

**TEKTRONIX®**

**408  
MONITOR**

**SERVICE**

**INSTRUCTION MANUAL**

Tektronix, Inc.  
P.O. Box 500  
Beaverton, Oregon 97005

Serial Number \_\_\_\_\_



## WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with the TEKTRONIX medical products sales representative in your area.

In all requests for repairs and replacement parts, please include the instrument Type Number or Part Number and Serial Number.

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### 408 FEATURES

The 408 is a portable physiological monitor suitable for use with electrically susceptible patients while operating from a suitable ac power line or an internal battery-pack.

The 408 provides a single-trace ECG display. Adjustable alarm limits are provided for heart rate. There are independent controls for the continuous-tone alarm loudness and for the beat loudness.

Trace intensity and focus do not require adjustment. On-location evaluation of common cable and electrode problems is provided by the ECG LEAD CHECK signal source and the LEAD FAULT indicator.

Other features include an anti-reflection graticule and a hospital-duty power plug (not molded on the power cord).

1525-1

Fig. 1-1. The 408 Monitor.

# SAFETY INFORMATION AND SPECIFICATION

## SAFETY INFORMATION

The 408 monitor has fully isolated ECG circuitry and is suitable for use with electrically susceptible patients when operated from either the specific ac-power source or the internal battery-pack. ECG leakage current does not exceed 5  $\mu$ A rms at 120 V, 60 Hz.

Electric appliances, applied to a patient, create hazards for both the patient and the operator unless the equipment is suitable for the application and the operator is skilled in its use. Several appliances, used simultaneously, compound the hazards.

Within certain governmental jurisdictions, all interconnected accessory equipment must be labeled by an approved testing laboratory. After interconnection with accessory equipment leakage current and grounding requirements must be maintained.

This manual contains informative and warning instructions that the user must follow to ensure safe operation and to retain the monitor in safe condition.

### WARNING

*The monitor is not explosion-proof. When used in locations with flammable anesthetics, the monitor must be at least five feet above the floor. See NFPA No. 56A, Standard for the use of Inhalation Anesthetics, articles 24114(c) and 24032.<sup>1</sup>*

*If the monitor is dropped or severely abused, it should be checked by qualified personnel to ensure that the safety features are intact.*

#### <sup>1</sup>Safety Documents

Additional safety information can be found in the following documents:

National Fire Protection Association  
60 Batterymarch Street  
Boston, Massachusetts, 02110

NFPA No. 76B-T, Safe Use of Electricity in Hospitals  
1973

NFPA No. 56A, Standard for the Use of Inhalation  
Anesthetics, 1972

NFPA No. 70, National Electrical Code (Article 517), 1971

Underwriters' Laboratories, Inc

UL 544, Standard for Safety, Medical and Dental Equip-  
ment

*High voltage inside. Do not remove covers. Operating voltages can cause injurious or fatal electric shock. Refer servicing to qualified personnel.*

### AC POWER SOURCE

The monitor is intended to be operated from a single-phase earth-referenced power source having one current-carrying conductor (the neutral conductor) near earth potential. Operation from power sources where both current-carrying conductors are live with respect to earth (such as phase-to-phase on a three-phase system) is not recommended, since only one conductor has fuse protection within the monitor. The monitor is compatible with isolated power systems such as used in operating rooms.

### AC POWER CORD and PLUG

The monitor has a three-wire power cord with a three-terminal polarized plug for connection to the power source and safety earth. The safety-earth terminal of the plug is directly connected to the monitor frame. For electric shock protection, insert this plug only in a mating outlet with a safety-earth contact.

#### Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

Inspect the power cord periodically for fraying, or other damage, and repair as needed. Do not operate the apparatus from ac power with a damaged power cord or plug.

### GROUNDING

In addition to the safety-earth ground provided by the power cord and plug, a separate ground terminal is provided on the rear panel. When the power cord is not connected, use the ground terminal to ground the monitor case. This protects the patient and operator from electric shock from extraneous voltages that might contact the monitor case.

# SPECIFICATION

## INSTRUMENT CHARACTERISTICS

The following electrical characteristics apply over an ambient temperature range of 0°C to 50°C when the monitor has been calibrated in a +25°C, ±5°C environment.

TABLE 1-1  
ELECTRICAL

Characteristic	Performance Requirement	Supplemental Information
ECG TRANSFER CHARACTERISTICS		
Input to Display and Input to Output		
Lead Selector	I, II, III	
Bandwidth	Monitoring (0.2 Hz to 50 Hz)	Also see Circuit Description.
CMRR		>500,000:1 at 60 Hz with 15 kΩ maximum electrode resistance and 5 kΩ imbalance.
Input Signal DC Offset		No degradation of signals having up to 100 mV dc offset.
Overdrive Recovery	On screen within 1 second.	
Differential Input Resistance		Approximately 10 MΩ.
Input to Display		20 mm/mV at X1 "SIZE" Size variable X1/3 to X3.
Input to Output High Level	X1000 gain.	±2.5 V out, linear range within 5%. ±10 V out, maximum during overdrive conditions. <100 Ω R <sub>o</sub> , single-ended output short-proof to ground. Load resistance 100 kΩ minimum.
Low Level	X1 gain. This output permits direct recording on a standard ECG machine or slaving one monitor to another.	±2.5 mV, linear range within 5%. ±10 mV out, maximum during overdrive conditions. <500 Ω R <sub>o</sub> , single-ended output, short-proof to ground.
Isolation Leakage Current	<5 μA rms at 120 Vac, 60 Hz.	

TABLE 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
Self Protection Defibrillator and Cauterizer	Instrument may remain connected to patient during defibrillation and electrocautery when used with a Tektronix patient cable.	No damage to instrument when patient cable has 1000 Ω in series with each electrode. Resistors in cable can open in extreme cases.
QRS Detector R Edge Timer		Normally set to 10 ms, ±10%. For use with premature babies and neonates, this may be set as low as 6 ms. See note 1 in the Calibration Section.
Inhibit Timer		Set to 200 ms within 10%.
LIMITS		
Rate		
Range		
HIGH	100-250 beats/min.	Within 10% of reading.
LOW	15-150 beats/min.	Within 10% of reading.
Violations		
HIGH		Must remain continuously in violation for about 4 seconds for alarm (range, 2 to 6 seconds).
LOW		Requires two R-R intervals of excessive duration within about 12 seconds for alarm (range, 6 to 24 seconds).
ARREST		Alarm if no beat for about 6 seconds (range, 3 to 11 seconds).
TRIGGERING		
Source		ECG
Auto Baseline		About 4 seconds delay after last trigger (range 1.8 to 9 seconds).
SWEEP		
Speeds	25, 50, 100 mm/second.	
Accuracy		Within 5% of reading, rated against heart rate scale of 35 to 120 beats/minute on 50 mm/SEC range, +15°C to +35°C.

TABLE 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
<b>AUDIO</b>		
Alarm	Continuous tone.	
Beat	Burst of same tone as alarm.	
Loudness	Independent controls for alarm and beat.	
<b>ECG LEAD CHECK</b>		
Pulse Amplitude	0.5 mV, Leads I and III. 1.0 mV, Lead II.	
<b>LINE VOLTAGE</b>		
Ranges	115 vac. 230 vac.	103.5 to 136 vac. 207 to 272 vac.
Frequency	48 to 440 Hz.	
<b>INTERNAL BATTERY</b>		
Operating Time	Nominal, 4.5 hours (D cells). 9.0 hours (F cells).  Minimum, 3.3 hours (D cells). 6.6 hours (F cells).	Dual-trace mode with pulse sensor.
Recharge Time	Approximately 16 hours.	400 mA. (D cells) 700 mA. (F cells)
<b>CRT</b>		
Phosphor	P7	
<b>ENVIRONMENTAL</b>		
<b>TEMPERATURE</b>		
Operating	0°C to +50°C.	The instrument will function, but not necessarily meet its specifications over the extended range of -15°C to +55°C.  Battery Charging should be done in an environmental temperature between 0°C and +25°C. See Supplementary Data.
Storage	-40°C to +60°C.	
<b>ALTITUDE</b>		
Operating	To 15,000 feet.	
Non-operating	50,000 feet maximum.	



TABLE 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
<b>PHYSICAL</b>		
<b>WEIGHT</b>		
408 with batteries	11 lb 8 oz. (5.2 kg).	
Battery pack (D cells)	1 lb 8 oz. (0.7 kg).	
<b>HEIGHT</b>		
Including Feet & Snaps	5.7 in. (14.4 cm). 6.1 in. (15.5 cm).	
<b>WIDTH</b>		
Including Handle	9.0 in. (22.9 cm). 9.5 in. (24.13 cm).	
Including Handle & Adapter	10.0 in. (25.4 cm).	
<b>DEPTH</b>		
Including cord Wraps and knob protrusion	10.0 in. (25.4 cm). 11.8 in. (30.0 cm).	

**SUPPLEMENTARY DATA**

**BATTERY OPERATION and CONDITION**

Batteries should be charged in an environmental temperature between 0°C and +25°C to accept maximum charge.

Charging at temperatures above +25°C will proportionately lessen the battery charge. For example, operating time is reduced 50% or more when charging is done in a +50°C environment. Longer charging time will not compensate for this. A good rule of thumb is to allow about eight hours of charging time for each hour of battery use.

A properly charged battery should provide 4.5 hours (or no less than 3.3 hours) of operation. See Fig. 1-2.

**POWER OFF.** Battery is charging when the monitor is plugged into an AC outlet.

**CHARGED.** Power is on. When the monitor is plugged into an AC outlet, this is a correct indication, but does not show battery condition. A battery peculiarity may cause

the meter to read high during the first fifteen minutes of operation following disconnection from an AC outlet; this may be a false indication of battery condition.

**PARTIAL CHARGE.** Power is on. A few minutes of operating time remains.

**DISCHARGED.** POWER button is pushed in. The monitor is shut off at this point. The monitor will operate on ac power lines. Plug into an ac outlet to use it and recharge the battery pack. To fully charge the battery pack, leave the monitor connected to the ac outlet for at least sixteen hours.

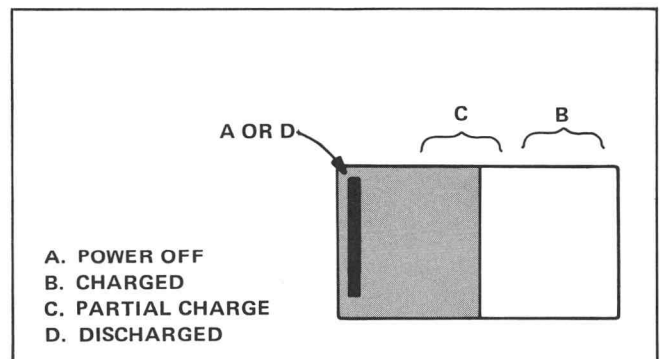
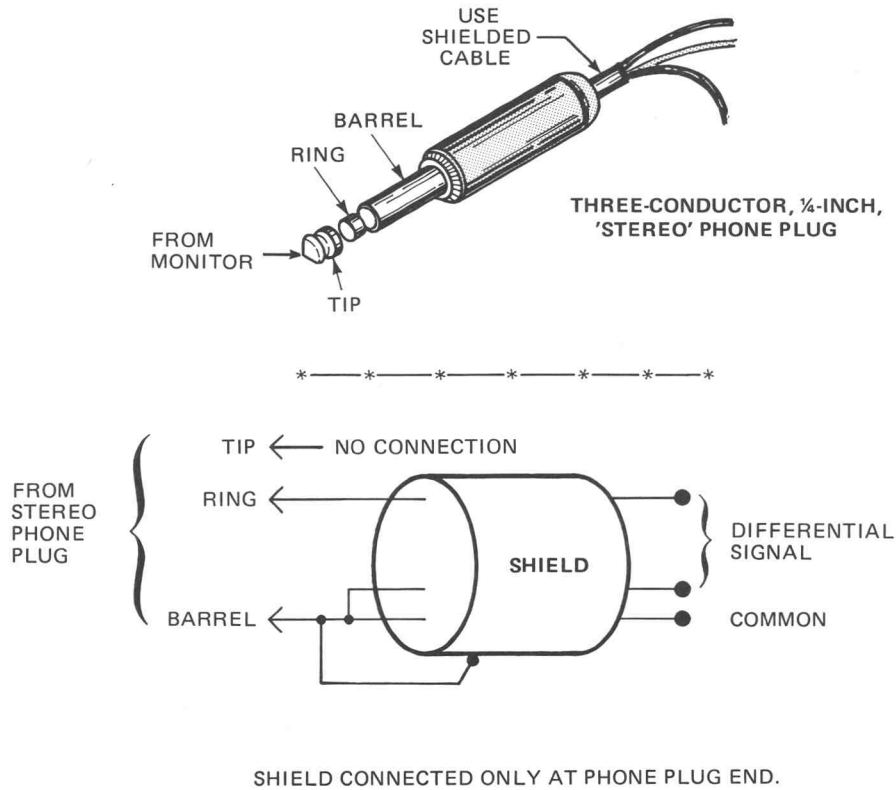


Fig. 1-2. Battery condition.

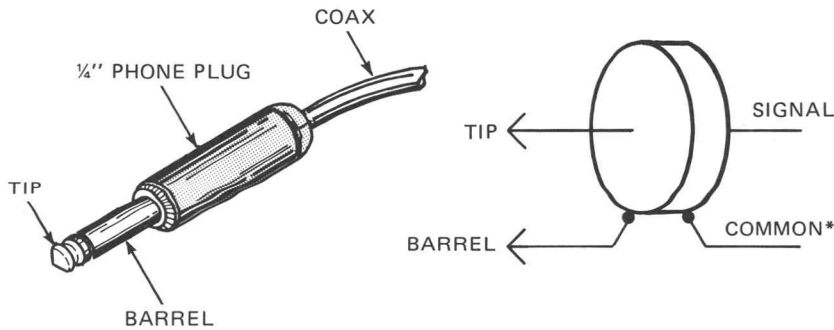
**LOW LEVEL**

Provides a low-level (X1) output signal from the monitor's ECG or PRESSURE/PULSE channel.

A three-conductor ¼-inch 'stereo' phone plug connects to the monitor.



**HIGH LEVEL**



**NOTE**  
 A TWO-CONTACT PHONE PLUG WILL SHORT TO GROUND THE LOW-LEVEL OUTPUT SIGNAL. THIS WILL NOT ADVERSELY AFFECT MONITOR PERFORMANCE.

\*COMMON SHOULD NOT BE GROUNDED BY THE DEVICE RECEIVING THE SIGNAL. SINGLE-ENDED FLOATING OR FULL DIFFERENTIAL INPUTS ON THE RECEIVING DEVICE WILL PREVENT GROUND-LOOP CURRENTS.

2042-16

Fig. 1-3. Output Cables.

**CABLES and PLUGS**

The information shown in Figures 1-3 and 1-4, permits the user to adapt other equipment to the 408 Monitor.

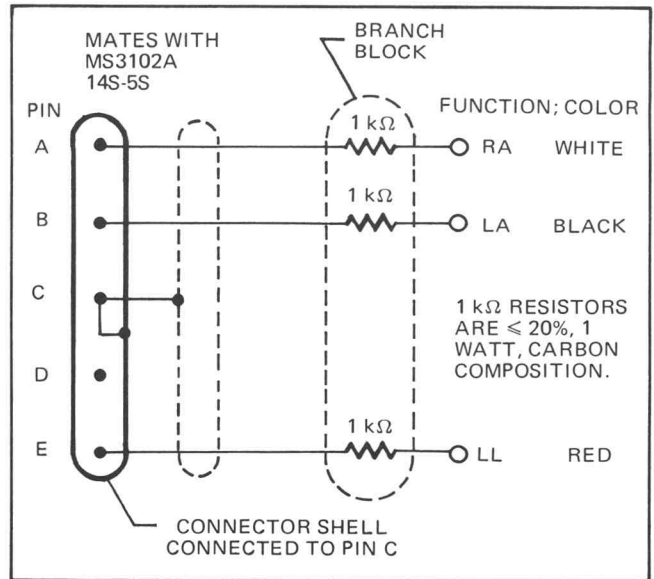


Fig. 1-4. ECG Cable.



# OPERATING INFORMATION

## INTRODUCTION

This section explains the function of each external control, connector and indicator that appears on the external surfaces of the monitor, and is used during normal operation. All other controls are inside the instrument covers and should be adjusted only when the monitor is being calibrated.

## FRONT PANEL (See Fig. 2-1)

**1. BEATS/MIN SCALE.** The display graticule (screen) is marked in beats per minute for use with the 50 mm/SEC sweep speed. To read beats per minute at the 100 mm/SEC sweep speed, multiply the BEATS/MIN reading by 2. For the 25 mm/SEC sweep speed, divide the BEATS/MIN reading by 2.

At certain heart rates, a spot will appear at the left-hand edge of the display. This is the starting point of the sweep,

which has been reset and is waiting for the next triggering event. Any vertical movement of this spot is an accurate indication of the events prior to triggering.

**2. BATTERY.** Monitors with a battery pack have a meter in the lower left corner. The meter indicates the approximate state of charge of the battery pack when the monitor is in battery operation. To interpret meter reading, see Supplementary Data in the Specification section.

**3. POWER.** This push-button switch turns the monitor on or off. Instruments with a battery pack have a battery charger, which operates continuously as long as the monitor is connected to an ac outlet.

**4. BEAT LOUDNESS.** This control adjusts the loudness of the beat tone and should be set fully clockwise if maximum loudness is desired. The beat is heard once for each QRS pulse during ECG use, or once for each rising portion of the pressure or pulse waveform during pressure/pulse operation.

