-0262-05
	010-0262-02	B010100	B054369	1		LEAD, TEST:1 X, LIGHT GRAY	80009	010-0262-02
	010-0262-04		B054370	1		PROBE, VOLTAGE:1 X	80009	010-0262-04
-94	013-0107-02			1		.TIP, TEST PROD:RETRACTABLE HOOK	80009	013-0107-02
-95	175-1288-03	B010100	B054369	1		.CABLE ASSY, RF:94 OHM COAX, 49.125 L	80009	175-1288-03
	175-1498-01		B054370	1		CABLE ASSY, RF: 80009		175-1498-01
-96	175-0940-00	B010100	B054369	1		..LEAD, ELECTRICAL:STRD, 24 AWG, 12.5 L	80009	175-0940-00
	175-0940-01		B054370	1		..LEAD, ELECTRICAL:PROBE COMMON W/CLIP	80009	175-0940-01
-97	200-1281-00	B010100	B054369X	1		..CABLE NIP, ELEC:0.125 ID-0.174 SQ X 0.75	80009	200-1281-00
-98	200-1280-00	B010100	B054369X	1		...COVER, ELEC CLIP:YELLOW VINYL	80009	200-1280-00
-99	344-0024-00	B010100	B054369X	1		...CLIP, ELECTRICAL:ALLIGATOR TYPE	76545	#30
-100	214-0592-00	B010100	B054369X	1		..CONTACT, ELEC:0.429 INCH LONG	71785	318-20-00-003
-101	204-0490-03	B010100	B054369	1		.BODY, TEST PROD:DARK GRAY	80009	204-0490-03
	204-0594-01		B054370	1		.BODY ASSY, PROBE:1X	80009	204-0594-01
-102	204-0490-05	B010100	B054369	1		.BODY, TEST PROD:LIGHT GRAY	80009	204-0490-05
	204-0594-02		B054370	1		.BODY ASSY, PROBE:1 MEG OHM/1 MEG OHM SILVER	80009	204-0594-02

**APPENDIX A
REFERENCES**

DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA PAM 310-7	Index of US Army Equipment Modification Work Orders.
FM 21-11	First Aid for Soldiers
AR 385-40	Accident Reporting and Records.
AR 750-1	Army Materiel Maintenance Concept and Policies
TB 750-25-1	Maintenance Supplies and Equipment: Army Metrology and Calibration System.
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 43-0002-26	Organizational Maintenance Manual, Destruction of Equipment to Prevent Enemy Use for Launcher, Rocket, Armored Vehicle Mounted: XM270, Multiple Launch Rocket System

A-1/(A-2 blank)

APPENDIX B

MAINTENANCE ALLOCATION CHART

SECTION I. INTRODUCTION**B-1. GENERAL.**

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance categories.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section III lists the tools and test equipment (both special and common) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS. Maintenance Functions will be limited to and defined as follows:

a. *Inspect.* To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. *Test.* To verify serviceability by measuring the mechanical, pneumatic, hydraulic, electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. *Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. *Adjust.* To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. *Aline.* To adjust specified variable elements of an item to bring about optimum or desired performance.

f. *Calibrate.* To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. *Remove/Install.* To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. *Replace.* To remove an unserviceable item and install a serviceable counterpart in its place.

i. *Repair.* The application of maintenance services 1, including fault location/troubleshooting 2, removal/ installation, and disassembly/assembly 3, procedures, and maintenance actions 4, to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. *Overhaul.* That maintenance effort (service/action) prescribed to restore an item to a completely serviceable-operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the army. Overhaul does not normally return an item to like-new condition.

k. *Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to army equipment and is normally reserved for the depot category of maintenance. The rebuild operation includes the act of returning to zero those age measurements (hours/mile, etc.) considered in classifying army equipment/components.

(1) Services - inspect, test, service, adjust, align, calibrate, and/or replace.

(2) Fault locate/troubleshoot - the process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

(3) Disassembly/assembly - encompasses the step-by-step taking apart (or breakdown) of a repairable assembly (group numbered item) to the level of its least component identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration.

(4) Actions - welding, grinding, riveting, straightening, facing, remachinery, and/or resurfacing.

B-3. EXPLANATION OF COLUMNS IN THE MAC, Section II.

a. *Column 1, Group Number.* Column 1 lists group numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.

b. *Column 2, Component/Assembly.* Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. *Column 3, Maintenance Function.* Column 3 lists the functions to be performed on the item listed in Column 2. (for detailed explanation of these functions, see paragraph B-2.)

d. *Column 4, Maintenance Category.* Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column.

3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

- COperator or Crew
- OOrganizational Maintenance
- FDirect Support Maintenance
- HGeneral Support Maintenance
- LSpecialized Repair Activity (SRA) 5
- DDepot Maintenance

5 This maintenance category is not included in Section II, column (4) of the Maintenance Allocation Chart. To identify functions to this category of maintenance, enter a work time figure in the "H" column of Section II, column (4), and use an associated reference code in the Remarks column (6). Key the code to Section IV, Remarks, and explain the SRA complete repair application there. The explanatory remark(s) shall reference the specific Repair Parts and Special Tools List (RPSTL) TM which contains additional SRA criteria and the authorized spare/repair parts.

e. *Column 5, Tools and Test Equipment.* Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. *Column 6, Remarks.* This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks continued in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, Section III.

a. *Column 1, Reference Code.* The tool and test equipment reference code correlates with a code used in the MAC, Section III, Column 5.

b. *Column 2, Maintenance Category.* The lowest category of maintenance authorized to use the tool or test equipment.

c. *Column 3, Nomenclature.* Name or identification of the tool or test equipment.

d. *Column 4, National Stock Number.* The National Stock Number of the tool or test equipment.

e. *Column 5, Tool Number.* The manufacturers part number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, Section IV.

a. *Column 1, Reference Code.* The code recorded in Column 6, Section II.

b. *Column 2, Remarks.* This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

**SECTION II. MAINTENANCE ALLOCATION CHART
FOR
TEKTRONIX 212 OSCILLOSCOPE**

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
Fig 1	TEK 212 Oscilloscope	Insp	.00	.05	.10	.10			A
		Test	.00	.05	.15	.15		15	
		Calibrate	.00	.00	.00	.50		1-15	B
Fig 1-58	CCA A1	Repair				1.00			C D
		Insp	.00	.00	.00	.10			A
		Replace	.00	.00	.00	.50		15	B
Fig 1-32	CCA A2	Repair	.00	.00	.00	1.00		15	C D
		Insp	.00	.00	.00	.10			A
		Replace	.00	.00	.00	.50		15	B
Fig 1-48	CCA A3	Repair	.00	.00	.00	1.00		15	C D
		Insp	.00	.00	.00	.10			A
		Replace	.00	.00	.00	.50		15	B
Fig 1-93	Probe	Repair	.00	.00	.00	1.00		15	C D
		Insp	.00	.05	.10	.00			A
		Replace	.00	.00	.10	.00		15	B
		Repair	.00	.00	.50	.00		15	C D

*C.operator/crew O.organizational F.direct support H.general support D.depot

**SECTION III. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR
TEKTRONIX 212 OSCILLOSCOPE**

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1-14	F H	Test Equipment		Ref Table 4-1
15	F H	JaK 17LAL, 35H Tool Kit	4931-01-073-3845	

SECTION IV. REMARKS

REFERENCES CODE	REMARKS
<p>A</p> <p>B</p> <p>C</p> <p>D</p>	<p>Organizational maintenance will be accomplished by the organization owning and using the equipment.</p> <p>All special tools and test equipment are called out in Table 4-1.</p> <p>There will be a repair parts kit issued initially with each piece of MDE. Resupply of parts will be through normal supply channels.</p> <p>A recommended repair parts list will be published as part of this manual. Parts that have NSN's assigned will be requisitioned separately and will not be part of this kit.</p>