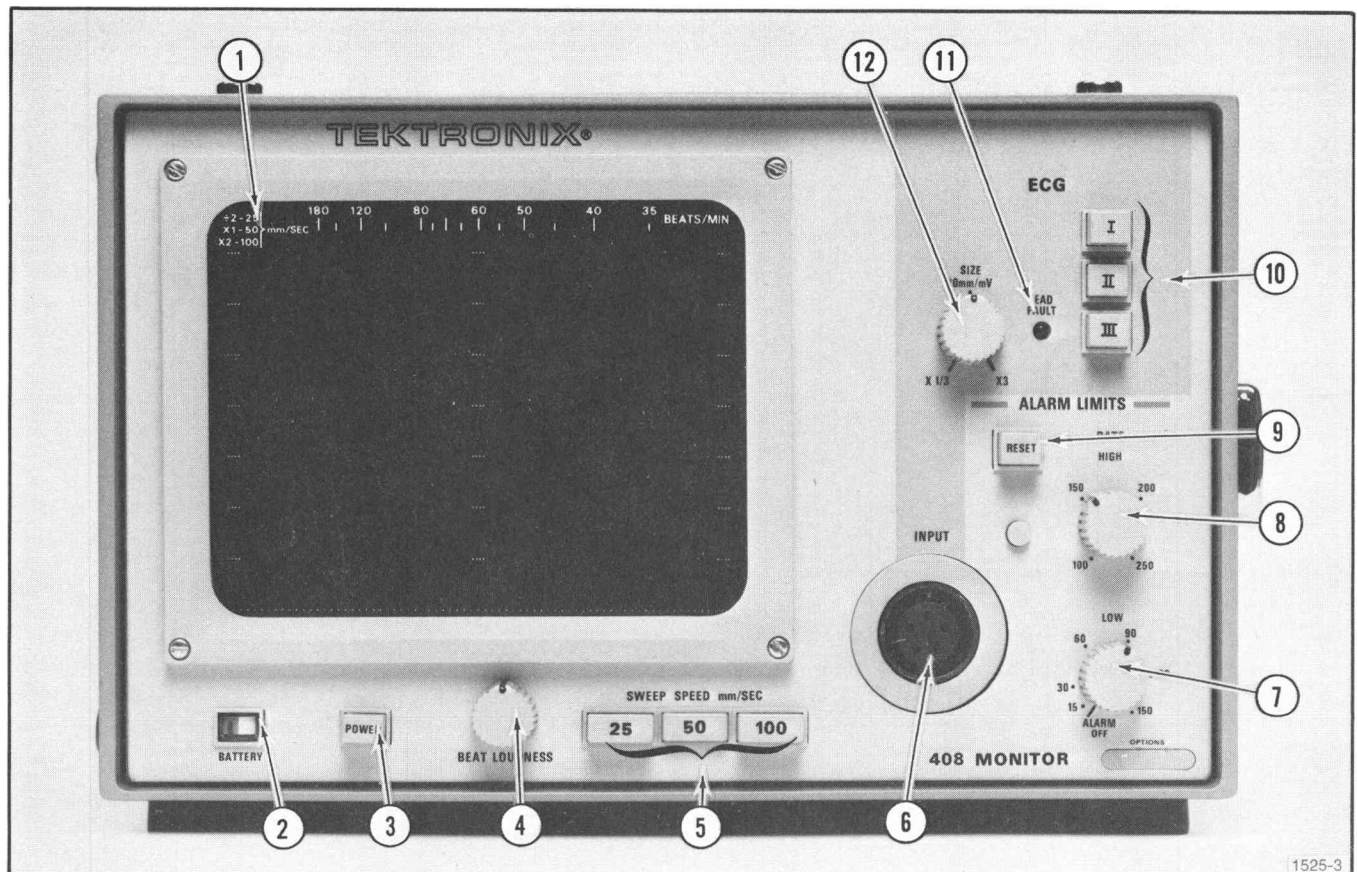


Fig. 2-1. Front Panel Controls, Connectors and Indicators.

**5. SWEEP SPEED mm/SEC.** Three push buttons select the speed of the trace across the screen. The sweep speeds are 25, 50 or 100 mm/SEC. The total time it takes the trace to cross the screen is 4, 2 or 1 seconds, respectively.

**6. ECG INPUT.** Permits attachment of the ECG patient cable to the monitor.

**7. RATE-LOW.** This control sets the lower rate alarm limit between 15 to 150 beats per minute.

**8. RATE-HIGH.** This control sets the upper rate alarm limit between 100 to 250 beats per minute.

**9. RESET.** This push button resets the alarm. If the condition that causes the alarm still exists, the alarm will again sound soon after the button is released. If the alarm was the result of an acceptable patient condition, then new limits must be selected and the RESET button must be pushed again.

**10. ECG.** Push buttons control the lead selection for ECG. They are I, II, and III. The ECG display is centered vertically.

**11. LEAD FAULT INDICATOR.** This lamp, when lighted, indicates the following possible problems:

- a. An open circuit (break) in the patient cable or in the electrode wires or electrode.
- b. Insufficient gel or paste in the electrode(s).
- c. One or more electrodes or electrode attachment wires disconnected.
- d. No buttons pushed in on the lead selector switch.
- e. Two or more buttons pushed in on the lead selector switch.
- f. Excessive dc offset in one or more electrodes.

**12. ECG SIZE.** This control varies the height of the ECG display. The ECG OUTPUT signal is not affected by the SIZE control.

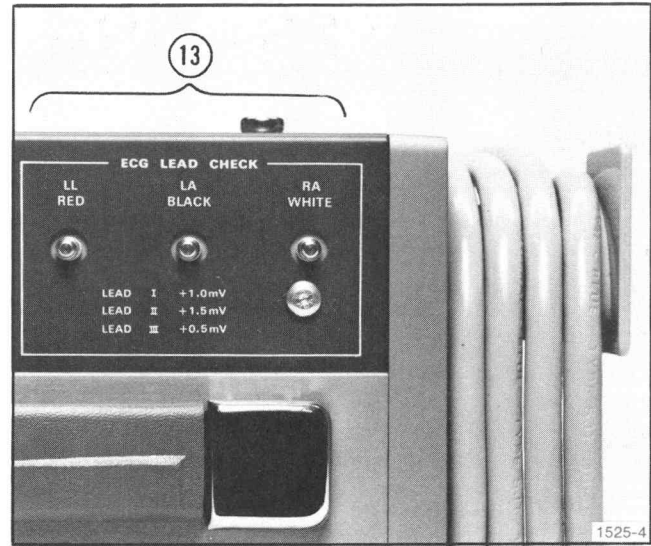


Fig. 2-2. ECG Lead Check Connectors.

### RIGHT SIDE (See Fig. 2-2)

**13. ECG LEAD CHECK TERMINALS.** The three terminals provide rectangular pulses that permit checking cable defects, electrode wire defects, amplifier operation and QRS detector function. When the patient wires are connected to the ECG LEAD CHECK terminals, an ECG lead selector button is pushed in and ECG SIZE is set to 20 mm/mV, the display should be:

Push	Display
Lead I	2 divisions of positive-going signal
Lead II	3 divisions of positive-going signal
Lead III	1 division of positive-going signal

### REAR PANEL (See Fig. 2-3)

**14. ALARM LOUDNESS.** Adjusts the loudness of the alarm signal. Set fully clockwise if maximum loudness is desired.

**15. GROUND.** Provides an additional grounding point (there is one in the power cord) for the instrument case. When the power cord is not connected to a power source, the case may be grounded as added protection against any voltage source that might contact the case and reach the patient. Grounding through the power cord requires an appropriate three-wire outlet. Do not use a three-terminal to two-terminal adapter.

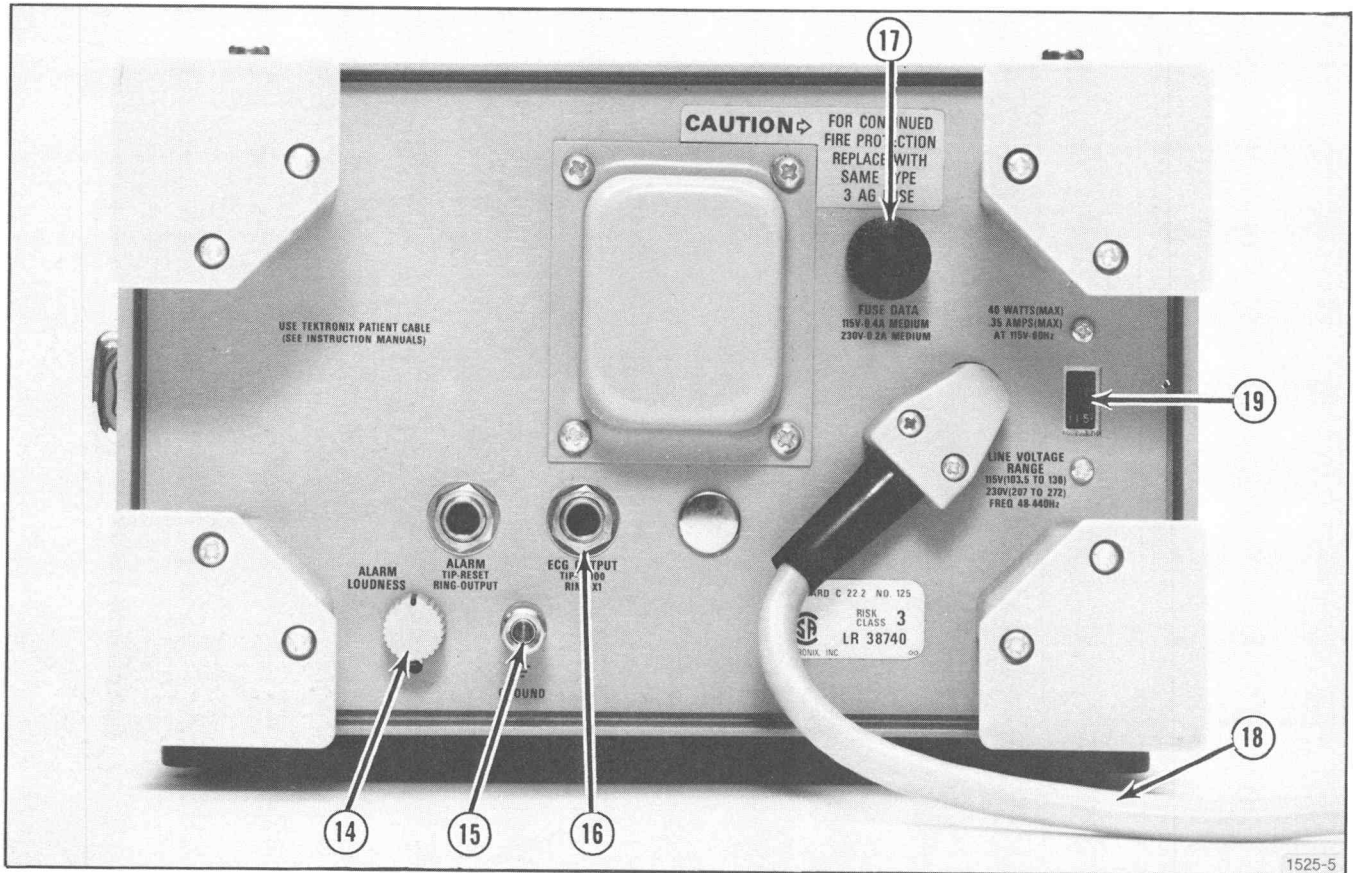


Fig. 2-3. Rear Panel Controls and Connectors.

**16. ECG OUTPUT.** Provides two output levels. The tip is times 1000 gain. The ring is times one gain for direct recording on a standard ECG machine or slaving to another monitor.

**17. FUSE HOLDER.** Contains the ac power-line fuse.

**18. AC POWER-LINE CORD and PLUG.** Permits connection to an ac outlet for ac operation and battery charging.

**19. LINE VOLTAGE RANGE.** This switch is a screw-driver-operated slide switch. It should indicate the proper line voltage. The nominal line voltage in the U.S.A. is generally 115 Vac. 115 means a range from 103.5 Vac to 136 Vac. 230 means a range from 207 Vac to 272 Vac.





# CIRCUIT DESCRIPTION

The circuitry in the 408 monitor is largely contained on three circuit boards (see Fig. 3-1). The main circuit board contains the power supplies and crt display circuitry and is mounted horizontally on the lower part of the monitor. The other two boards plug into sockets mounted on the main board. The boards are mounted directly behind the front-panel controls. Ribbon cables with multi-pin connectors are used to make connections between the boards and the other components.

The alarm speaker is mounted approximately in the center of the instrument.

The power transformer, along with all other ac-line-voltage circuitry, is mounted to the rear panel.

## SIMPLIFIED BLOCK DIAGRAM

The Simplified Block Diagram (Fig. 3-1) shows the basic circuit sections and signal flow. Each major circuit-board section is outlined and described in detail. Circuits not within the outlined circuit board areas are described along with their related circuits.

COS/MOS (Complementary-Symmetry/Metal-Oxide Semiconductor) devices are used in this monitor. These devices operate from the +7 volt and -7 volt supplies and have a usable HI state between +4 volts and +7 volts, and a usable LO state between -4 volts and -7 volts. HI and LO are used in this description to indicate these usable states.

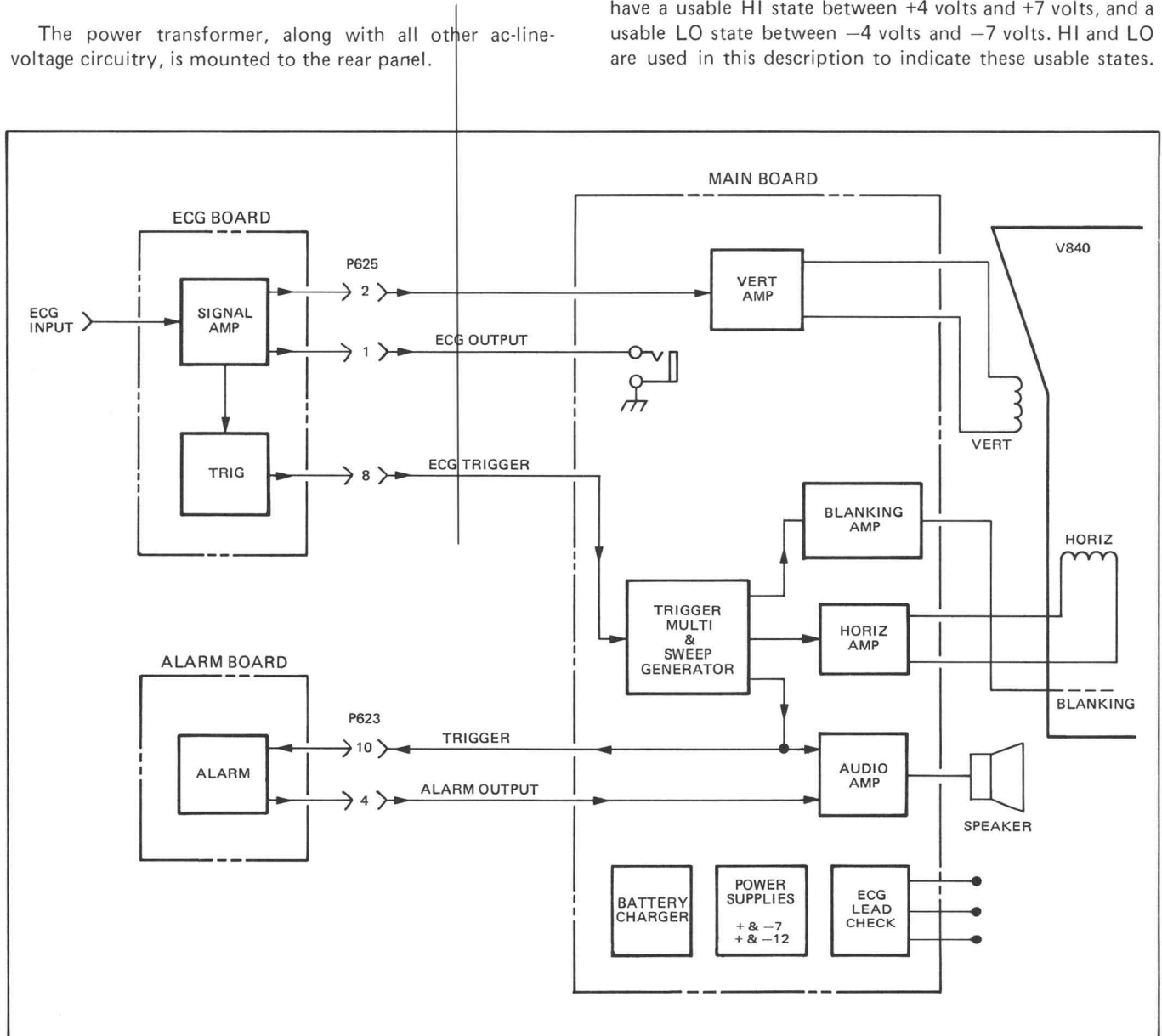


Fig. 3-1. Simplified block diagram and signal flow.

## ECG BOARD

### ECG AMPLIFIER CIRCUIT FUNCTIONS

The ECG circuit accomplishes the following:

1. Amplifies the ECG signal (three input lead configurations). The circuit provides extremely low-leakage isolation (less than  $5\mu\text{A}$ , rms at 120 Vac, 60 Hz) between patient and monitor. The input circuitry is protected for use during defibrillation and electrocautery.

2. Indicates when a fault exists in ECG input cables, wires, electrodes, etc.

3. Provides ECG output signals to a rear-panel jack. Output amplitudes are fixed at X1000 and X1 of the input signal.

4. Provides an amplified ECG display signal, whose amplitude is variable with the SIZE control. The display baseline is approximately at the screen center.

5. Provides a QRS trigger to the main board for sweep triggering and beat tone and to the alarm limits board for analysis of alarm conditions. The trigger circuit rejects pacer signals.

### ECG AMPLIFIER CIRCUIT OPERATION

The ECG signal enters the input amplifier (Fig. 3-2) through three electrode wires. One of the wires is signal reference and the other two are used for a differential input signal. The ECG pushbuttons are used to select any pair of wires as the input signal.

The ECG patient cables contain a resistor in series with each input wire. These resistors and the input protection circuit protect the input amplifier during defibrillation and electrocautery.

A very small amount of current ( $0.1\mu\text{A}$ ) is injected into the patient electrodes. When this current is interrupted in any input wire, (such as when a wire breaks) the LEAD FAULT indicator lights.