APPENDIX C

RECOMMENDED REPAIR PARTS LIST FOR
TEKTRONIX 212 OSCILLOSCOPE

ITEM NO.	TEKTRONIX PART NO.	ITEM NAME	REC. QTY	UNIT PRICE	SEE NOTE 1&2
1	108-0691-00	COIL RF 1	1.50 EA	5950-01-062-0627	
2	120-0735-00	XFMR, PWR, SDN&SU	1	23.00 EA	5950-01-110-4088
3	120-1103-00	TRANSFORMER, RF	1	10.25 EA	See Note 3
4	136-0328-02	SOCKET, PIN TERM	1	0.20 EA	5999-01-134-3597
5	136-0521-00	SKT, PL-IN ELEK.	1	7.50 EA	See Note 3
6	150-1061-00	LT EMITTING DIO	1	0.55 EA	See Note 3
7	151-0136-00	TRANSISTOR	1	1.50 EA	5961-01-079-8653
8	151-0341-00	TRANSISTOR	1	1.00 EA	*5961-00-930-5325
9	151-0432-00	TRANSISTOR	1	0.85 EA	5961-01-078-3606
10	151-0504-00	TRANSISTOR	1	1.75 EA	*5961-00-485-8783
11	151-1057-00	TRANSISTOR	1	12.25 EA	See Note 3
12	152-0107-00	SEMICONDC DVC, DI	1	1.85 EA	5961-01-063-9264
13	152-0246-00	SEMICONDC DVC, DI	1	1.00 EA	*5961-00-858-5686
14	152-0333-00	SEMICONDC DVC, DI	1	0.85 EA	*5961-00-350-8371
15	154-0699-00	ELECTRON TUBE	1	295.00 EA	5960-01-063-9667
16	155-0047-00	MICROCKT, LINEAR	1	20.00 EA	5962-01-110-1645
17	155-0048-01	MICROCKT, DGTL	1	15.00 EA	5962-01-064-9571
18	155-0083-00	MICROCKT, LINEAR	1	47.00 EA	5962-01-064-9556
19	156-0280-00	MICROCKT, DGTL	1	2.15 EA	See Note 3
20	159-0121-00	FUSE, CARTRIDGE	10	0.85 EA	See Note 3
21	260-0984-01	SWITCH, SLIDE	1	2.80 EA	*5930-00-197-1548
22	281-0178-00	CAP, VAR, PLASTIC	1	3.85 EA	*5910-00-454-7885
23	283-0000-00	CAP, FXD, CER DI	1	0.10 EA	*5910-00-688-8702
24	283-0103-00	CAP, FXD, CER DI	1	0.65 EA	*5910-00-485-4854
25	283-0111-00	CAP, FXD, CER DI	1	1.00 EA	*5910-00-436-i7154
26	285-0697-06	CAP, FXD, PLASTIC	1	6.75 EA	5910-00-326-2019
27	290-0535-01	CAP, FXD, ELETLT	1	1.30 EA	*5910-00-345-4638
28	295-0144-00	CAP SET, MATCHED	1	11.75 SE	See Note 3
29	307-0307-01	NTWK, HYB CKT	1	10.00 EA	See Note 3
30	307-0395-00	RES, FXD, FILM	1	3.90 EA	See Note 3

<i>ITEM NO.</i>	<i>TEKTRONIX PART NO.</i>	<i>ITEM NAME</i>	<i>REC. QTY</i>	<i>UNIT PRICE</i>	<i>SEE NOTE 1&2</i>
31	311-1172-00	RES, VAR, NONWW 1	4.10 EA	See Note 3	
32	311-1173-00	RES, VAR, NONWW 1	13.00 EA	See Note 3	
33	311-1252-00	RES, VAR, NONWW 1	2.15 EA	5905-01-064-5425	
34	311-1422-00	RES, VAR, NONWW 1	9.50 EA	See Note 3	
35	311-1422-00	RES, VAR, NONWW 1	2.10 EA	See Note 3	

NOTE 1 - NSN adjacent to component indicates current use within DOD.

NOTE 2 - NSN preceded by an asterisk indicates current use within the Army.

NOTE 3 - Refer to Appendix B, Section IV, Remarks.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-32, Section III, Direct and General Support Maintenance requirements for Multiple Launch Rocket System(MLRS).

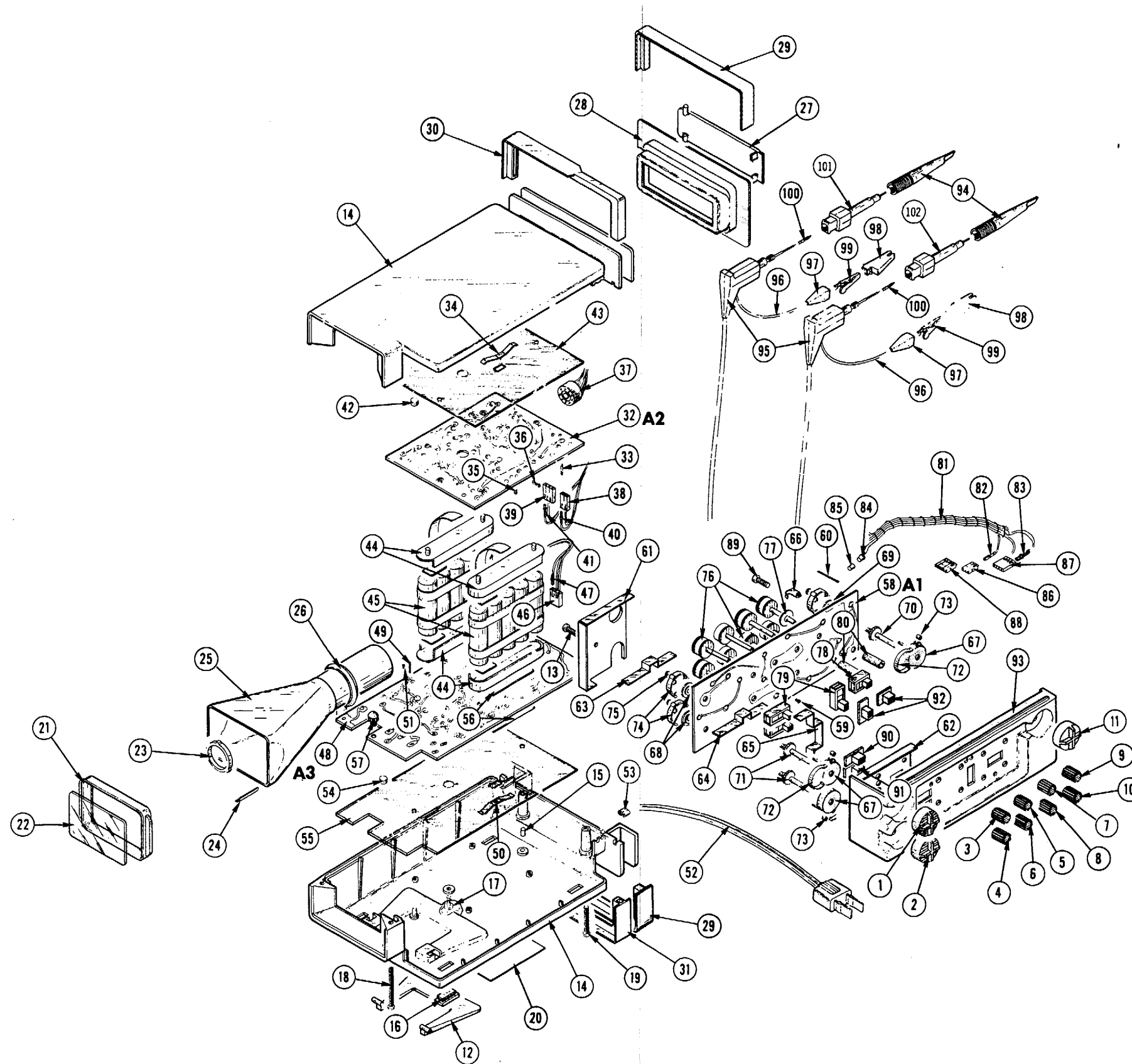


Figure 8-0. Mechanical Parts, Exploded View

8-17/(8-18 blank)