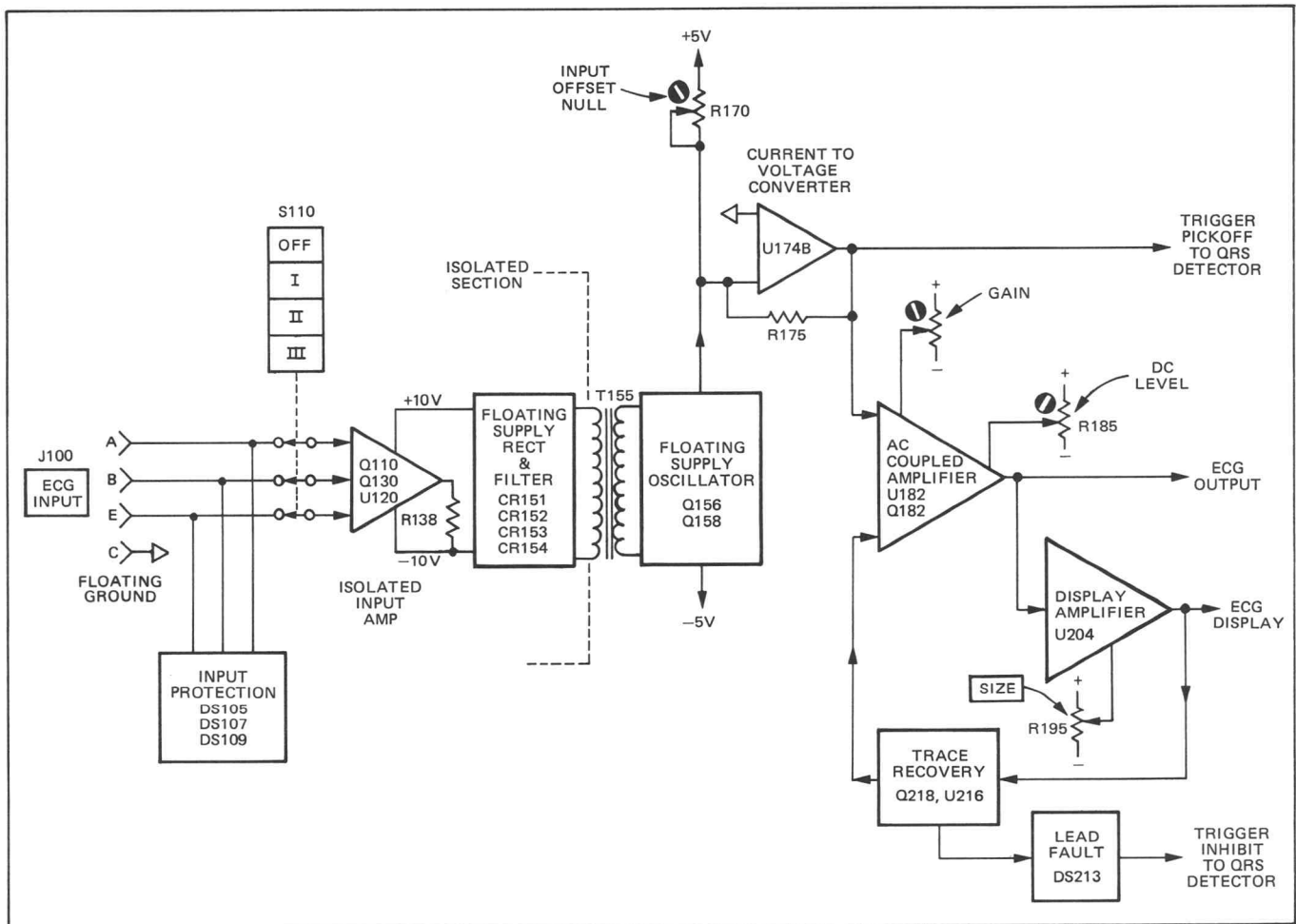


Fig. 3-2. ECG Amplifier.

The input amplifier is isolated from the other circuitry and from the monitor chassis. The shield covering the ECG input amplifier circuitry and the shield in the patient cable are connected to the floating ground point to reduce ac interference.

The Floating Power Supply Inverter provides the power for the Isolated Input Amplifier through a transformer. The circuit is designed so that the amplified ECG signal varies the loading on the floating supply transformer, which causes the inverter supply current to change. This changing inverter current becomes an amplified voltage-signal at the output of the Current-To-Voltage Converter.

The output of the Current-To-Voltage Converter provides two signals to the QRS Detector and the input signal to the AC-Coupled Amplifier.

The AC-Coupled Amplifier provides the remainder of the needed gain and determines the high and low-frequency response of the ECG channel. Gain and dc level are set by the two calibration adjustments in this circuit. Output of this amplifier provides the ECG output to the rear panel and the input to the Display Amplifier.

In the Display Amplifier, ECG-display-signal amplitude can be varied with the SIZE control. This control does not change the ECG-output signal amplitude to the rear panel.

**FLOATING POWER SUPPLY.** This circuit consists of an inverter (Q156, Q158), a transformer (T155) and a Rectifier-Filter Circuit. The inverter produces an approximate 250 kHz trapezoidal wave. The frequency is dependent upon the load on the inverter. T155 is insulated for at least 5 kV.

**ISOLATED INPUT AMPLIFIER.** Circuitry is provided that protects the input amplifier during electrocautery and defibrillation. Input voltage is limited by DS105, DS107, DS109, R107, R114, CR107, CR109, CR114, CR116, VR120, VR122 and the 1 k $\Omega$  resistors in the patient cable. C105, C107 & C109 reduces rf interference from TV and radio signals and electrocauterizers. R107 and R114 also provide patient protection in case of circuit failure.

R104 & R112 supply about 1 nA to the patient electrodes. If this current is interrupted (wire breaking or high electrode resistance), the display will shift off-screen and the LEAD FAULT indicator will light.

The input amplifier is a differential-input, single-ended-output circuit consisting of balanced pair Q110A and Q110B and output amplifier U120B. The output of U120B varies the current through R138 in proportion to the

ECG-input signal. The differential gain of the amplifier is determined by feedback dividers R133/R136 and R117/R130. The gain up to TP136 is about 23.6 times the input signal.

U120A maintains the junction of R130 and R133 at 0 volts (referenced to the floating ground), which permits R127 to set a constant current through Q110A and Q110B. U120A also provides negative feedback through the reference wire and the patient to Q110A and Q110B, which reduces the ac common-mode signals to a very low level.

When no signal is applied there should be about 0 volts at TP136 and at the junction of R130 and R133. Under this condition, R138 current is about 5 mA.

R138 current comes from the +10 V supply, through U120B and to the -10 V supply. When a signal enters the input amplifier, the current through R138 increases or decreases which changes the load on the Floating-Supply Inverter.

**CURRENT TO VOLTAGE CONVERTER.** Feedback action of U174B maintains 0 volts at TP170, by way of R175. R170, Input Offset Null is adjusted so that TP178 is 0 volts when no signal is applied to the ECG INPUT.

The ECG input signal thus varies the current in the Floating Supply Inverter. Since the current through R170 and R172 is constant, the current through R175 will change. The changing current in R175 is produced by a voltage at the output of U174B which is 50 times the ECG input signal. The gain is determined by the Isolated Input Amplifier gain up to TP136, the turns ratio of T155 and the ratio of R175 to R138.

R178 and C178 filters out most of the inverter hash from the signal. Remaining hash is removed by the AC-Coupled Amplifier.

**AC COUPLED AMPLIFIER.** U182 and its associated circuitry make up a special form of non-inverting amplifier with upper and lower bandwidth limits.

Short-duration overdrive signals will not shift the display baseline significantly because ac-coupling capacitor C181 is in the feedback circuit. The matched field-effect-transistors Q182A and Q182B are connected as a source follower and raise the load impedance to the ac-coupling network, R219-C181.

## Circuit Description—408 Service

X20 amplifier gain is determined by R179, R181, R183, R184 (Gain) and R186. High-frequency bandwidth is determined by R179, R181 and C179.<sup>1</sup> Low-frequency bandwidth is determined by C181 and R219.<sup>1</sup>

R179 and R181 limit the input dynamic range of the amplifier to  $\pm 7.5$  V, corresponding to a  $\pm 150$  mV dc offset at the ECG INPUT connector. This allows the LEAD FAULT indicator to be on when the input dc offset exceeds the  $\pm 150$  mV limit.

**DISPLAY AMPLIFIER.** The times 1000 ECG signal from pin 1 of U182A goes to the Display Amplifier, which consists of U204A and U204B. U204B is an inverting operational amplifier with R193, R195 and R196 making up the gain-determining divider. The SIZE control R195, varies the gain approximately from X-1/3 to X3 with X1 gain at R195 mechanical center.

U204A is an inverting operational amplifier with a gain of 1/2. R199 and R200 set the dc level of the ECG signal.

**TRACE RECOVERY CIRCUIT.** The Trace Recovery Circuit speeds up the return of an off-screen signal. When the dc level at pin 1 of U204A exceeds  $\pm 1.0$  V (corresponding to  $\pm 4$  cm on the screen), Q218 conducts, shunting R217 across R219 to speed up the charging of C181 in the AC-Coupled Amplifier.

U216A, CR208 and CR205 act as a full-wave rectifier so that Q218 will turn on regardless of the polarity at pin 1 of U204A.

C212 delays Q218 turn-on so that short-duration overdrive signals (such as pacemaker signals) will not affect the Q218 and lead-fault circuits. C212 also delays Q218 turn-off to allow the recovery action to return the trace to its quiescent level.

**LEAD FAULT CIRCUIT.** When the ECG input dc offset exceeds about  $\pm 150$  mV, the LEAD FAULT light-emitting diode, DS213, lights. The current, through DS213, is limited to 10 mA by CR215, CR216 and R215 and feedback action of U216B. When the ECG channel is off, a positive signal through CR213 keeps DS213 turned off. A signal from CR216 anode disables the QRS detector when DS213 is on.

<sup>1</sup> For diagnostic bandwidth of 0.5 Hz to 100 Hz C179 and R219 can be changed to .022  $\mu$ F and 2.2 M $\Omega$ .

**+5 V AND -5 V POWER SUPPLY.** These regulated supplies provide power to the floating supply inverter and Input Offset circuitry. The +5 V regulating circuit, Q232, Q234 and VR235, is referenced to the -12 V supply. The -5 V regulating circuit is then referenced to the regulated +5 V supply.

## QRS DETECTOR CIRCUIT OPERATION

The QRS detector (Fig. 3-3) evaluates the content of the incoming ECG signal to determine when the QRS portion occurs.

The QRS complex, or R-wave has at least one slope which has a greater rate of voltage change for a longer period of time than other portions of the ECG waveform.

When a QRS pulse is detected, an output signal is generated that triggers the sweep and rate beat tone, and supplies rate information to the rate limit alarm circuits.

The ECG signal passes through the automatic gain-controlled amplifier, a differentiator circuit and a full-wave rectifier. The resulting positive signal contains one or more large, relatively wide, essentially sinusoidal pulses for each QRS complex at the input. Feedback through the automatic gain control circuit maintains pulse amplitude at about 3-4 volts.

Those portions of the pulses over 1 volt pass through an amplitude comparator to the slope and inhibit timer circuits. The first pulse greater than 10 ms wide that enters the slope timer circuit, will set the inhibit timer, which is the ECG trigger. The inhibit timer locks out any other pulses (i.e., pulses caused by T-waves) which may occur in less than 200 ms after the first pulse.

The pacemaker circuit eliminates pacemaker signals from the trigger signal. A signal from the LEAD FAULT circuit also prevents trigger output when the LEAD FAULT indicator is on.

**AUTOMATIC GAIN CONTROLLED AMPLIFIER.** U324 is a non-inverting amplifier with ac-coupled feedback (through C324 and C325), that provides a low-frequency cutoff of about 1 Hz. The gain of the amplifier is automatically controlled by feedback to a light-dependent resistor (LDR) R324 from the +3 V comparator.

**DIFFERENTIATOR AND FULL-WAVE RECTIFIER.** Signals from the automatic gain controlled amplifier are

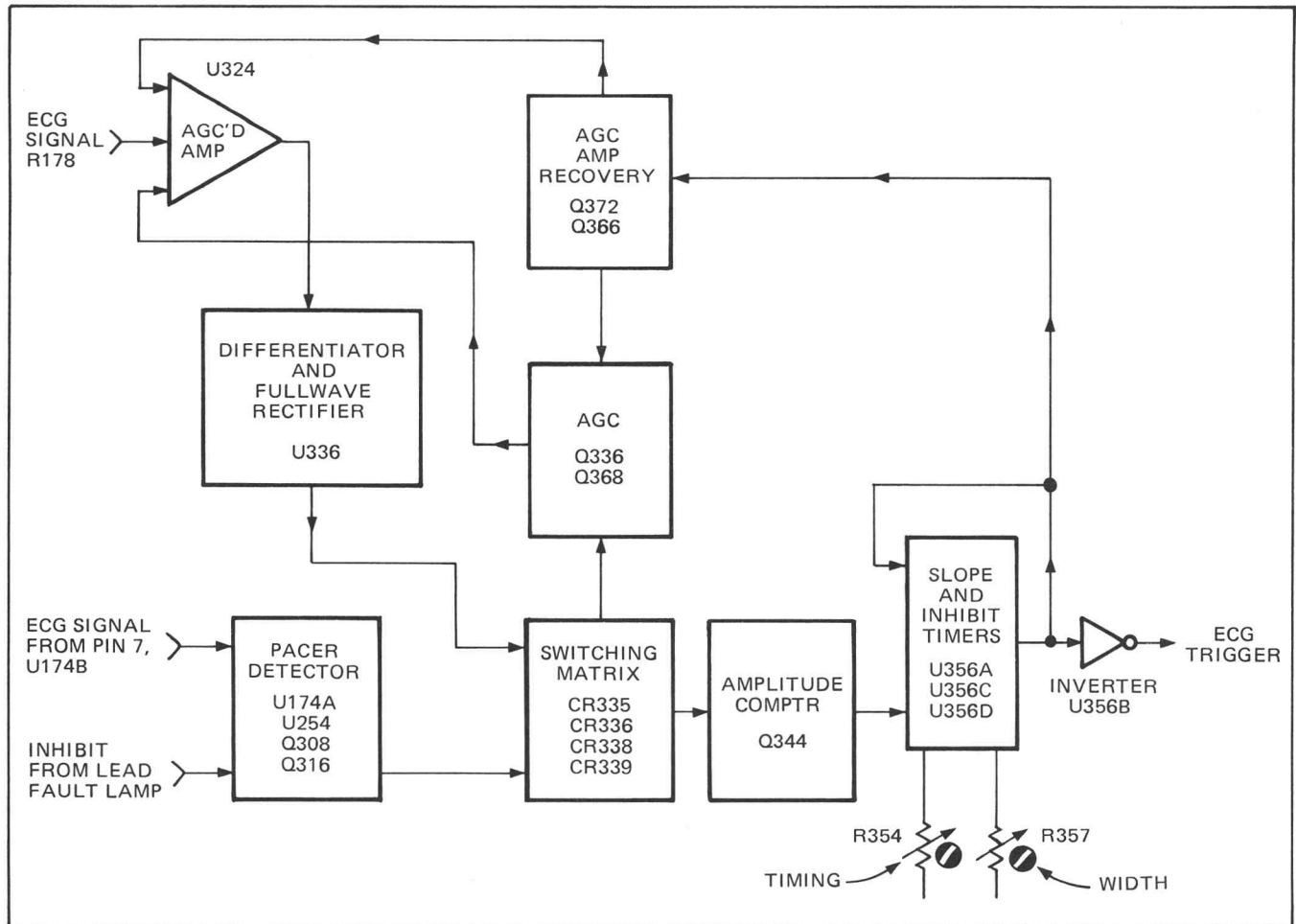


Fig. 3-3. QRS Detector.

differentiated and inverted through U336B. The differentiated signal is then full-wave rectified, through CR332, for the rising portion and through U336A, (X1 inverting amplifier) and CR333 for the falling portion. This full-wave-rectifier action produces two positive pulses for each positive or negative pulse into U324A, one pulse for the rising portion and the other for the falling portion.

**AUTOMATIC GAIN CONTROL.** The amplitude of the pulses at TP333 is controlled by feedback through Q336 and Q368 to R324 in the U324 circuit.

Q336 base is set at about +3 V by R336 and R337. CR335 is normally conducting which keeps Q336 off. If the pulse amplitude reaches +3 V, Q336 turns on, causing C367 to charge positive. This increases Q368 conduction, which increases the intensity of the LED in R324 and reduces the gain of U324.

**AMPLITUDE COMPTR.** Q344 base is set at 1 volt by R344 and R345. CR336 is normally conducting, which keeps Q344 turned off. When pulses at TP333 reach 1 volt, Q344 turns on, which allows only the portion above the 1-volt level to enter the slope and inhibit timers.

**SLOPE AND INHIBIT TIMERS.** When Q344 turns on, it biases Q382 off. When Q382 is biased off, C382 starts charging toward -7 volts. After about 6 milliseconds (depending on the action of Q384 and associated circuitry), the charge on C382 reaches the lower threshold (TL) point of U388, a one-shot, and it switches. The ECG Trigger output on U388 pin 3 goes HI for 200 milliseconds.

When U388 is switched, C388 is permitted to charge toward +7 volts. As the charge on C388 increases, the upper threshold (TH) of U388 is reached, it resets, and the ECG Trigger signal goes LO.

## Circuit Description—408 Service

Transistor Q384 provides noise immunity for the ECG Trigger circuitry. If considerable 60 Hz or other noise is present, the holdoff period set by Q382 and associated circuitry is automatically lengthened to prevent U388 from triggering on the noise. If the noise level is low, the holdoff period is automatically reduced to less than 6 milliseconds.

**AUTOMATIC GAIN CONTROLLED AMPLIFIER RECOVERY.** If a QRS signal is not present for several seconds, pin 3 of U388 remains LO and cuts off Q386 long enough for C373 to charge up and turn on Q372. This turns off Q366. With Q372 on, the dc-level recovery time is shortened by allowing C324 and C325 to charge more rapidly.

When Q366 is turned off, the AGC feedback time constant (R338, C367) is decreased by a factor of about 10 (R366 paralleled with R338) so that the gain will rapidly increase to compensate for a weak QRS signal. In the absence of a signal the gain increases to maximum and remains until the signal returns. At that time, VR334 will conduct through R334 to rapidly reduce the gain within range of the normal feedback control.

**PACER DETECTOR.** The Pacer Detector circuit keeps pacer signals from entering the Q336 gain control and the Q344 amplitude comparator circuits. U174A is a differentiator with limited upper bandwidth. A pacer pulse at the input to C303 produces an output at pin 1 of U174A. When the pulse at pin 1 of U174A exceeds + or -5 volts, a negative output at the collector of Q254 triggers Q308 into conduction. This action discharges C315 in the positive direction, which causes Q316 to saturate and pull the cathodes of CR338 and CR339 below +1 volt. This clamps the Q336 and Q344 emitters below +1 volt to lock out signals to the timing and feedback circuits for the duration of the pacer detector output pulse (about 20-30 ms).

## ALARM LIMITS BOARD

### CIRCUIT FUNCTIONS

The purpose of the alarm limits circuit, (Fig. 3-4), is to determine if a rate alarm condition exists and provide an output to the audio circuit.

This circuit examines the trigger from the main board for the following alarm conditions:

1. Rate higher than HIGH RATE control setting and continuous for about 4 seconds (High rate violation).
2. Rate lower than LOW RATE control setting with two excessively slow beats occurring within about 12 seconds (Low rate violation).

3. No beat for about 6 seconds (arrest).

When the trigger indicates any of these three conditions, an alarm output is sent to the audio circuit.

The trigger represents the ECG signal rate.

### CIRCUIT OPERATION

The logic table in Figure 3-4 shows circuit conditions during the four trigger states.

The trigger is about 5 ms, HI pulse. The HI state of the trigger pulse resets the HIGH RATE and LOW RATE timers to zero. Both timers start at the same time, as the pulse returns to the LO state.

The outputs of the timers at TP522 and TP523 determine the Alarm Out signal (at J623-4) to the Audio circuit. The Alarm Out signal is a LO when the trigger rate is within the set rate limits or a HI during rate violation or arrest conditions.

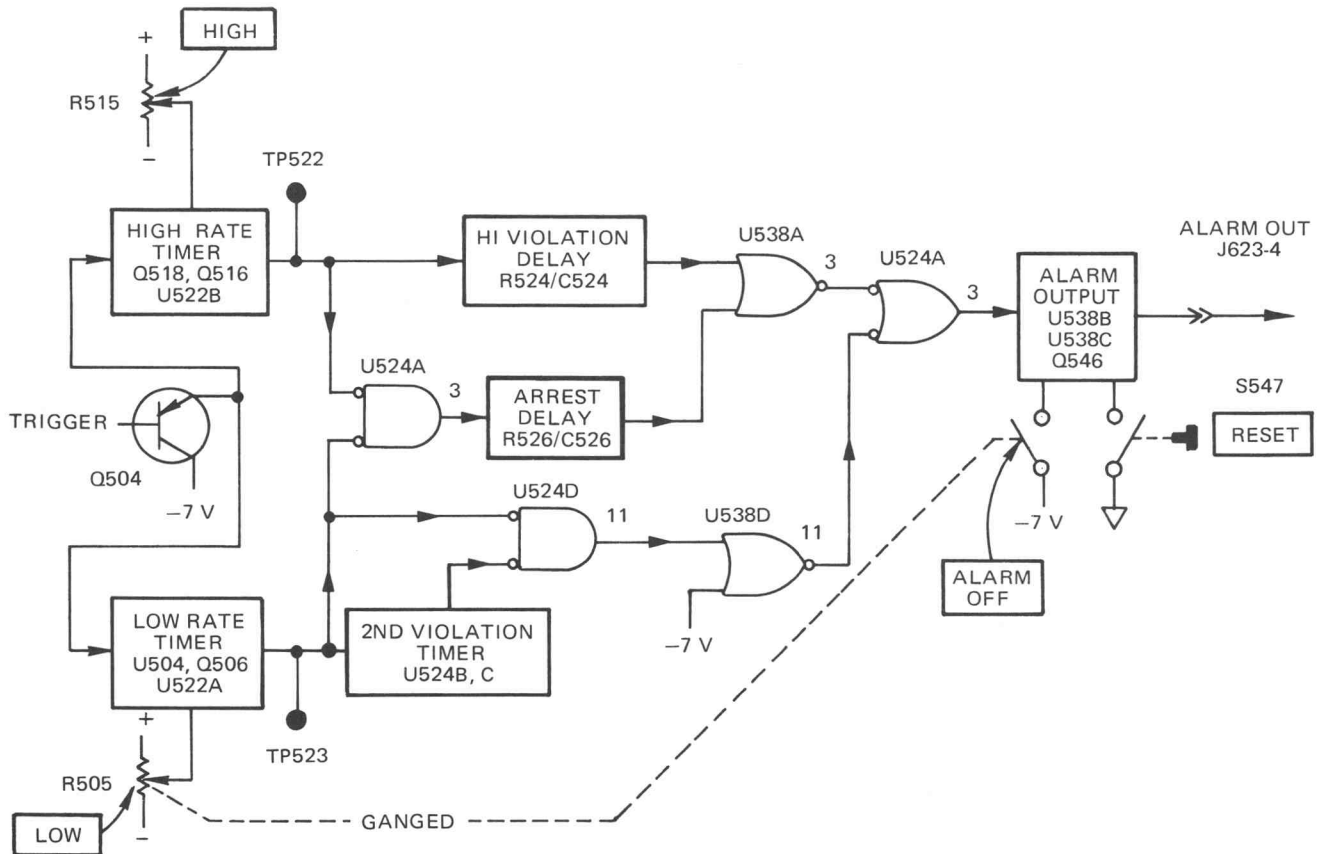
**ALARM TIMERS.** The Low and High Rate Timers are identical Miller Integrator circuits. Q506 and Q516 provide the reset action. The positive portion of the trigger turns off Q504, CR518 and CR508, which turns on Q516 and Q506 to reset the Miller-Integrator timers to zero. The Miller-Integrator ramps are compared at U522A and U522B to a +6 volt reference.

If the trigger period is longer than the timer period (set by RATE control), the timer is allowed to reach the +6 volt reference level and cause the output at TP522 or TP523 to be pulses.

If the trigger period is shorter than the timer period, the timer ramp does not reach the comparison level and the output at TP522 or TP523 is a HI.

If the trigger stops (arrest condition), the last timer ramp reaches the comparison level and the output at TP522 and TP523 is a LO.

**HIGH VIOLATION DELAY.** The High Violation Delay network consists of C524 and R524. When the trigger rate is within the set limits, the pulses at TP522 go through CR524, keeping C524 charged LO. CR524 is reverse-biased during the HI portion of the pulses, permitting C524 to



NOTE: MOST SIGNIFICANT STATES APPEAR IN BOLD FACE TYPE.

	TRIGGER AT BASE Q504	TP522	TP523	U538A PIN 3	U524D PIN 11	U524A PIN 3	U538D PIN 11	U524A PIN 3	ALARM OUT J623-4
WITHIN SET RATE LIMITS			HI	HI	LO	LO	HI	LO	LO
HIGH RATE VIOLATION		<b>HI</b>	HI	<b>LO</b> AFTER ≈ 4 SEC DELAY BY R524/C524	LO	LO	HI	<b>HI</b>	<b>HI</b>
LOW RATE VIOLATION				HI	<b>HI</b> 2ND EXCESSIVE R-R WITHIN ≈ 12 SEC		LO	HI	HI
ARREST	LO	LO	LO	<b>LO</b> AFTER ≈ 6 SEC DELAY BY R526/C526	LO	HI	HI	HI	HI

Fig. 3-4. Alarm Limits circuit and logic.

retain its LO charge. When a high violation occurs, U522B output is a HI which allows C524 to start discharging through R524. If the high violation continues for more than about 4 seconds, one input of U538A goes HI, causing an alarm.

**SECOND VIOLATION TIMER.** The Second Violation Timer is a monostable multivibrator consisting of U524B, U524C, plus C527 and R527, which establish the time constant for the timer. When the trigger rate is within the set limits, the HI at TP523 goes to pin 13 of U524D and to C525. The stable state of U524B is a LO input and a HI output, which holds pin 12 of U524D HI. If a low-rate violation occurs, TP523 becomes pulses. The first LO goes to pin 13 of U524D, but cannot switch U524D because pin 12 is still HI. The first LO is also ac coupled through C525 to U524B input, which is already LO; nothing happens until the trailing, positive-going edge of the first LO occurs and starts the Second Violation timer. The timer output and pin 12 of U524D are LO for about 12 seconds. If a second low-rate violation occurs during this time, pin 11 of U524D goes HI, causing an alarm.

**ARREST DELAY.** The Arrest Delay network consists of R526 and C526. When the trigger is present, C526 is charged LO. If there is no trigger (arrest condition), U524A pin 3 goes HI, CR526 is reverse-biased and C526 starts discharging through R526. If the arrest condition continues for more than about 6 seconds, one input of U538A goes HI and an alarm is initiated.

**ALARM OUTPUT.** The output stage is a set-reset flip-flop, consisting of U538B and U538C, which requires a HI on the input of U538C to reset it. A HI from U542A causes a HI output, which is the alarm condition.

The RESET Button applies a negative-going step to Q546, turning it on. Q546 applies a HI to U538C, resetting the flip-flop output to a LO, no alarm condition.

The ALARM OFF Switch applies a LO through CR533, CR534, and CR535 to U538A and D, keeping their inputs in the LO, no alarm condition. The initial negative transitions are coupled through C542 and CR544 to turn on Q546 and reset the output stage multivibrator.

## MAIN BOARD

### CIRCUIT FUNCTIONS

The circuits on the main board accomplish the following:

1. Amplify the ECG signal to drive the vertical deflection coil.
2. Provide a 5 ms trigger signal for sweep triggering, beat tone and rate alarms.
3. Provide a triggered sweep (front panel controls select channel is on, the ECG trigger signal is selected. When the ECG channel is off, the pressure/pulse trigger is selected. Selected trigger is used for sweep triggering, beat tone and rate alarms.
4. Provide audio tone for alarm sound or beat tone. The circuit is triggered by the 5 ms trigger signal or gated by an alarm signal from the alarm limits board.
5. Provide an ECG LEAD CHECK signal to check patient cable continuity and ECG amplifier operation.
6. Provide power and signal distribution between the circuit boards. Power supplies provide +7 volts, -7 volts, +12 volts and -12 volts for all boards, and -50 volts, +175 volts and +3400 volts for the main board and crt circuits.
7. Provide battery or ac-line voltage to power the inverter in the primary circuit. When the ac-line plug is connected to an ac outlet, the battery will be charging and the monitor will operate from the ac line when the POWER pushbutton is pushed in. When the ac plug is not connected, the monitor will operate from battery power.

### VERTICAL CIRCUIT OPERATION

The Vertical Circuit amplifies the selected display signal and drives the vertical deflection coil. U628A and its associated circuitry, is basically a voltage follower configuration of an operational amplifier as in Fig. 3-5A. Output current is determined by R648, which loads the amplifier output as shown in Fig. 3-5B. With the output current simply defined as output voltage divided by load resistance (R648), the vertical deflection coil is added in series with the amplifier output as in Fig. 3-5C. Fig. 3-5C is, therefore, the basic circuit for the vertical amplifier.



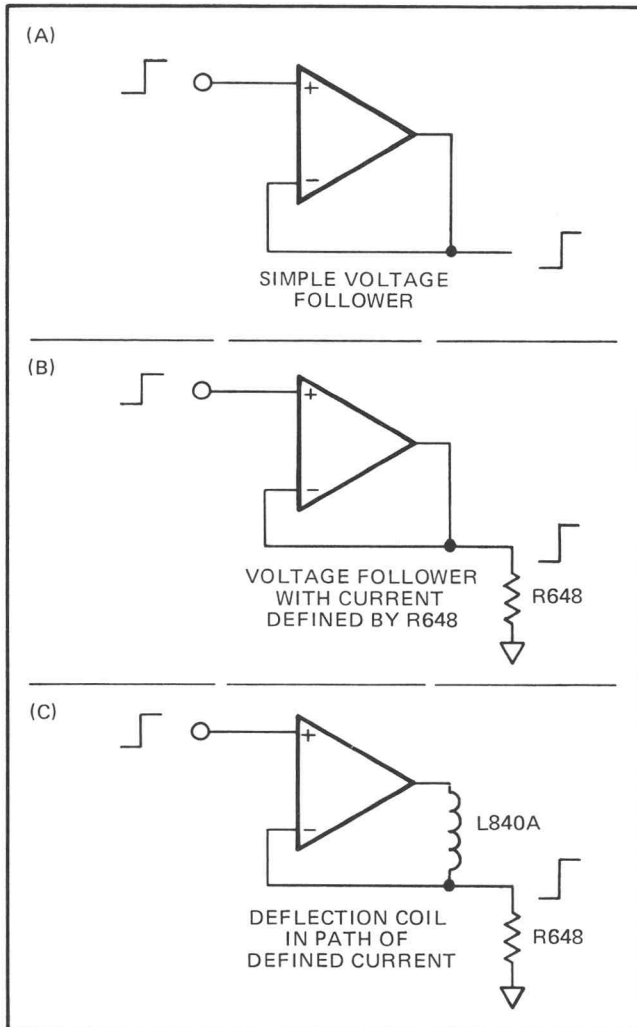


Fig. 3-5. Vertical Amplifier basic concepts.

Q636, Q638, Q646, and Q648 are current boosters for the operational amplifier output. Q632 and Q642 provide the interface circuitry between the output of U628A.

The circuit, consisting of CR628, Q631, and Q633, is a bi-directional voltage clamp on the input so that the amplifier does not try to establish unnecessarily high current levels in the vertical deflection coil.

Some rapid changes at the input of U628A cannot be followed instantaneously by the output. This can create a substantial voltage difference between the input and the feedback. Therefore, the bi-directional clamp, Q635 and Q637, limits Q632 and Q642 collector current to a value that is usable by the output stage.

## HORIZONTAL CIRCUIT OPERATION

The Horizontal Circuit (Fig. 3-6) consists of a trigger-shaping circuit, a free-run hold off circuit, a sweep generator and a horizontal amplifier to drive the horizontal deflection coil.

The ECG trigger signal is shaped by the Trigger Multivibrator to produce a standardized trigger pulse that is approximately 5 ms in duration. This trigger signal is used for sweep triggering, beat tone, and rate alarms.

If the trigger pulses have stopped for 3 or 4 seconds, the Sweep Free-run Holdoff circuit discharges and allows the audio tone generator to trigger the sweep, thus providing a baseline trace.

When the Sweep Generator is triggered it produces a sawtooth signal which is amplified by the Horizontal Amplifier to drive the horizontal deflection coil.

**SWEEP FREE-RUN HOLDOFF.** When trigger pulses are present at the base of Q652, C656 charges, making pin 12 of U656D HI and pin 6 of U656B LO. This allows the trigger signals to pass through pin 5 of U656B to the Sweep Generator. Should the trigger pulses stop for at least 3 or 4 seconds (C656 discharge time), pin 12 of U656D and pin 5 of U656B remain LO and the Audio signal at pin 13 of U656D, triggers the Sweep Generator to provide a baseline trace.

**SWEEP GENERATOR.** The Sweep Generator is a Miller Integrator circuit; Q666 provides the reset function. The Miller Integrator begins run-up whenever pin 8 of U662C goes HI and changes the state of the R-S flip-flop (U662A, U662D). This turns off Q666 and run-up begins. When the voltage fed back to R662 causes pin 5 of U664B to go through 0 volts, the R-S flip-flop again changes the state and terminates the sweep.

**HORIZONTAL AMPLIFIER.** U668A and its follower transistors, Q670 and Q672, compose a conventional inverting-type operational-amplifier circuit. The deflection coil is operated in the voltage mode so that the coil current is determined by the voltage across the coil divided by the coil resistance.

The amplifier impresses a negative-going sawtooth at pin 2 of P641. That voltage is fed through R676 to the opposing half of the horizontal amplifier (U668B, Q674 and Q676). This sawtooth is inverted through U668B to impress a positive-going sawtooth at the other side of the horizontal deflection coil.

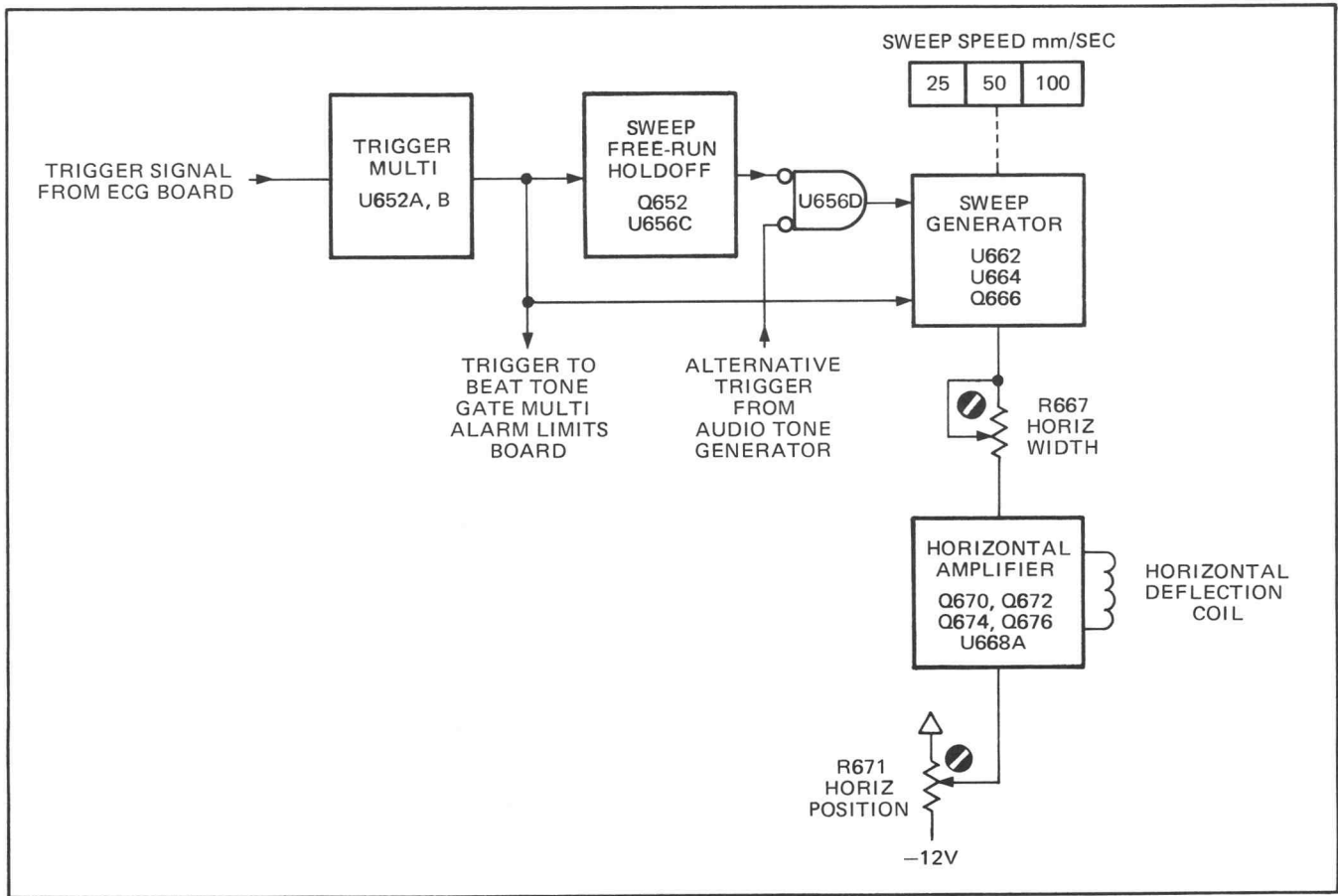


Fig. 3-6. Horizontal circuit.