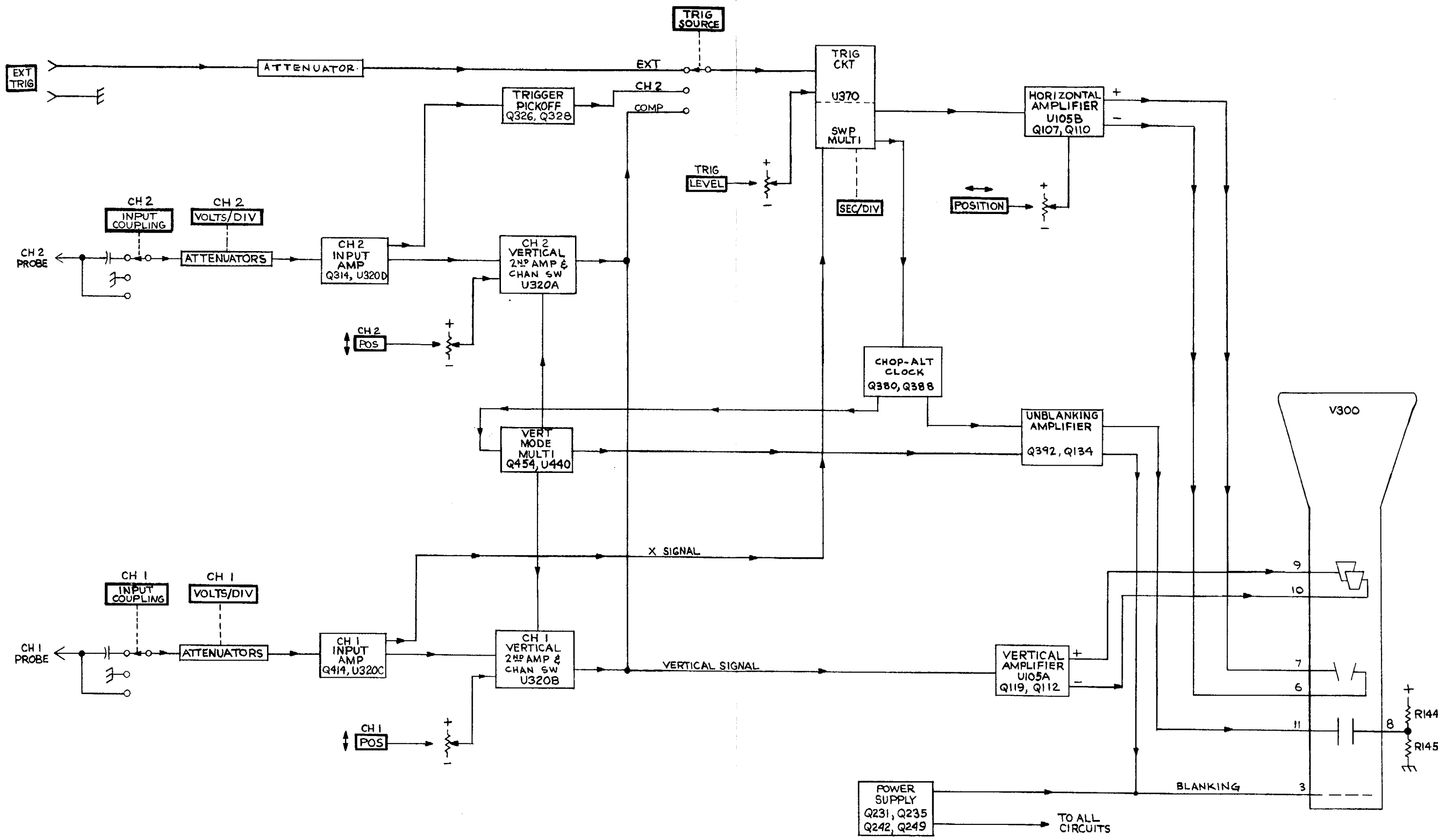
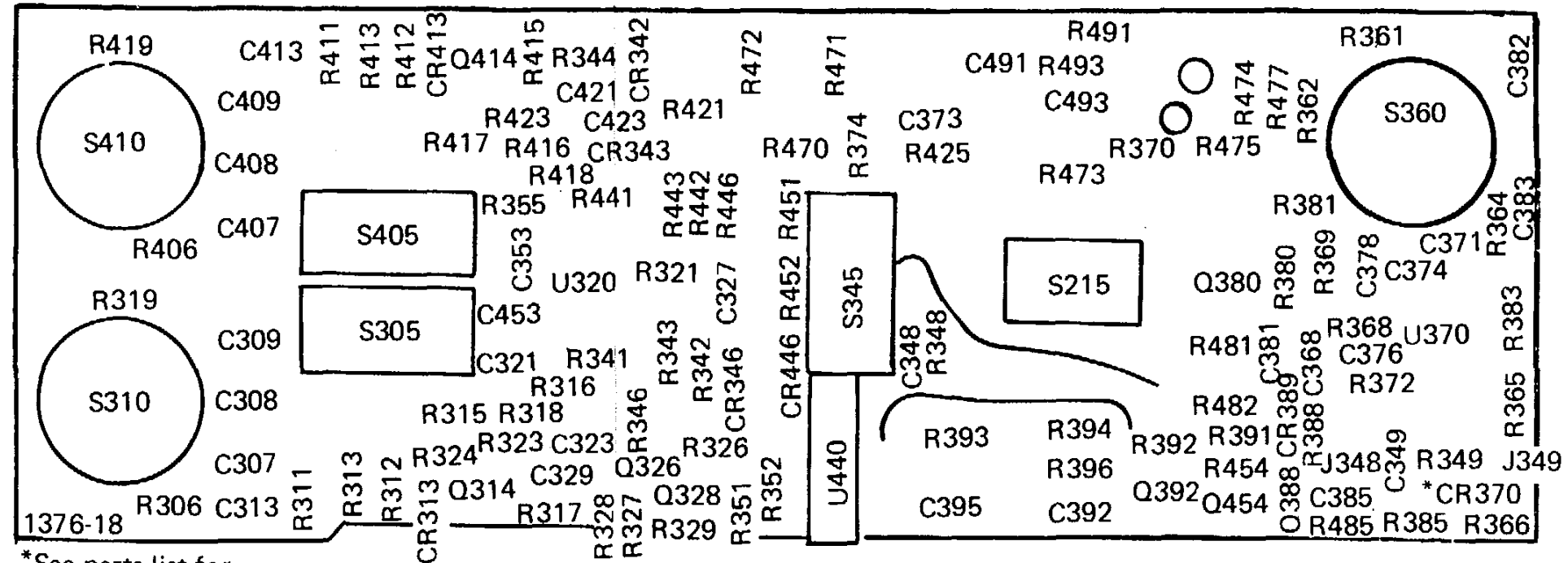


Figure 8-1. Block Diagram.



*See parts list for serial number ranges.

Figure 8-1A. A1 Input Circuit Board (Front).