### AUDIO CIRCUIT OPERATION

The audio circuit (Fig. 3-7) provides audible beat and alarm tones. Both tones are produced when the signal from the audio tone generator is gated to the audio amplifier. The beat tone is produced when the trigger pulse triggers the beat-tone multivibrator, which operates at approximately 75 ms. The alarm tone is gated on whenever the alarm line (pin 4 of the Alarm Limits Board) is pulled HI.

**AUDIO TONE GENERATOR.** The audio tone generator is an astable multivibrator consisting of U686A and U686B. It produces a steady signal (approximately 600 Hz) that is gated into the audio amplifier circuit through CR685 or CR684.

**BEAT TONE GATE MULTI.** The beat tone gate circuit is a monostable multivibrator, consisting of U686C and U686D. It produces a positive pulse (approximately 75 ms in duration) at pin 10 of U686C each time a trigger pulse appears at pin 13 of U686D. The positive output pulse turns off CR683 and turns on CR684, allowing the audio tone generator signal to enter the audio amplifier through the BEAT LOUDNESS control.

When the alarm circuit determines the alarm condition, a HI signal at the cathode of CR686 turns off CR685. This allows the audio generator signal to enter the audio amplifier through the ALARM LOUDNESS control.

**AUDIO AMPLIFIER.** The audio amplifier circuit consists of an amplifier U628B and two emitter followers Q692 and Q694. The audio tone signal enters either through the ALARM LOUDNESS control, R695, or the BEAT LOUDNESS control, R692, to be amplified and output through the 100  $\Omega$  voice-coil speaker.

### ECG LEAD CHECK CIRCUIT OPERATION

The ECG Lead Check circuit (Fig. 3-7) provides an output pulse for checking patient cable continuity and ECG circuit operation. The circuit is a non-symmetrical astable multivibrator consisting of U652C and U652D. CR617 and R617 cause the non-symmetry. The output pulses are about 0.1 second wide and have a repetition rate of about 80 per minute. C614 gives the output pulses the appropriate rise and fall times to activate the QRS detector.

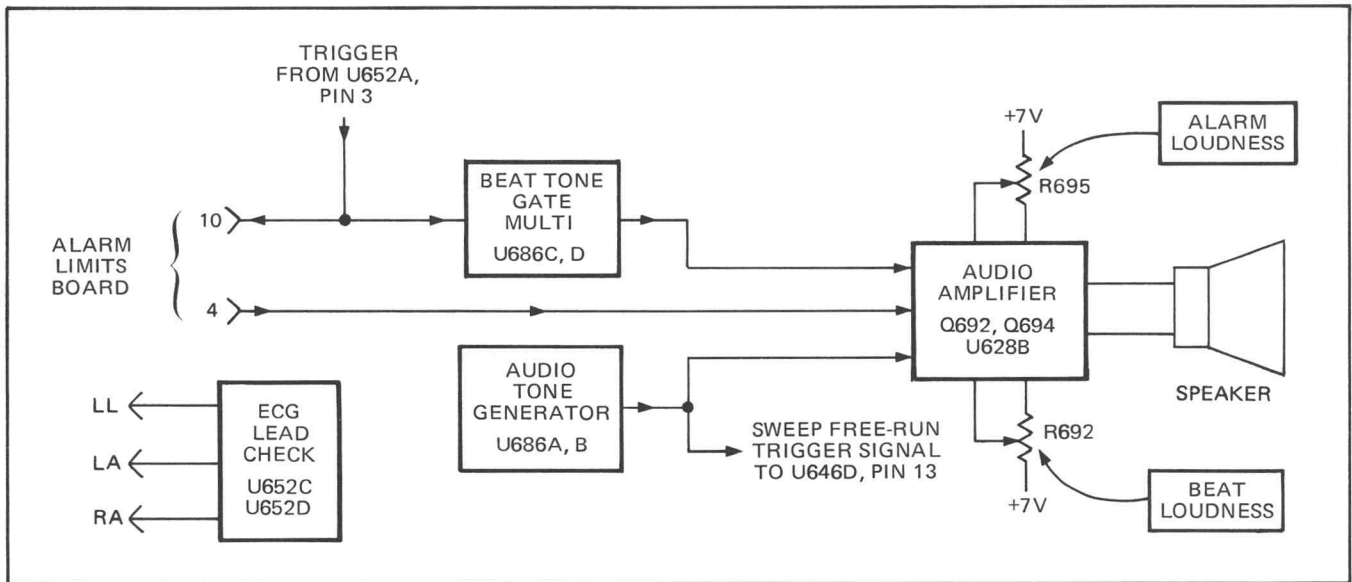


Fig. 3-7. Audio and ECG Lead Check circuits.

## POWER SUPPLY CIRCUIT OPERATION

The Power Supply operates from either a 115 or 230 Vac power line or from the internal battery. When the ac-power plug is connected to an ac outlet, a battery charging circuit is activated.

A battery-voltage monitoring circuit turns off the power supply inverter when the battery voltage drops to approximately 4.5 volts.

The -12 volt supply is regulated and adjustable by means of a primary regulating circuit.

**AC-LINE-VOLTAGE CIRCUIT.** The ac-line-voltage transformer, T701, has two balanced primary windings. The windings are connected in parallel for 115 Vac operation and in series for 230 Vac operation. The transformer has two secondary windings. One supplies about 10.5 Vdc through CR703 to operate K721 relay and the battery charging circuit; the other supplies about 6 Vdc to power the inverter.

When the ac plug is connected to an ac outlet, K721 closes to switch the power source from battery to ac and turn on the battery charging circuit.

**BATTERY CHARGER.** The charging circuit consists of Q712, Q714 and Q716. Charging current is supplied through R715, R716 and Q716. This current is limited to about 400 mA (about 700 mA with "F" cell option). The voltage developed across R715 and R716 turns on Q712,

current is diverted from the base of Q714, thus regulating the current through Q716.

When the POWER button is pushed in (either on ac or battery), a positive voltage is applied to T801 primary center tap and to the emitter of Q726. Q726 conducts, turning on Q742 and Q744 to aid in starting the power-supply inverter. As the supply voltages build up, the +7 volts at R727 turns off Q726 because it is no longer needed to keep the inverter going. The inverter frequency is about 30 kHz.

**BATTERY MONITORING CIRCUIT.** Well-charged batteries provide about 5.4 volts. The battery voltage is applied across R767 and R766 to -12 volts. When the battery voltage is up, pin 2 of U764A is slightly above ground, its output pin 1 is negative and CR756 is off. When the battery voltage drops to a level where pin 2 of U764A goes slightly negative, the current in R764 reverses. This makes pin 5 of U764B go positive. Then due to positive feedback through CR762 and R762, pin 7 of U764B goes almost all the way to +7 volts. CR756 turns on, charging C755 and turning on Q754. This turns off Q742, which stops all base current to the power-supply inverter and shuts down all supplies. C755 holds the base of Q754 positive long enough to make sure the supplies are completely off.

When operating on ac, a positive voltage turns on CR752 and saturates Q756, which holds off Q754 to lock out the effects of a low-battery condition.

**POWER SUPPLY REGULATION.** Q734 and Q736 make up a common comparator circuit to regulate the

## Circuit Description—408 Service

power-supply inverter current as referenced to the -12 volt supply. As the -12 volt supply changes, the collector of Q734 reflects the change and through Q742, adjusts the inverter current to readjust the secondary output voltages.

## CRT CIRCUIT OPERATION

**CRT.** The crt has electrostatic focus and electromagnetic deflection. The cathode is directly heated for good efficiency and fast warmup. The intensity is fixed because the beam current is maintained constant. R841, Focus adjustment is provided to obtain best spot focus.

V840, (crt), Q842 and Q844 form a feedback circuit which sets the crt grid voltage to any required level so that the crt cathode voltage is held very close to ground. This fixed cathode voltage results in a constant beam current of about  $6 \mu\text{A}$ .

**BLANKING CIRCUIT.** The crt is turned off during sweep retrace. This is accomplished by positive-going blanking pulses applied through CR845 to the base of Q844. The positive pulses turn off Q844 and Q842 allowing the collector of Q842 to go to -50 volts which cuts off the crt beam current. The crt cathode remains near ground potential due to C843.

# MAINTENANCE

## PREVENTIVE MAINTENANCE

### OPERATOR'S INFORMATION

Maintenance to be performed consists of cleaning and visual inspection. The following information, also included in the Operator's Instruction Manual, is intended for use by both operator and service personnel.

**CLEANING.** Clean the exterior surfaces of the monitor with a cloth or swab dampened with a warm water and mild soap solution. Do not permit fluids to run behind the knobs and push buttons or into the connectors.

#### CAUTION

*Avoid the use of chemical cleaning agents that might damage the plastics used in this monitor.*

**INSPECTION.** Inspect all removable cables, wires, etc. Pay careful attention to the points that are subjected to repeated flexing. Breakage may have occurred at these points. Replace frayed or otherwise damaged cables.

Inspect the power cord and plug for damage. Repair or replacement should be performed only by qualified personnel.

**ABUSE.** Monitors that have been dropped or otherwise abused, should be checked by qualified service personnel to verify all safety features.

**CALIBRATION & SAFETY.** Qualified service personnel should check the calibration of the monitor at least every two years. It is also recommended that the electrical safety features be inspected and leakage current measured every six months.

#### WARNING

*Electric shock hazard exists when the monitor covers are removed. Refer servicing to qualified personnel.*

**MAINTENANCE SCHEDULE.** Table 4-1 is a suggested routine maintenance schedule for monitors in continuous use. Obvious defects should be corrected immediately.

TABLE 4-1

Routine Maintenance Schedule

	1 Month	6 Month	2 Year
Clean Exterior	As Required		
Inspect Removable Wire & Cables	X		
Inspect Power Cord & Plug	X		
Calibration (by qualified Service Personnel only)			X
Safety Inspection (Leakage check)		X	

### ISOLATION LEAKAGE CHECK

A leakage check should be made at least every six months or whenever the monitor has been dropped or otherwise abused. Also, check leakage after working on primary or ECG circuits.

This check is to determine the amount of leakage current which could be present between the patient and the monitor under either of the following abnormal conditions: 1) monitor is properly grounded and patient is at 120 Vac, 60 Hz, 2) monitor is not grounded, case is connected to 120 Vac, 60 Hz, and patient is grounded.

The recommended method for checking this leakage current is to measure directly in the ECG input using an instrument (such as a Tektronix 211 Oscilloscope) that can tolerate the full line voltage at its input circuit without distorting the measurement.

The alternative method provides equally satisfactory results when such an instrument is not available. Using this method, the measurement is made in the ground return (safety earth) conductor of the monitor power cord. A test oscilloscope is required that has a bandwidth of 500 kHz or more, a maximum vertical sensitivity of 1 mV dc and a sweep rate of about 5 to 10 ms per division.

Additional test fixtures required are shown in Fig. 4-1 and Fig. 4-2.

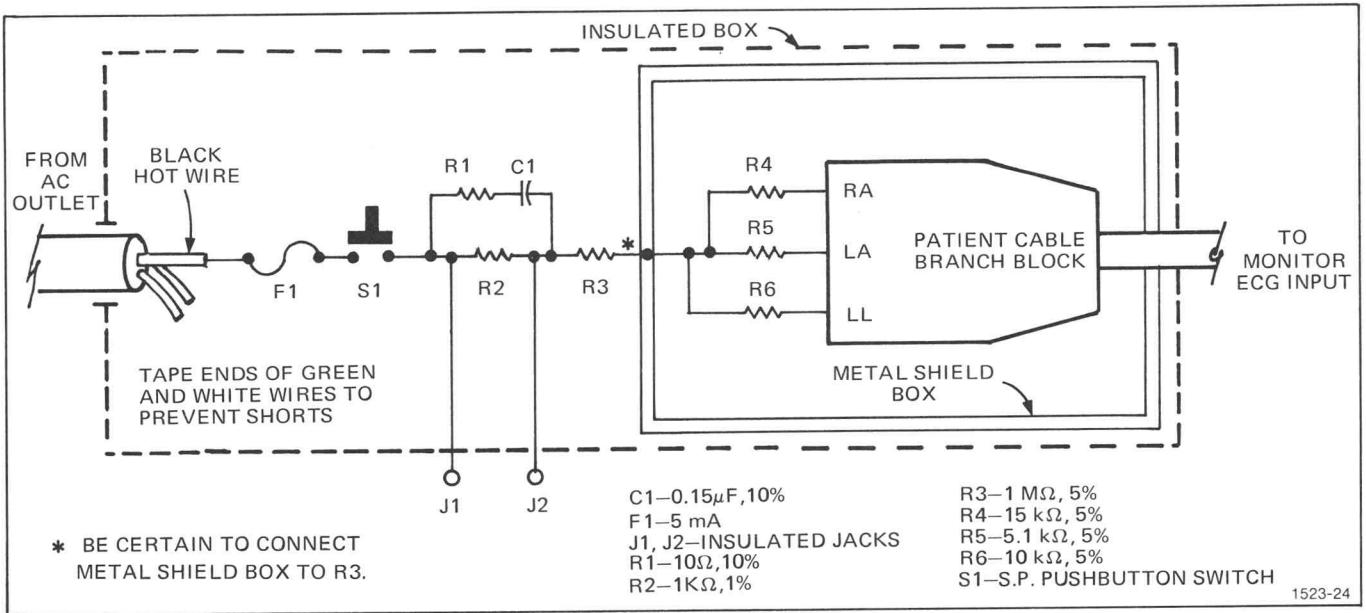


Fig. 4-1. CMRR-Leakage Test Fixture.

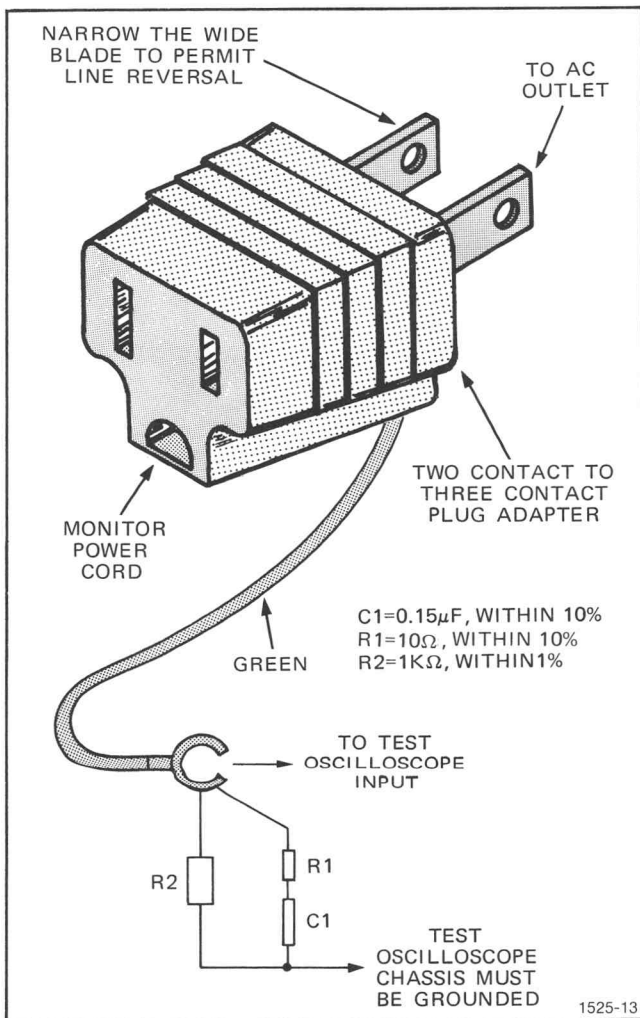


Fig. 4-2. Leakage Test Fixture.

Before beginning either method:

1. Disconnect the monitor from the ac power source.
2. Remove the top and bottom covers.
3. CHECK—All plug-in circuit boards are pushed firmly into their mating sockets and seated in their slots on the board retainer clip.
4. CHECK—All cables are plugged firmly into their mating pins and that they are dressed away from the ECG shield, the input connector shield and the pushbutton switch shafts.
5. CHECK—The screw and spacer securing the ECG circuit board are tight. See Fig. 4-3.
6. Replace top and bottom covers.

**RECOMMENDED METHOD.** Set up the monitor and the test fixtures as shown in Fig. 4-4.

CHECK—60 Hz amplitude on oscilloscope should be 14.4 mV, p-p (5  $\mu$ A, rms) or less.

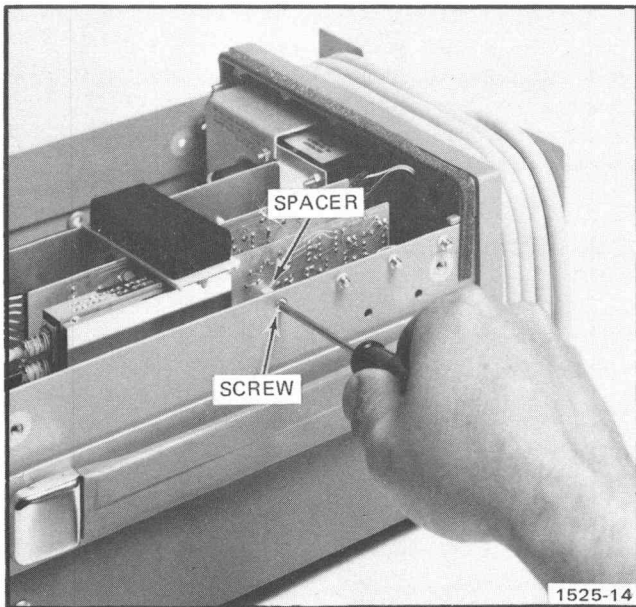


Fig. 4-3. ECG Board securing.