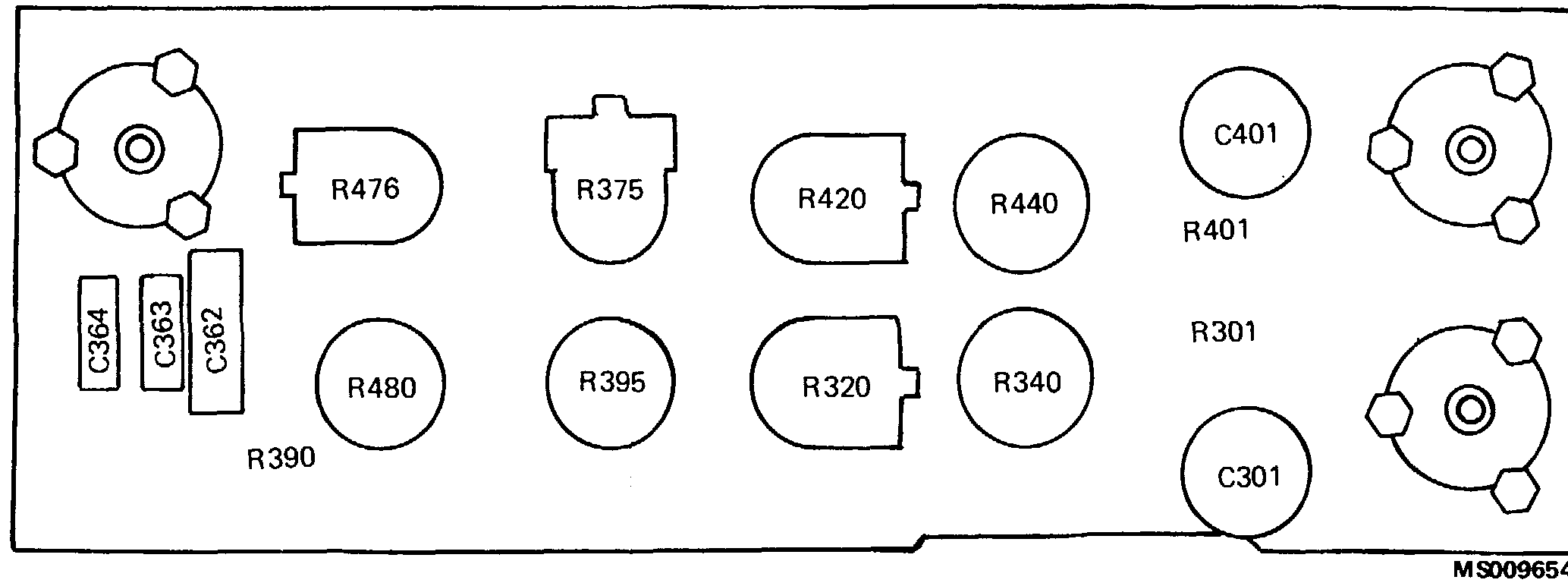


Figure 8-1B. A1 Input Circuit Board (Rear).

WAVEFORM CONDITIONS

TRIGGER SOURCE - CH 2
 TRIGGER LEVEL - AUTO
 SEC/DIV - 0.1 m
 VOLTS/DIV - 0.5

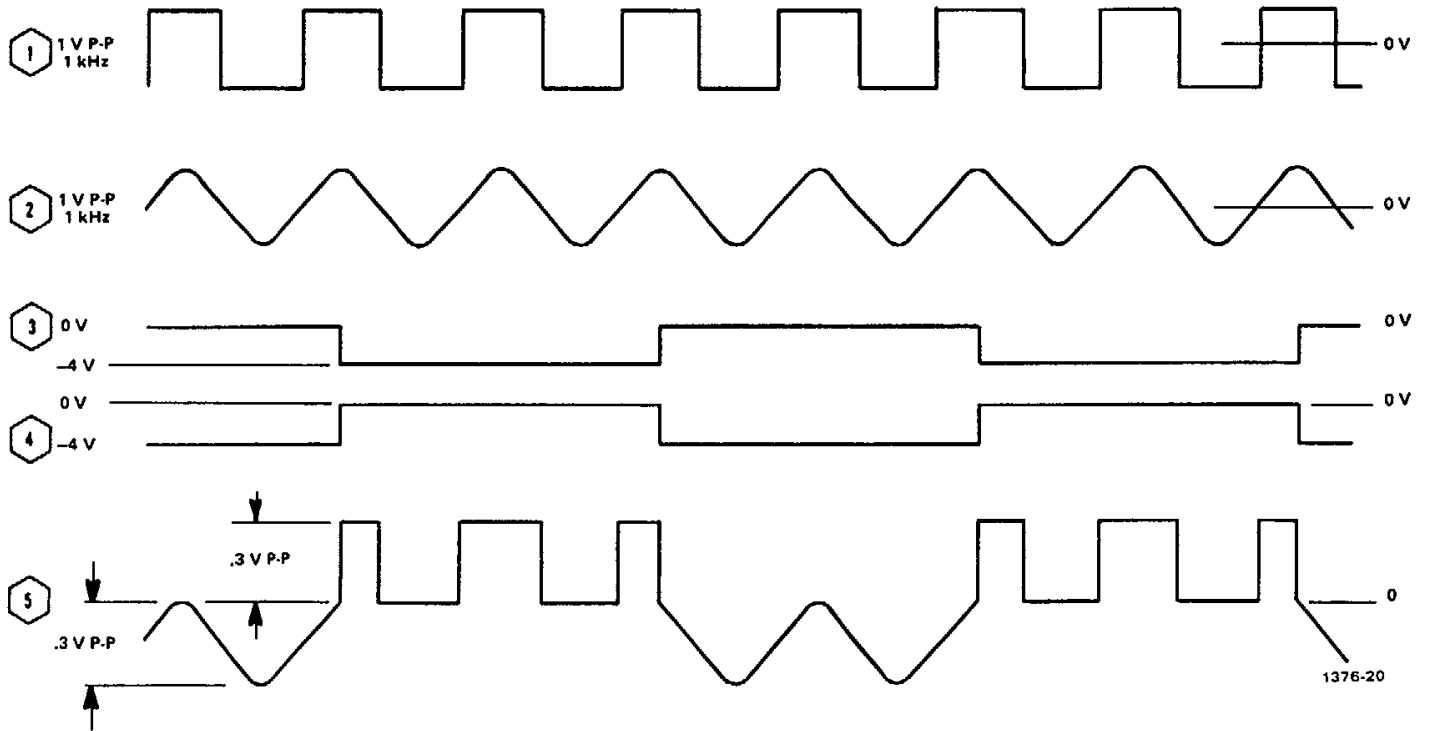
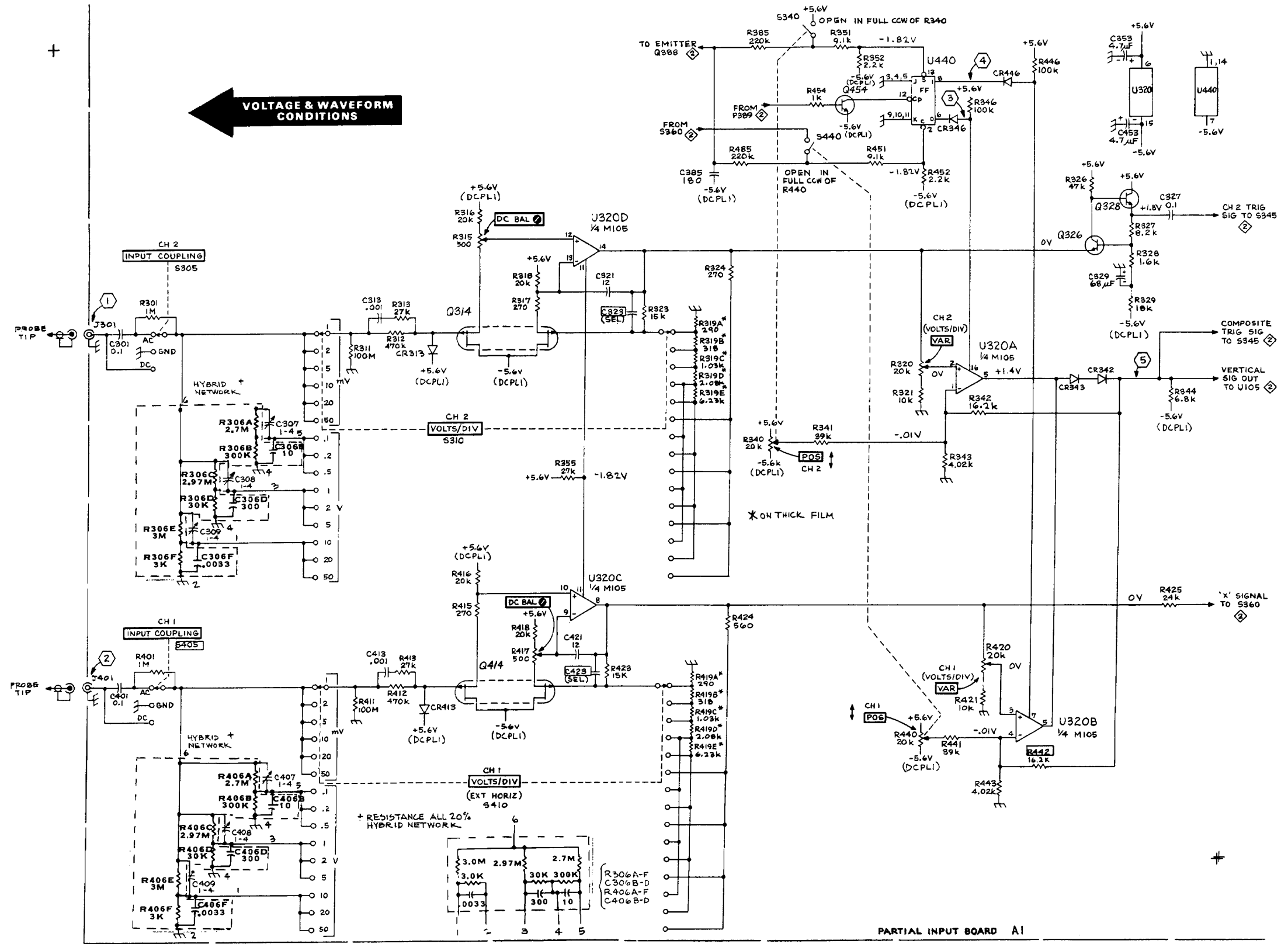


Figure 8-1C. Waveform Conditions.