**ALTERNATIVE METHOD.** Set up the monitor and the test fixture as shown in Fig. 4-5.

**NOTE**

*Oscilloscope chassis must be grounded.*

**CHECK**—Total 60 Hz amplitude on test oscilloscope should be 84.4 mV, p-p (30  $\mu$ A, rms) or less, disregarding monitor converter hash. Record the reading. Remove CMRR-Leakage test fixture from the ac outlet.

**CHECK**—Primary 60 Hz amplitude on test oscilloscope should be 70 mV, p-p (25  $\mu$ A, rms) or less, disregarding converter hash.

**CALCULATE**—Total amplitude minus primary amplitude = ECG isolation leakage which should be 14.4 mV, p-p (5  $\mu$ A, rms) or less.

Reverse the leakage test fixture in the ac outlet and repeat the above checks.

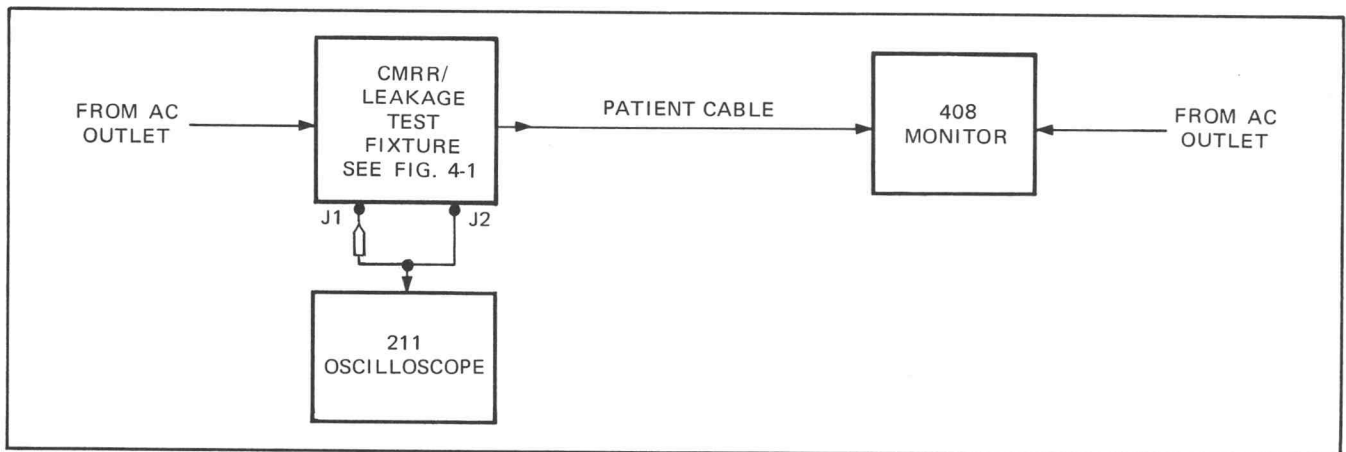


Fig. 4-4. Recommended method to check leakage current.

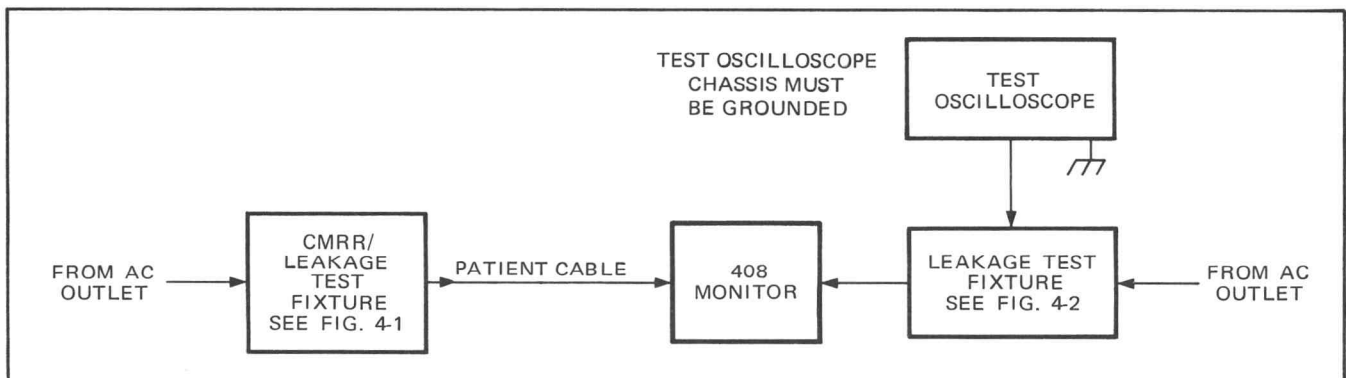


Fig. 4-5. Alternative method to check leakage current.

## CORRECTIVE MAINTENANCE

### KEEPING A SERVICE RECORD

It is advisable to keep a service record since the monitor and its accessories are involved with patient care and safety. Include information such as monitor type and serial number, failures, problems, routine maintenance performed and the date.

### SOLDERING INFORMATION

#### WARNING

*Disconnect the monitor from the power source and unplug the battery pack plug (P711) before soldering.*

Use ordinary 60/40 solder and a 15 watt pencil-type soldering iron for most of the soldering to be done in the monitor. Using a soldering iron with a higher voltage rating on etched circuit boards can cause circuit wiring to separate from the base material.

### SERVICING EXTENDER SET

By using the Servicing Extender Set, any of the plug-in circuit boards can be raised above the others for troubleshooting purposes. The set includes three eight-connector ribbon cables and an extender circuit board. The Tektronix part number is 020-0078-00.

### COMPONENT REPLACEMENT

#### WARNING

*Disconnect the monitor from the power source and unplug the battery pack plug (P711) before replacing components.*

**RECALIBRATION AFTER REPAIR.** After any electrical component has been replaced, check the calibration of that particular circuit and other closely related circuits. Check the calibration of the entire monitor after working on the power supply or after replacing the crt or the yoke assembly.

**INSTRUMENT DISASSEMBLY.** Use the exploded drawings at the rear of this manual as a guide for disassembly. Observe all cautions and warnings found in the manual and on the instrument.

**PUSHBUTTON REMOVAL.** Remove pushbuttons by pulling straight off with fingers or with pliers that are protected with cloth or tape. Install pushbuttons by pressing them onto the shaft extensions. Pushbuttons should be removed before removing circuit boards or cards to prevent damage to switch shafts.

**MAIN CIRCUIT BOARD REPLACEMENT.** The main circuit board is held in place with four securing screws through the board and two screws through the left side rail into the transistor heat sink. The heat sink should be removed with the board. After replacing the main circuit board, check the calibration of the entire instrument.

#### NOTE

*Replacing U652 may change the width of the pulse at U652 pin 3. The nominal width of this pulse is 6 ms, the allowable range is from 4 ms to 8 ms. If the pulse width is outside the range, change R653 as appropriate to correct the pulse width. The nominal value of R653 is 1.2 M $\Omega$ , the permitted range of values for this resistor is from 510 k $\Omega$  to 3.9 M $\Omega$ .*

*Replacing U662 may change the width of the Retrace Blanking pulse (30 ms nominal, allowable range from 20 ms to 40 ms; measure at U662 pin 4). To re-establish the desired pulse width, change the value of R658 as required (6.2 M $\Omega$  nominal value, allowable range from 2.7 M $\Omega$  to 22 M $\Omega$ ).*

*Replacing U686 may change the width of the pulse at U686 pin 10. The nominal width of this pulse is 75 ms and the permitted width range is from 50 ms to 125 ms. If the pulse width is outside the permitted range, change the value of R683 as appropriate to make the pulse width the nominal value. The nominal resistance of R683 is 1.5 M $\Omega$ , the permitted range of values is from 750 k $\Omega$  to 4.7 M $\Omega$ .*

**ECG CIRCUIT BOARD REPLACEMENT.** Perform the following steps to replace the ECG circuit board.

#### WARNING

*Safety features of the monitor depend upon proper ECG board installation. Follow these instructions carefully.*

#### REMOVAL

1. Remove the gray plastic spacer clip.
2. Remove the ECG pushbuttons.



3. Remove the board mounting screw from the right-hand side rail. See Fig. 4-3.
4. Pull the board straight up to unplug.
5. Tip the board and remove it from the monitor.
6. Remove the screw from the input circuit shield. Slide the shield down the cable.
7. Unplug both cables from the board.
8. If a replacement board is to be installed, transfer the pushbutton switch shaft extensions to the new board.

#### NOTE

Switch shaft extensions are easily broken during removal unless the proper method is used. Carefully insert a sharp pointed tool, such as an awl, between the end of the switch shaft and the extension. This should force the extension straight off the shaft.

#### INSTALLATION

1. Plug the input cable on board in the shielded area. Match the arrows on the connector housing with that on the board.
2. Install the shield as shown in Fig. 4-6.
3. Plug the ribbon cable onto the board. Match the arrows.
4. Plug the board into the mating connectors. Tip as necessary to install.

#### CAUTION

Align the board pins with their mating connectors as shown on the tags on the chassis and side rail.

5. Install the board retaining screws through the side rail. See Fig. 4-3.
6. Install the pushbuttons on the shaft extensions. Insert them through the front panel and push into place. Sequence from top down: OFF, I, II, III.
7. Dress the cables away from the shield and the switch shafts.

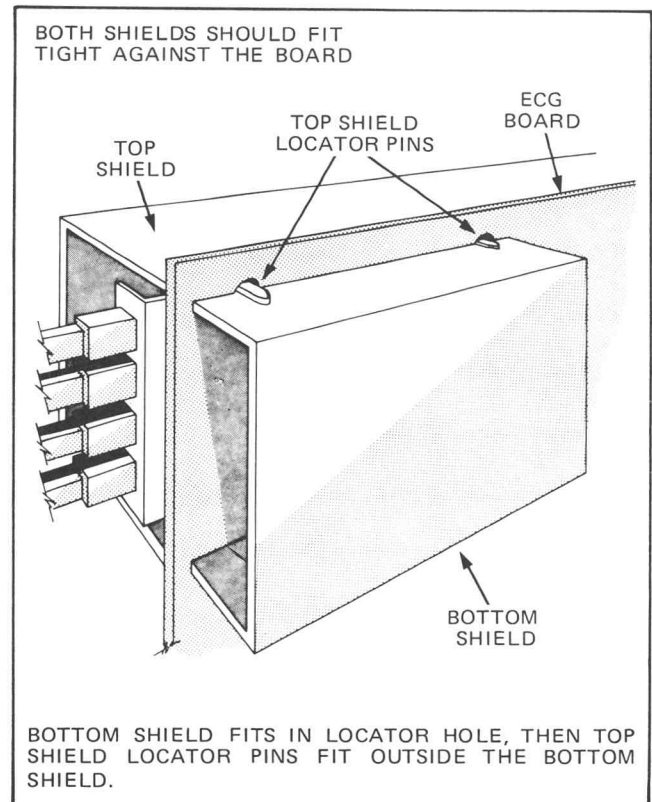


Fig. 4-6. ECG Shield installation.

8. Install the board spacer clip.
9. Check the calibration of the ECG channel and perform the isolation leakage check. Refer to the Calibration section.

**ALARM LIMITS CIRCUIT BOARD REPLACEMENT.** Unplug the two ribbon cable connectors from the board and unplug the board from the mating connectors by pulling straight up.

#### CAUTION

When replacing the board, be sure to align the board pins with the mating connectors as shown on the tags on the chassis and side rail.

#### NOTE

Replacing Alarms Second Violation Timer integrated circuit U524 may change the width of the pulse at U524 pin 10. The nominal width of this pulse is 10 seconds and the permitted width range is from 5 seconds to 25 seconds. If the pulse width is outside the permitted range, change the value of R527 (nominal value 6.2 M $\Omega$ ) as appropriate. The permitted range of values for R527 is from 3.3 M $\Omega$  to 9.1 M $\Omega$ .

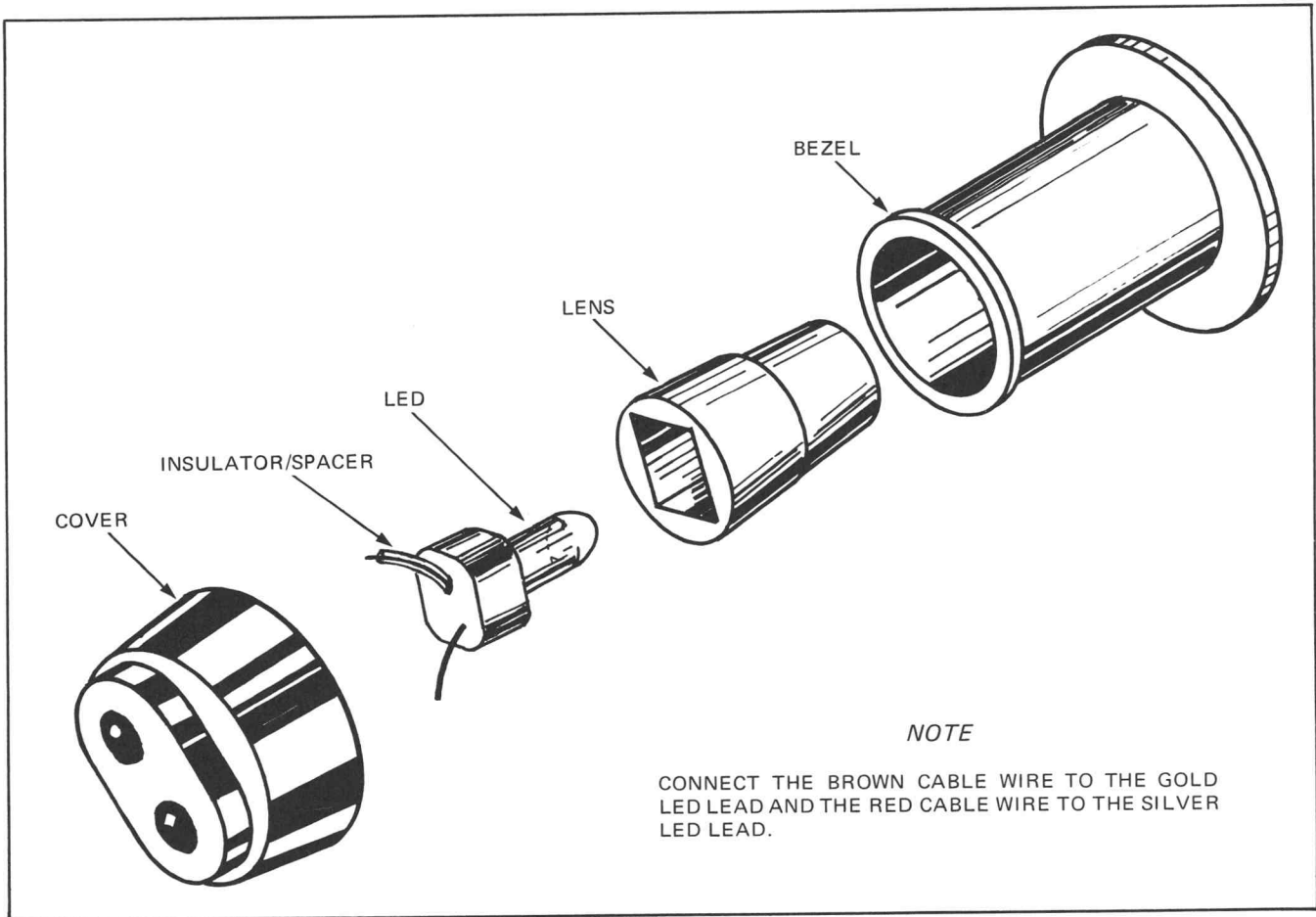


Fig. 4-7. Lead Fault Indicator Lamp assembly.

**CRT REPLACEMENT**

**CAUTION**

*Discharge the crt anode to the chassis at point B (see adjustments pullout). This point is the anode side of R807. Do not short the rectifier side because high discharge current may create electromagnetic or electrostatic fields which can damage nearby semi-conductors.*

**WARNING**

*Handle the crt carefully. Rough handling or scratching increases the implosion hazard.*

To replace the crt it is necessary to remove the front assembly which is held with four #4-40 nuts at the inside corners. The crt is secured to the front panel assembly with a retainer frame which is held with four long #4-40 screws. After replacing the crt, check the complete monitor calibration.

**LEAD FAULT LAMP REPLACEMENT.** Note the following important considerations, when replacing the LEAD FAULT LED (light emitting diode). See Fig. 4-7.

- a. The LED terminal cover melts easily with excessive heat.
- b. The LED terminal cover is snapped in place on the bezel.
- c. Lead length on new LED should be the same as the old one.
- d. The insulating tubing on one lead is essential to prevent shorting between leads and to act as a spacer to keep the LED pushed into the lens.
- e. The lens must be in place in the bezel. Use a blunt instrument of the same diameter and press the lens into the bezel.

f. The lens has a square hole as shown in Fig. 4-7. Be sure to mate the essentially square LED body with it. The LED is in place when it is flush with the lens face.

g. Connect the brown cable wire to the gold LED lead and the red cable wire to the silver LED lead.

**BATTERY REPLACEMENT.** The battery pack consists of four D or F size, 1.25 V nickel-cadmium (NiCd) cells, which are mounted inside of a metal case and fastened to the left side rail with two screws. The battery power plug (P711) is connected to the main board.

Before replacing the batteries read the Battery Operation and Condition information in the Specification section of this manual.

#### WARNING

*Dangerous voltages exist at several points throughout the monitor. When operating it with the cover removed, do not touch exposed connections or components. Some transistor cases are elevated. Disconnect the monitor from the ac power source and unplug the battery pack plug (P711) before cleaning the interior of the monitor or replacing components.*

#### CAUTION

*The nickel-cadmium cells are capable of delivering a high current. Do not short circuit the cells, since this can cause the wire insulation to melt.*

Unplug the battery pack plug P711 from the main board. Remove the two screws holding the battery pack to the left side rail and lift it out of the monitor. Remove the four nuts holding the battery pack together.

Do not replace individual cells unless the batteries are relatively new (e.g., less than one year). Replace the cells only with the type specified. Other types may not function properly or may be a hazard to the monitor and personnel. Operating time or high-temperature performance may be degraded.

## ACCESSORY REPAIR

The supplementary data portion of this manual gives part numbers and diagrams related to some accessory repairs. Here are a few precautions to consider before replacing these accessories.