VOLTAGE & WAVEFORM CONDITIONS

Figure 8-1D. Vertical Amplifier

8-23/(8-24 blank)

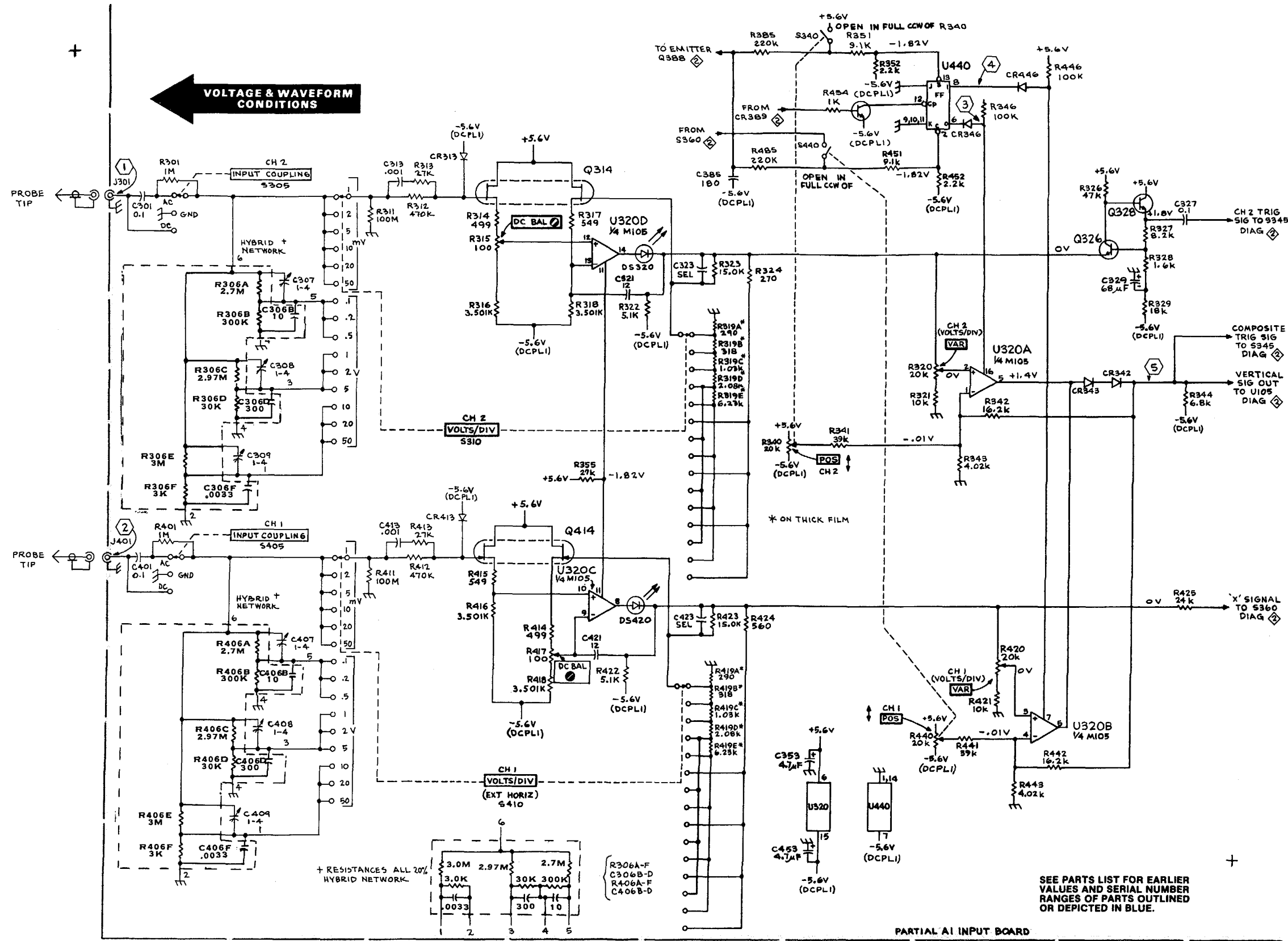
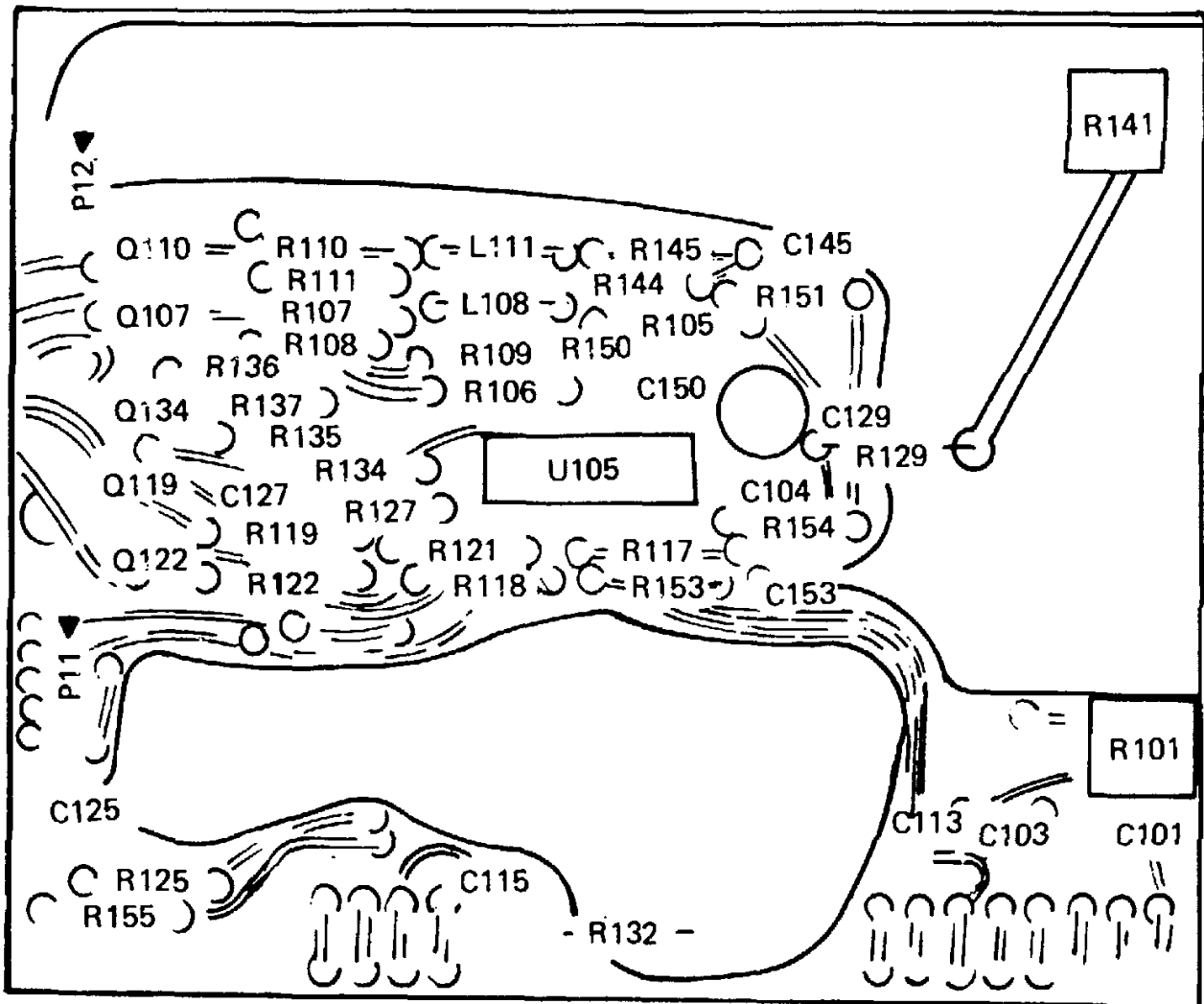


Figure 8-1E. Vertical Amplifier.