## ECG CABLES

ECG cables are not considered repairable, except the tapped #4-40 connectors at the ends of the limb patient cable wires. The tapped individual electrode connectors can be repaired using a repair kit, Tektronix Part Number 040-0696-00.

Snap connectors should grip the electrode terminal firmly. If not they often can be tightened by bending the contact inward gently with a scribe or small screwdriver.

## OBTAINING REPLACEMENT PARTS

### STANDARD PARTS

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

### SPECIAL PARTS

In addition to the standard electronic components, some special components are used in the monitor. 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 including any option or mod numbers.
2. Instrument serial number.
3. A description of the part (if electrical, include circuit number).
4. Tektronix Part Number.

## INSTRUMENT REPACKAGING

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, 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 275 pounds.

# CALIBRATION

## CALIBRATION INTERVAL

Monitor calibration should be checked at least every two years. Complete recalibration should also be performed after any repair, if the monitor has not been recalibrated in the past year. Partial or complete recalibration should be performed following specific repairs; see the Maintenance Section.

### NOTE

*Safety features should be checked any time the monitor has been dropped or otherwise abused. An isolation leakage check procedure is located in the Maintenance section and at the end of the Check/Adjustment Procedure.*

## CALIBRATION PROCEDURES

There are two procedures in this section; a Check/Adjustment procedure and an Adjustment procedure. The Check/Adjustment Procedure is intended for general monitor calibration. The Adjustment Procedure is intended to permit rapid touch-up of all internal controls.

## TEST EQUIPMENT REQUIRED

The following test equipment and accessories are required for complete calibration of the monitor. The specifications given for the test equipment are the minimum necessary for accurate calibration. All test equipment should be correctly calibrated and operating within their specifications.

## SPECIAL TEST ACCESSORIES

The special test accessories, which are required for this calibration procedure, can be readily constructed using common electronic components. Be sure to use components with at least the accuracy specified.

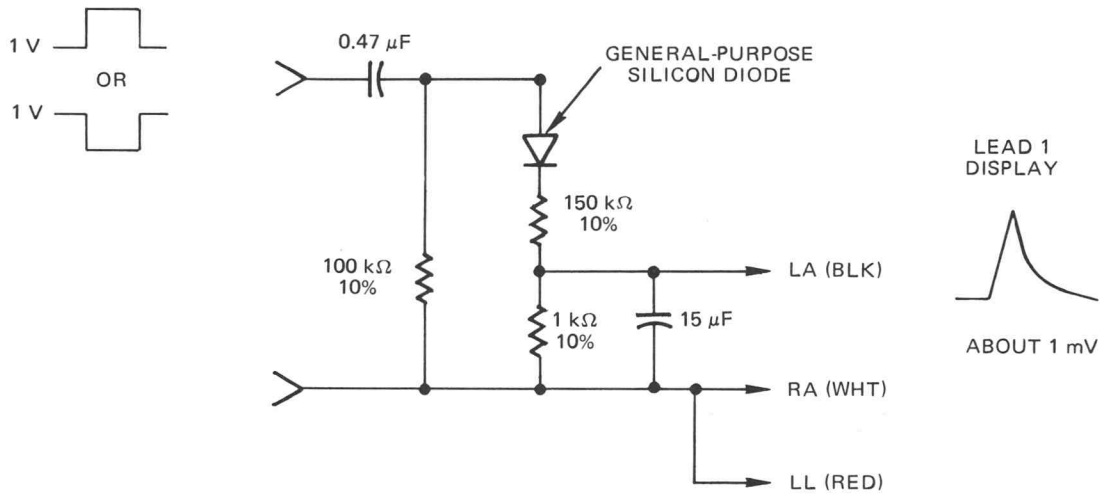
## EQUIPMENT REQUIRED

1. Function Generator. Output: 1 volt square wave with a risetime of 10  $\mu$ s or faster. Frequency Range<sup>1</sup>: 0.5 Hz to 10 Hz. Accuracy:  $\pm 10\%$  except as follows: 3 Hz to 3.67 Hz  $\pm 2\%$ , 1.35 Hz to 1.65 Hz  $\pm 2\%$ .
2. Oscilloscope. Bandwidth: Dc to at least 500 kHz. Minimum Vertical Deflection factor: 1 mV per division. Sweep Rates: 10  $\mu$ s/division to 200 ms/division.
3. Digital Voltmeter (DVM). Range: +2.5 V to  $-12$  V. Accuracy:  $\pm 0.1\%$ .
4. Low-pass Filter and Attenuator. See Fig. 5-1A.
5. Jumper (e.g. alligator clip).
6. ECG Shorting Connector. See Fig. 5-1B.
7. Stereo Phone Plug. See Fig. 5-1C.
8. Precision Attenuator. See Fig. 5-2A.
9. CMRR-Leakage Test Fixture. See Fig. 5-2B.
10. Pacer Input Circuit Adapter. See Fig. 5-2C.
11. Leakage Test Fixture. See Fig. 5-3.

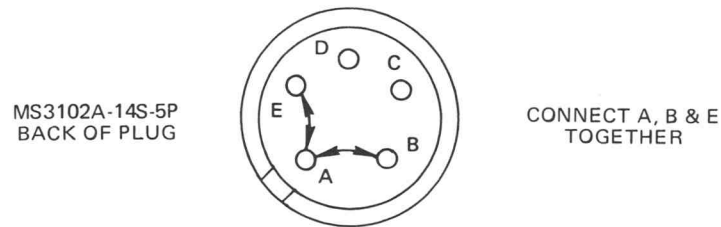
<sup>1</sup> Low-frequency function generators that do not have this frequency accuracy can be checked with a frequency counter. If a counter is not available, use the following method. Adjust the test oscilloscope time base, with a time-mark generator, for zero timing error in relation to the oscilloscope graticule. Then, verify the accuracy of the function generator by comparing it to the oscilloscope graticule.

**A. LOW-PASS FILTER AND ATTENUATOR**

THE VALUES WERE SELECTED TO DETERIORATE PULSE RISETIME, PERMITTING THE QRS DETECTOR AND TRIGGER TO FUNCTION AND TO PROVIDE A SINGLE POSITIVE PULSE DISPLAY FOR EACH SQUARE WAVE.



**B. ECG SHORTING CONNECTOR**



**C. STEREO PHONE PLUG**

A STEREO PHONE PLUG WITH ITS COVER REMOVED MAKES A CONVENIENT TEST POINT FOR OBTAINING OUTPUT SIGNAL.

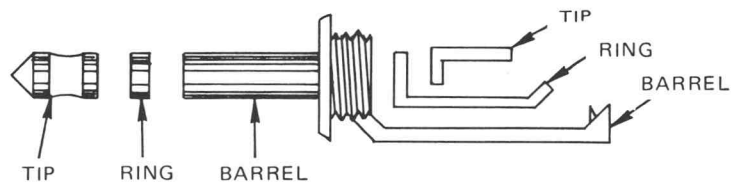
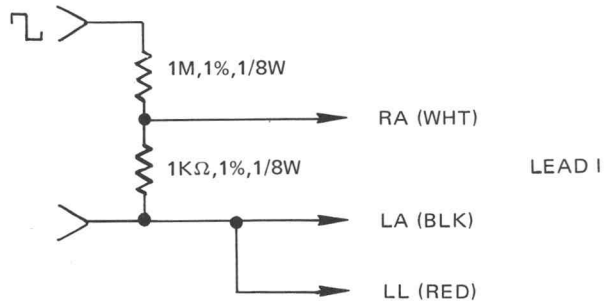
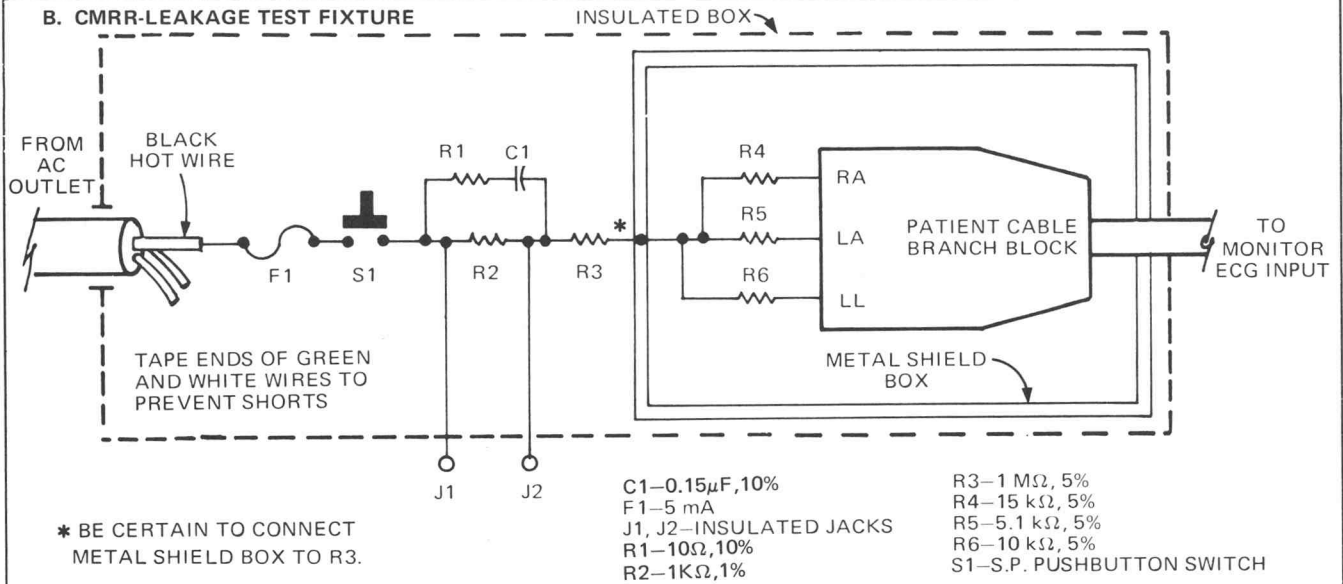


Fig. 5-1. Test Fixtures.

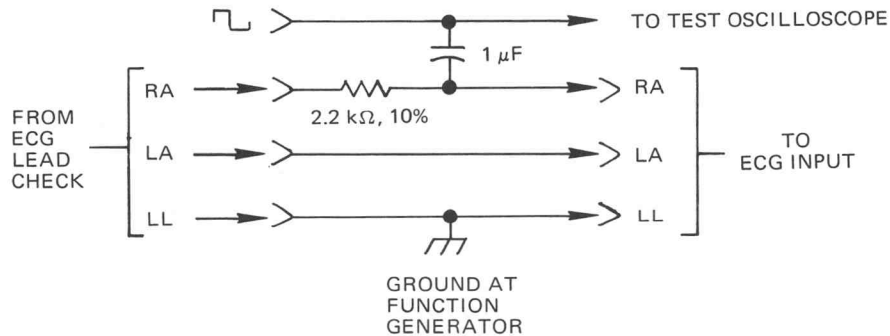
A. PRECISION ATTENUATOR



B. CMRR-LEAKAGE TEST FIXTURE



C. PACER INPUT CIRCUIT ADAPTER



1523-32

Fig. 5-2. Test Fixtures.

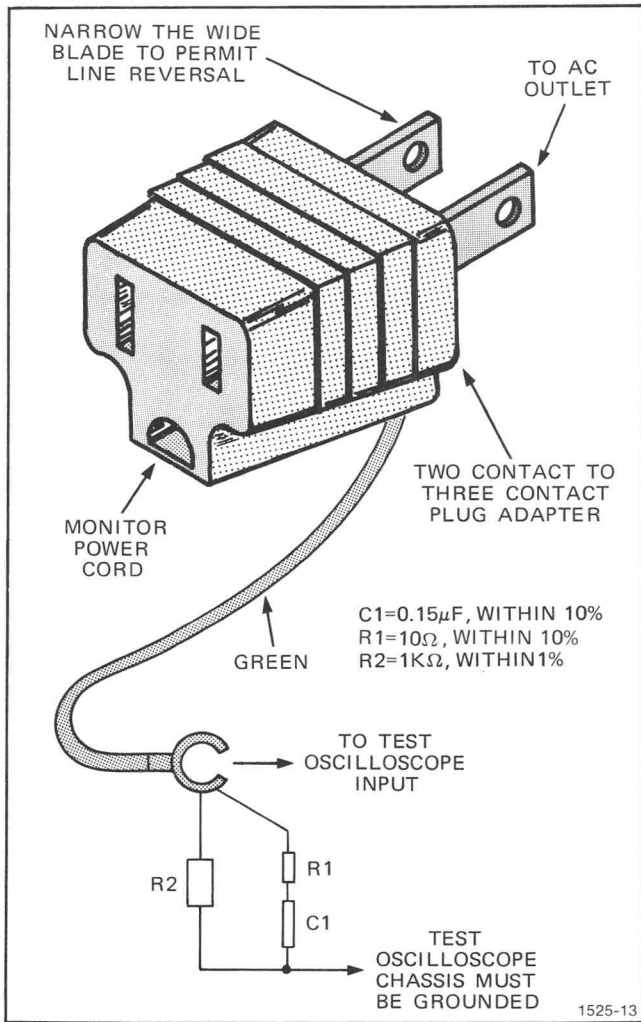


Fig. 5-3. Leakage Test Fixture.

## PRELIMINARY CONSIDERATIONS

### EARTH'S MAGNETIC FIELD

Vertical and horizontal trace positioning can be affected slightly by the position of the monitor in relation to the earth's magnetic field. Unless the monitor is kept upright when adjusting the spot centering and horizontal positioning, it may not be possible to match the user's display precisely.

### REFERENCE LETTERS and TEST POINTS

TP-12V, TP532, etc, and references to letters surrounded by hexagons, refer to points indicated on the schematics and Adjustment Locations pullout pages.

#### WARNING

*High voltage and high battery current capabilities exist inside the monitor. Voltages of over 15 volts are low-current sources and are not considered dangerous, but could produce an electrical shock. All ac line-voltage connections are covered and located on the rear panel.*

### DISASSEMBLY FOR CALIBRATION

Remove the four screws from each side. Pull the bottom cover straight away from the monitor. Lift the left side of top cover to permit the right side to clear the ECG LEAD CHECK terminals. If further disassembly is needed for repair or replacement of components, refer to the Maintenance Section and the mechanical drawing pullout pages.



## CHECK/ADJUSTMENT PROCEDURE

Before you begin, see **ADJUSTMENT LOCATIONS** in the pullout pages.

### INTRODUCTION

The purpose of this procedure is to permit complete calibration of an operating monitor; it is not intended as a trouble-shooting guide. The procedure is divided by circuit boards to facilitate calibration of individual circuits.

Some monitor specifications are not verified by this procedure. Additional information may be found in the Specification section, the Circuit Description section or on the schematics.

### PRELIMINARY CHECK

Operation of all modes should be checked and any defects corrected before attempting to calibrate the monitor.

### PRELIMINARY SETUP

POWER	On (pushed in)
ALARM LIMITS-LOW	ALARM OFF
Line Voltage Range	Correct Line selection

Set the remaining controls as desired. Connect the monitor to the correct ac line source.

#### NOTE

*Do not preset internal controls.*

### MAIN BOARD

#### 1. ADJUST POWER SUPPLY (–12 VOLTS)

- Connect DVM leads between point A and TP–12V.
- CHECK—Supply voltage should be  $-12.0\text{ V}$ ,  $\pm 100\text{ mV}$ .

#### NOTE

*Do not readjust  $-12\text{ V}$  supply if it is within  $100\text{ mV}$ , unless a complete recalibration is intended.*

- ADJUST—  $-12\text{ volts}$  (R737) for  $-12.0\text{ V}$ ,  $\pm 25\text{ mV}$ .
- Remove DVM leads.

#### 2. ADJUST TRACE ROTATION

- CHECK—Trace should be parallel with graticule lines.

#### WARNING

*Be careful when making yoke adjustments. There is  $+175\text{ V}$  in crt socket and  $+3400\text{ V}$  on crt anode.*

- Loosen yoke clamp (Fig. 5-4).
- ROTATE—Yoke for non-tilted trace (Fig. 5-4).
- Tighten yoke clamp.

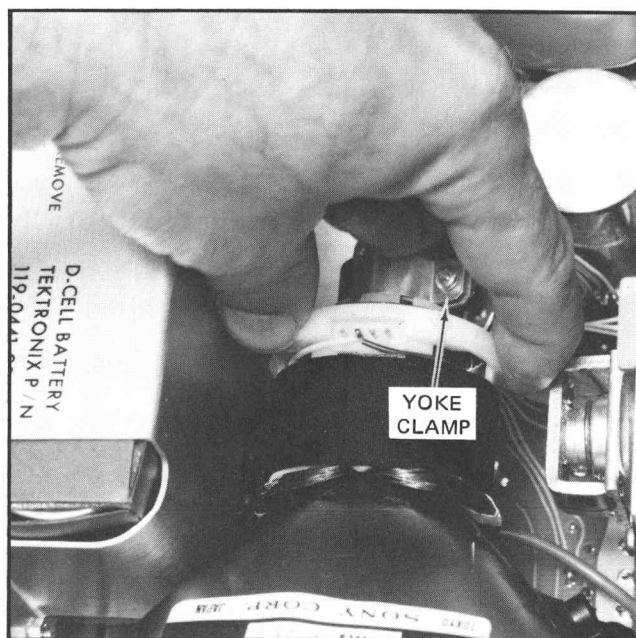


Fig. 5-4. Deflection Yoke adjustment.

**NOTE**

*Due to effects of earth's magnetic field, monitor should be positioned upright when performing steps 3, 4 & 5. Monitor will have to be supported above bench to make adjustments.*

**3. ADJUST SPOT CENTERING AND FOCUS**

- a. Turn POWER off and disconnect yoke plug, P641 (see Fig. 5-5). Turn POWER on.