MS009655

Figure 8-2. A2 Amplifier Circuit Board.

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WAVEFORM CONDITIONS

TRIGGER SOURCE - CH 2
 TRIGGER LEVEL - AUTO
 SEC/DIV - 0.1 m
 VOLTS/DIV - 0.5

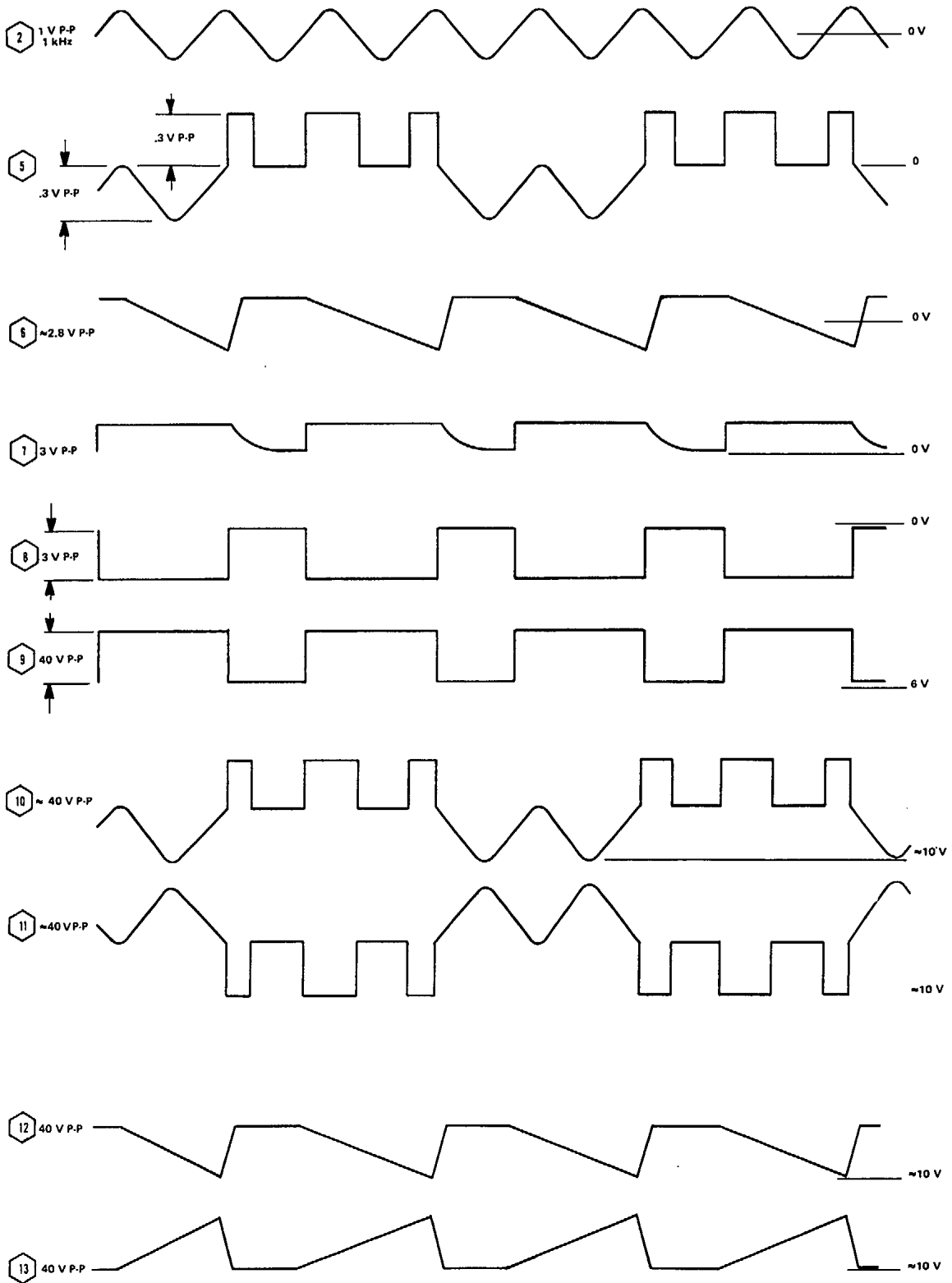


Figure 8-2A. Waveform Conditions.

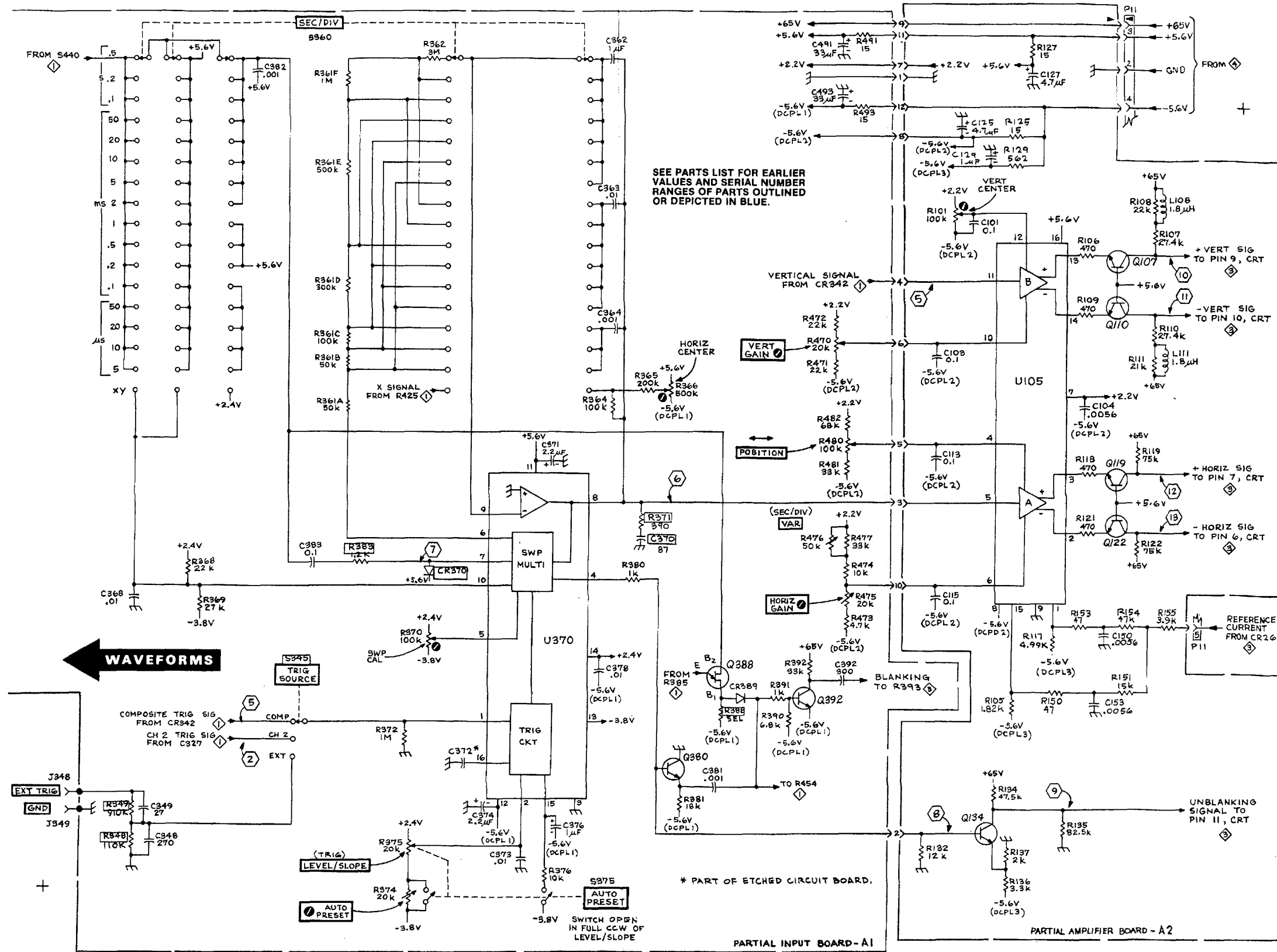
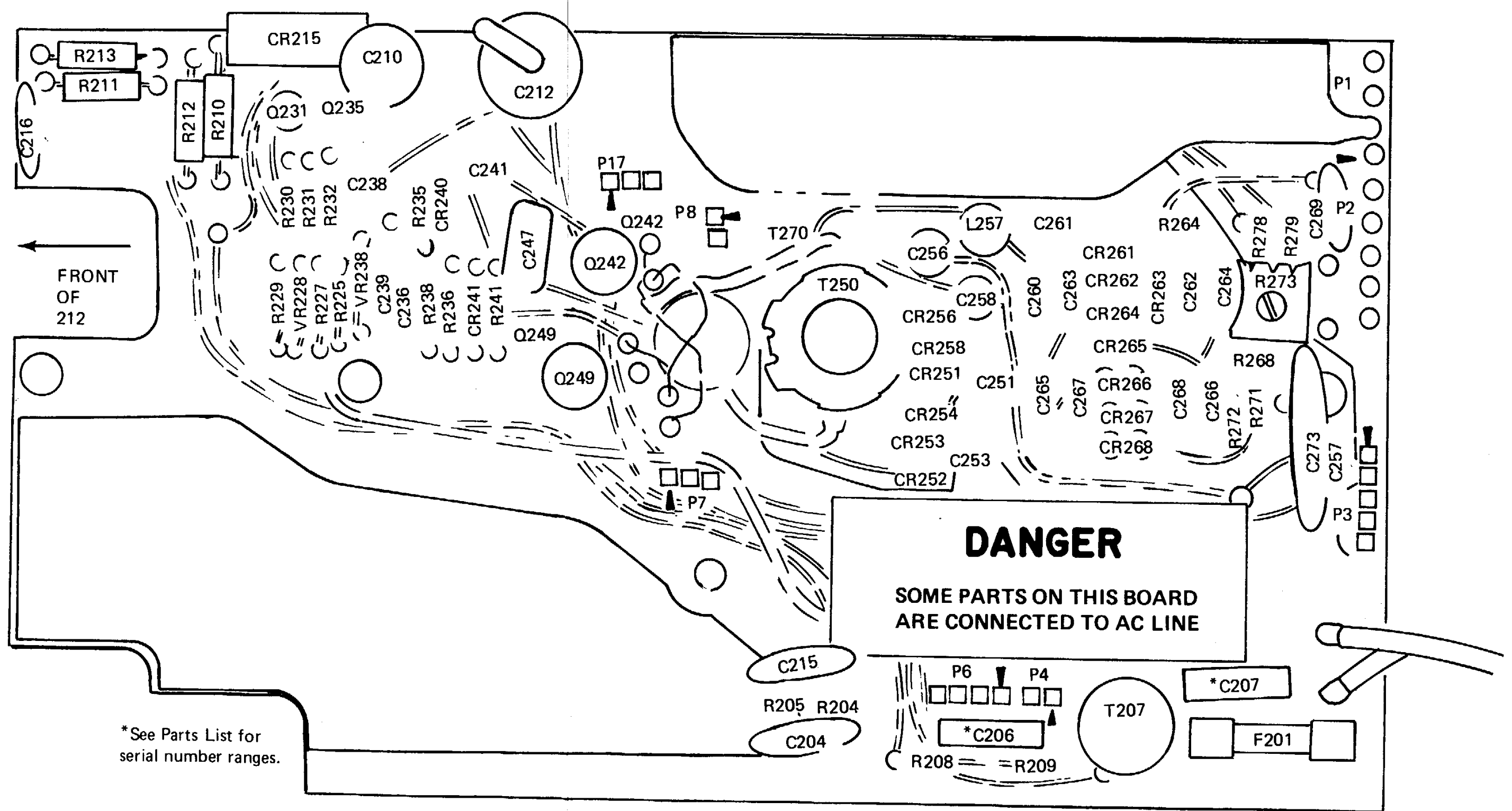


Figure 8-2B. Horizontal and Vertical Output Sweep and Trigger.



*See Parts List for serial number ranges.

DANGER
SOME PARTS ON THIS BOARD
ARE CONNECTED TO AC LINE

MS009656

Figure 8-3A. A3 Power Supply Circuit Board, SN B040000-up.

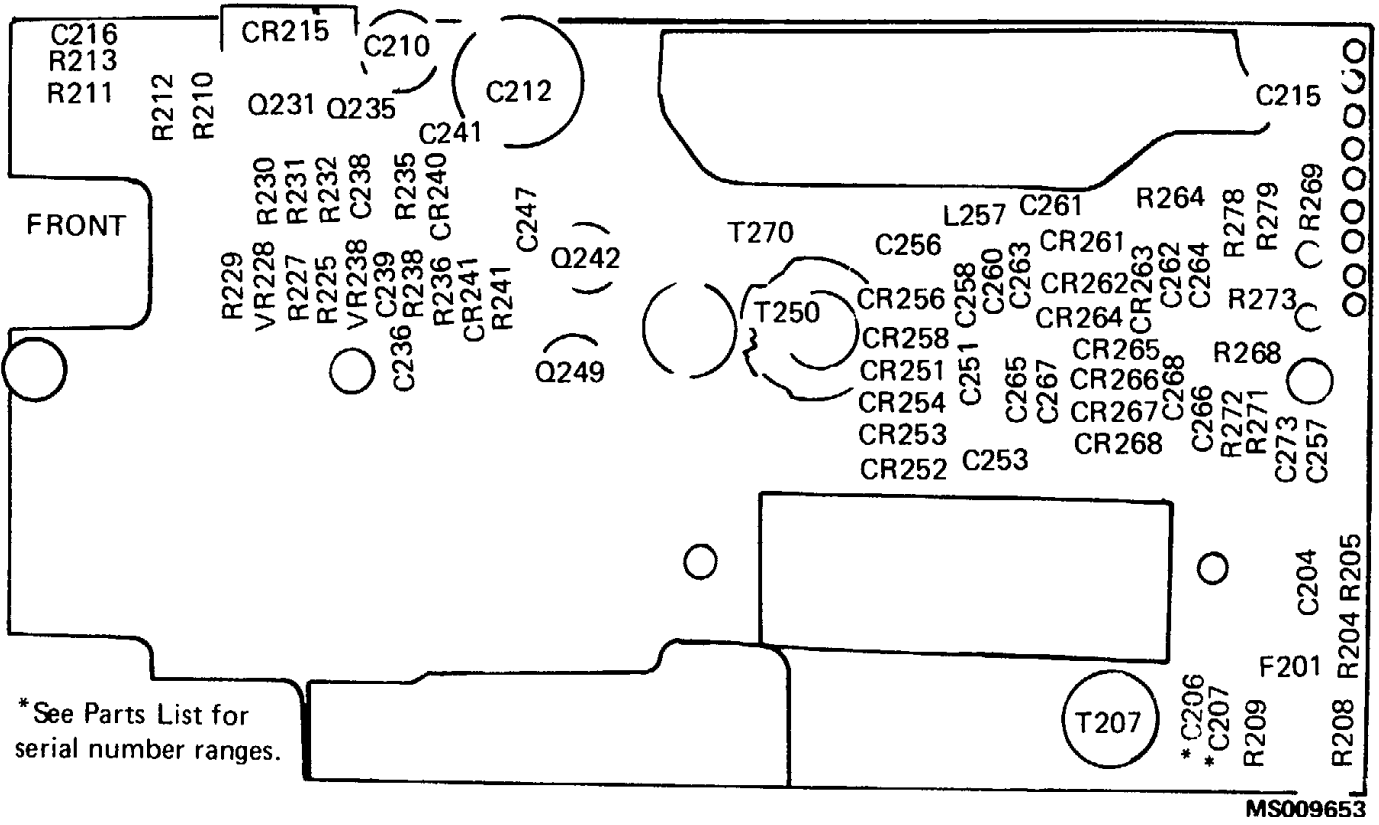


Figure 8-3B. A3 Power Supply Circuit Board, below SN B040000.

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

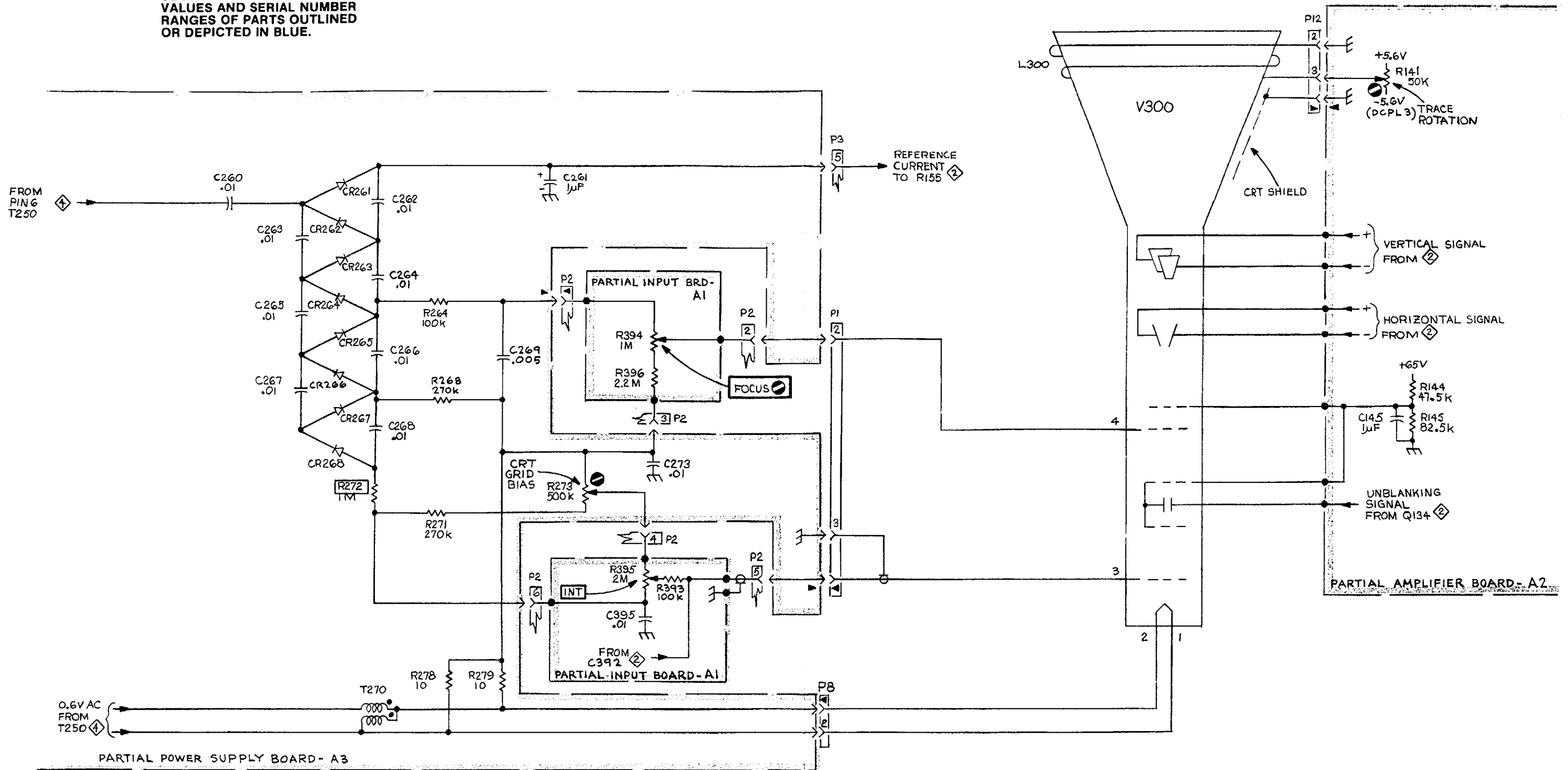


Figure 8-4. CRT Circuit.

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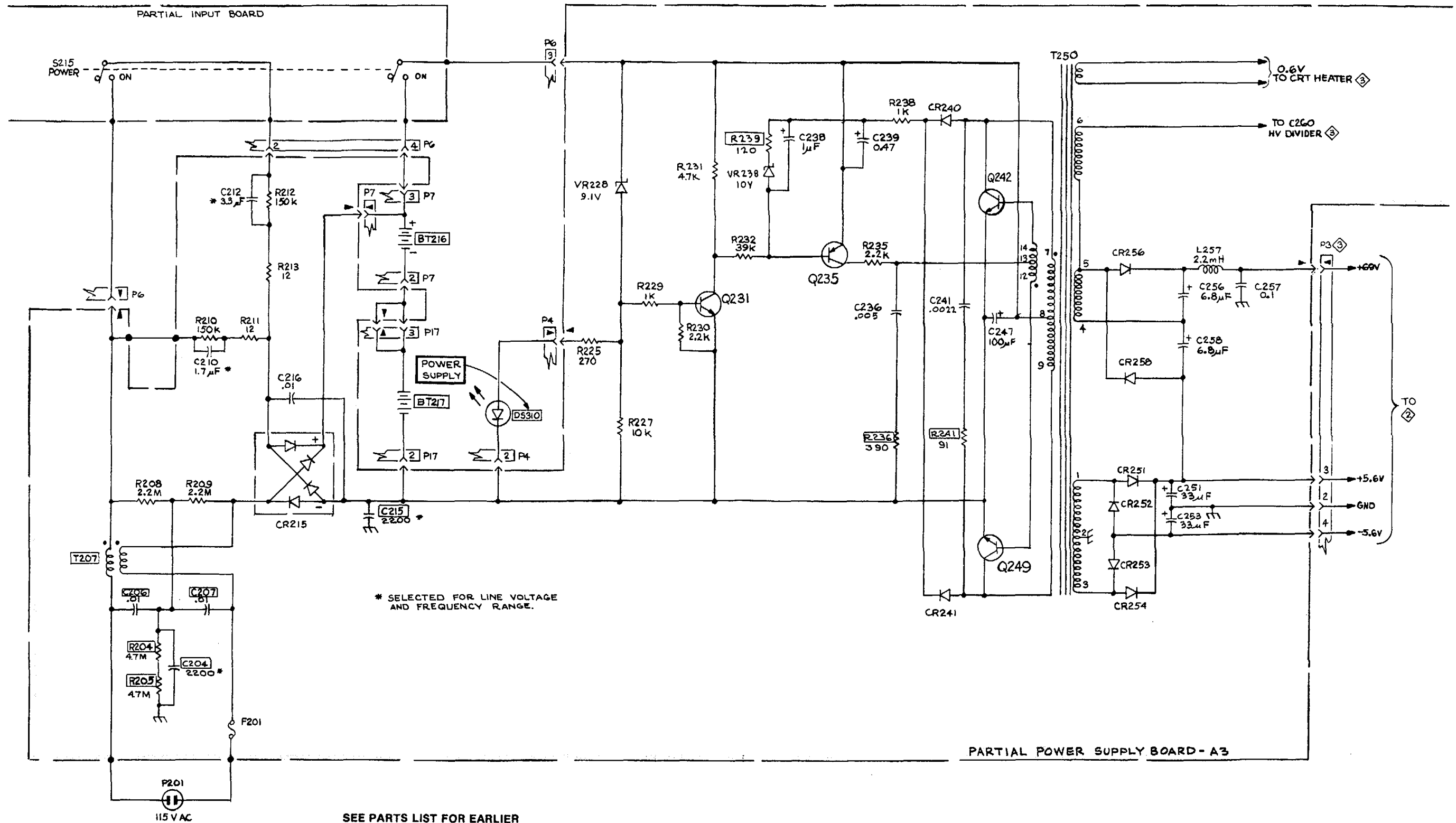


Figure 8-5. Power Supply.

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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN... JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

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DATE SENT

PUBLICATION NUMBER

PUBLICATION DATE

PUBLICATION TITLE

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.
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DA FORM 2028-2
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