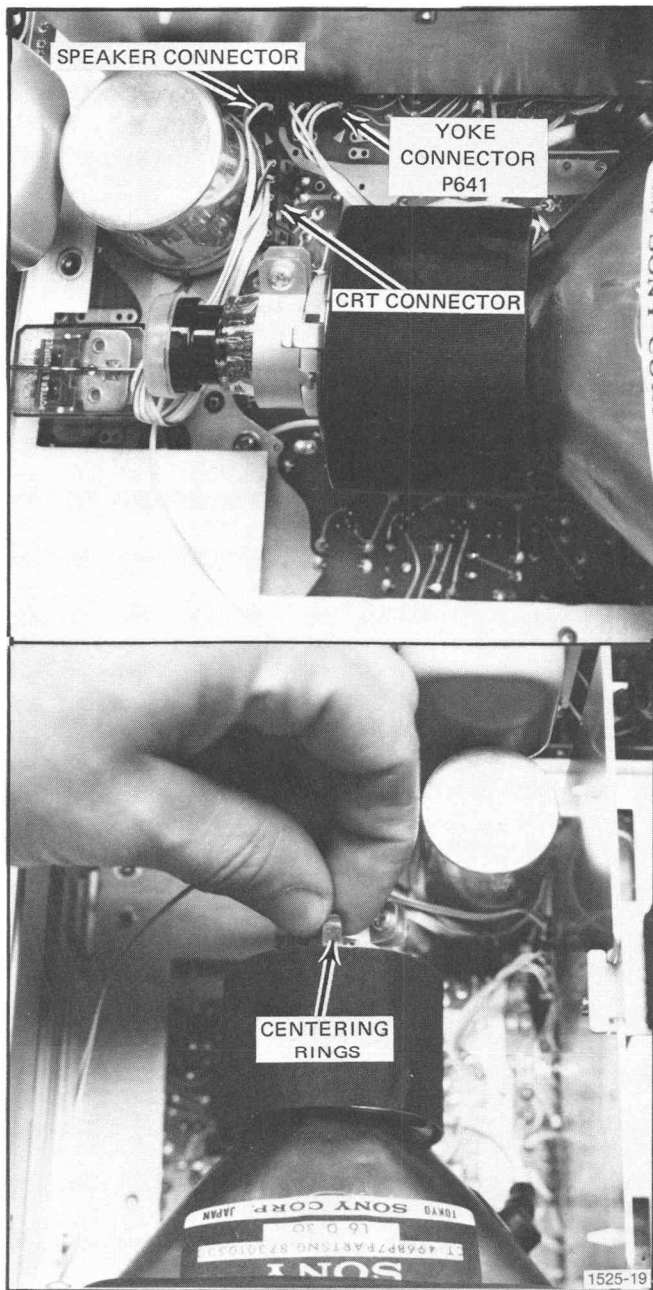


Fig. 5-5. Yoke Connector, P641 and spot centering rings.

- b. CHECK—Spot should be centered on the graticule, vertically at 150 mm<sub>Hg</sub> line,  $\pm 1$  mm and horizontally at 60 BEATS/MIN mark,  $\pm 2$  mm.
- c. ADJUST—Spot to graticule center, using centering rings (see Fig. 5-5).
- d. CHECK—Spot should be finely focused.
- e. ADJUST—Focus (R841) for smallest possible round spot.
- f. Turn POWER off and reconnect yoke plug. Be sure to match arrow on plug with arrow on main board. Turn POWER on.

**4. ADJUST HORIZONTAL POSITION**

- a. CHECK—Trace should start at left ends of graticule lines,  $\pm 2$  mm.
- b. ADJUST—Horizontal Position (R671) so that the trace starts at left ends of graticule lines.

**5. ADJUST HORIZONTAL WIDTH**

- a. Set ECG switch to I.
- b. Set SWEEP SPEED mm/SEC switch to 50.
- c. Connect function generator square wave through low-pass filter (Fig. 5-1A) to ECG Input and display approximately 4 cm at 3 Hz,  $\pm 2\%$ . Monitor should produce a beat tone and a triggered display.
- d. CHECK—Fourth pulse leading edge should coincide with 60 BEATS/MIN mark,  $\pm 2$  mm (see Fig. 5-6A).
- e. ADJUST—Horiz Width (R667) to make fourth pulse leading edge coincide with 60 BEATS/MIN mark.
- f. CHECK—100 mm/SEC Sweep Speed (see Fig. 5-6B).
- g. CHECK—25 mm/SEC Sweep Speed (see Fig. 5-6C).

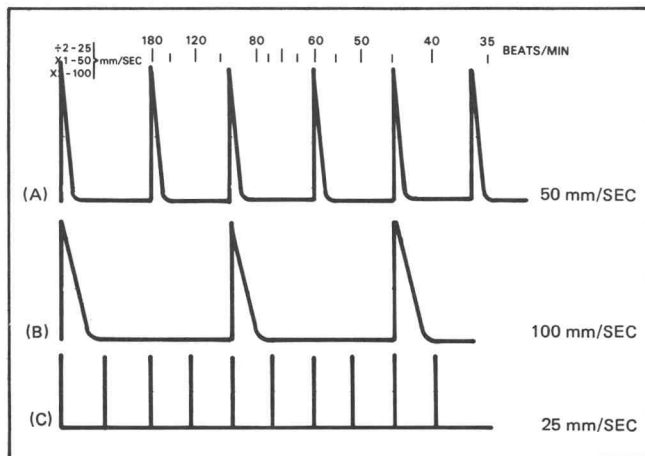


Fig. 5-6. Horizontal Position and Width adjustments.

## ECG BOARD

### 6. INPUT OFFSET NULL

- Connect shorting plug (Fig. 5-1B) to ECG INPUT.
- CHECK—Voltage at TP178 should be 0.0 V,  $\pm 200$  mV. Use test oscilloscope.
- ADJUST—Input Offset Null (R170) for 0.0 V.

### 7. ADJUST DC LEVEL

- Insert stereo phone plug (Fig. 5-1C) into ECG OUTPUT connector.
- CHECK—ECG Output (TIP-X1000) should be 0.0 V,  $\pm 25$  mV. Use test oscilloscope.
- ADJUST—DC Level (R185) for 0.0 V.
- CHECK—Trace is vertically centered at 150 mm<sub>Hg</sub> line,  $\pm 3$  mm.

### 8. ADJUST ECG OUTPUT GAIN

- Connect function generator to test oscilloscope and through precision attenuator (Fig. 5-2A) to ECG INPUT. Apply 1.0 V, 10 Hz square-wave. Note reference amplitude on test oscilloscope. Then connect test oscilloscope to ECG OUTPUT (TIP-X1000).

- CHECK—ECG OUTPUT (TIP-X1000) should be equal to the reference amplitude ( $\div 1000$  attenuator and X1000 monitor gain = 1).
- ADJUST—Gain (R184) for output equal to reference amplitude.
- Move test oscilloscope to ECG OUTPUT (RING-X1).
- CHECK—ECG Output (RING-X1) for approximately 1.0 mV p-p.
- Disconnect test oscilloscope, function generator, stereo phone plug and precision attenuator.

### 9. CHECK COMMON MODE REJECTION RATIO (CMRR)

- Connect CMRR/Leakage test circuit (Fig. 5-2B) to ECG INPUT. Then connect test circuit to ac power line.
- Set ECG SIZE control to 20 mm/mV.
- Set ECG switch to position displaying greatest amplitude.
- CHECK—Monitor display amplitude should be less than 1.3 cm, p-p for nominal 120 V lines (or less than 2.6 cm, p-p for nominal 240 V lines, if the lines are unbalanced).
- Disconnect test circuit.

### 10. CHECK ECG LEAD CHECK SIGNAL

- Connect ECG Lead Check signal to ECG INPUT through patient cable. Leads connect front to back as follows: LL (red), LA (black), RA (white).
- CHECK—Positive-going pulses should be approximately 100 beats/min (not critical). Rise and fall times are slow to activate QRS detector.
- Set ECG SIZE to 20 mm/mV.
- CHECK—Pulse amplitude for each position of ECG switch should be approximately as follows: I and III (1 cm), II (2 cm).

**11. CHECK LEAD FAULT OPERATION**

- a. CHECK—LEAD FAULT lamp lights when any ECG lead is removed from an ECG LEAD CHECK connector.

**12. ADJUST QRS TIMING**

- a. Connect test oscilloscope to TP382 (CH 1) and to TP388 (CH 2). Trigger scope on CH 1 (+SLOPE). Use chopped mode.
- b. CHECK—Interval between first positive-going edge at TP382 and rising edge of pulse at TP388 is 6 ms,  $\pm 1$  ms (see Fig. 5-7).
- c. ADJUST—Timing (R354) for 10 ms interval.

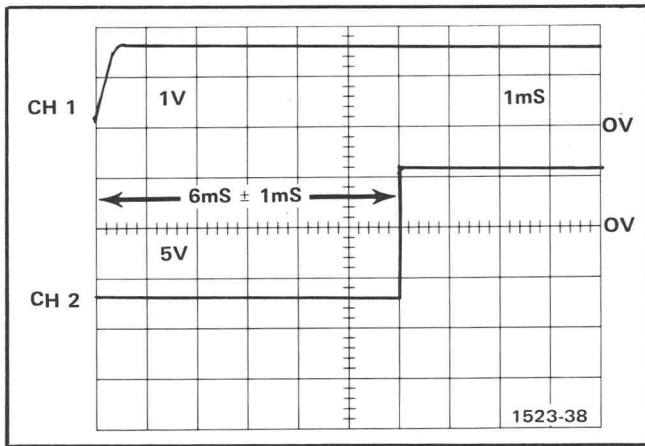


Fig. 5-7. QRS Timing.

**13. CHECK QRS WIDTH**

- a. Set oscilloscope to CH 2, Trigger on CH 2 + SLOPE.
- b. CHECK—Pulse duration at TP388 is 200 ms,  $\pm 25$  ms (see Fig. 5-8).
- c. Disconnect test oscilloscope.

**14. CHECK PACER SIGNAL REJECTION**

- a. Connect pacer input circuit adapter and function generator as shown in Fig. 5-2C.
- b. Set function generator output for approximately 500 mV, 1 Hz square-wave.
- c. Set monitor ECG switch to I.

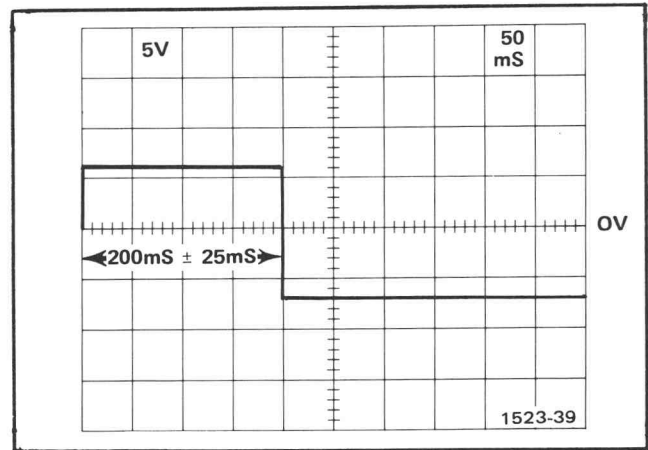


Fig. 5-8. QRS Width.

- d. CHECK—QRS detector should respond only to ECG lead Check signal and not to simulated pacer signal. When pacer signal coincides with leading edge of ECG lead Check signal, QRS detection should occur at trailing edge.
- e. Disconnect function generator and pacer adapter.

**ALARM LIMITS BOARD**

**15. CHECK RATE ALARM LIMITS**

- a. Set monitor ECG switch to 1.
- b. Connect function generator through low-pass filter (Fig. 5-1A), to ECG INPUT. Display approximately 4 cm at 2.4 Hz,  $\pm 2\%$ , (150 beats/min) square-wave signal. Beat tone indicates proper triggering.
- c. Connect test oscilloscope to TP522.
- d. Set monitor HIGH RATE control to 200 and LOW RATE control to 90.
- e. CHECK—Voltage at TP522 should switch from high to low once per beat.

- f. Increase function-generator frequency to determine frequency at which voltage stops switching and remains high.
- g. CHECK—Function-generator frequency should be between 3 Hz and 3.67 Hz (180 to 220 beats/min).
- h. Connect test oscilloscope to TP523.
- i. Decrease function-generator frequency to determine frequency at which switching just begins.
- j. CHECK—Function-generator frequency should be between 1.35 Hz to 1.65 Hz (81 to 99 beats/min).
- k. Set function generator for about 2.4 Hz (150 beats/min).
- l. Reset monitor alarm.
- m. CHECK—Alarm should sound in approximately 5 to 10 seconds after disconnecting function generator to simulate arrest condition.
- n. Reconnect function generator, wait for beat tone, then reset alarm.
- o. CHECK—Alarm should sound in approximately 2 to 6 seconds after rotating the HIGH RATE control quickly counter-clockwise past 150 to simulate high-rate violation.
- p. Set HIGH RATE control clockwise and LOW RATE control to ALARM OFF.
- q. Set function generator to 0.5 Hz (30 beats/min).
- r. CHECK—Alarm should sound within about four seconds after rotating the LOW RATE control quickly to 30 or more to simulate low-rate violation.
- s. Disconnect test oscilloscope, function generator and low-pass filter.

## ISOLATION LEAKAGE CHECK

A leakage check should be made at least every six months or whenever the monitor has been dropped or otherwise abused. Also, check leakage after any repairs.

This check is to determine the amount of leakage current which could be present between the patient and the monitor under either of the following abnormal conditions: 1) monitor is properly grounded and patient is at 120 Vac, 60 Hz, or 2) monitor is not grounded, case is connected to 120 Vac, 60 Hz and patient is grounded.

The recommended method for checking this leakage current is to measure directly in the ECG input using an instrument (such as a Tektronix 211 Oscilloscope) that can tolerate the full line voltage at its input circuit without distorting the measurement.

The alternative method provides equally satisfactory results when such an instrument is not available. Using this method, the measurement is made in the ground return (safety earth) conductor of the monitor power cord. A test oscilloscope is required that has a bandwidth of dc to 500 kHz or more, a minimum vertical sensitivity of 1 mV and a sweep rate of about 5 to 10 ms/division.

Additional test fixtures required are shown in Fig. 5-2B and Fig. 5-3. Before beginning either method:

1. Disconnect the monitor from the ac power source.
2. Remove the top and bottom covers.
3. CHECK—All plug-in circuit boards are pushed firmly into their mating sockets and seated in their slots on the board top retainer clip.
4. CHECK—All cables are plugged firmly into their mating pins and that they are dressed away from the ECG shield, the input connector shield and the pushbutton switch shafts.
5. CHECK—The screw and spacer securing the ECG circuit board are tight. See Fig. 5-9.
6. Replace top and bottom covers.

**RECOMMENDED METHOD.** Set up the monitor and the test fixtures as shown in Fig. 5-10.

CHECK—60 Hz amplitude on oscilloscope should be 14.4 mV, p-p (5  $\mu$ A, rms) or less.

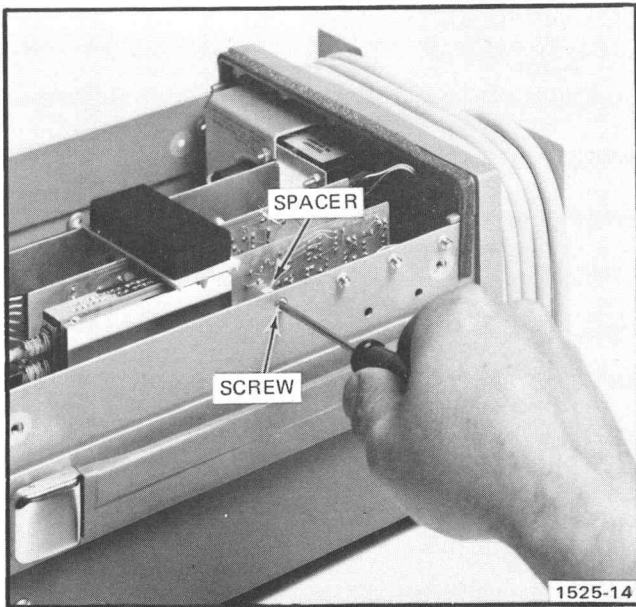


Fig. 5-9. ECG Board securing.

**ALTERNATIVE METHOD.** Set up the monitor and the test fixtures as shown in Fig. 5-11.

**NOTE**

*Test Oscilloscope chassis must be grounded.*

**CHECK**—Total 60 Hz amplitude on test oscilloscope should be 84.4 mV, p-p (30  $\mu$ A, rms) or less, disregarding monitor converter hash. Record the reading. Remove CMRR/Leakage test fixture from the ac outlet.

**CHECK**—Primary 60 Hz amplitude on test oscilloscope should be 70 mV, p-p (25  $\mu$ A, rms) or less, disregarding converter hash.

**CALCULATE**—Total amplitude minus primary amplitude = ECG isolation leakage which should be 14.4 mV, p-p (5  $\mu$ A, rms) or less.

Reverse the leakage test fixture in the ac outlet and repeat the above checks.

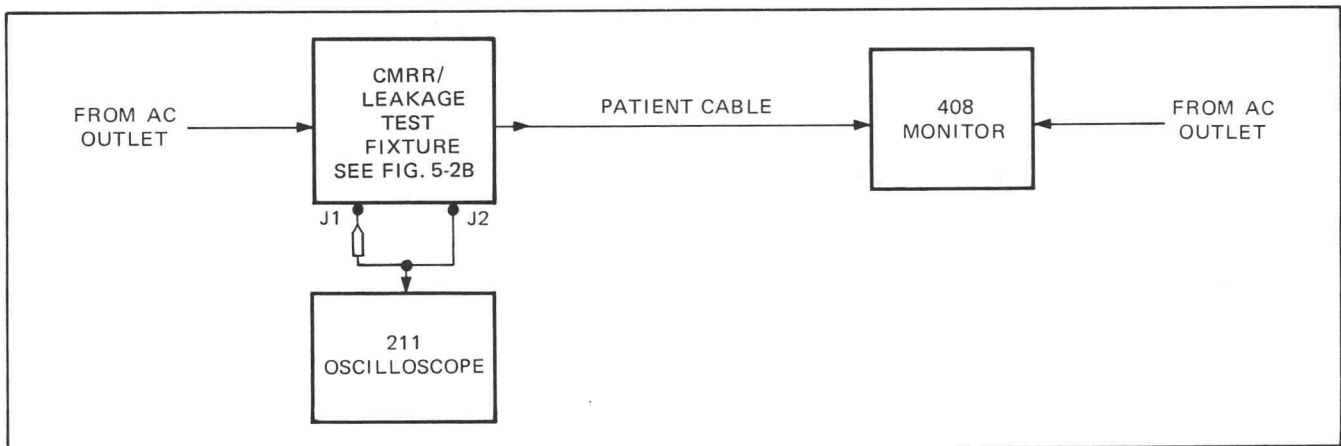


Fig. 5-10. Recommended method to check leakage current.

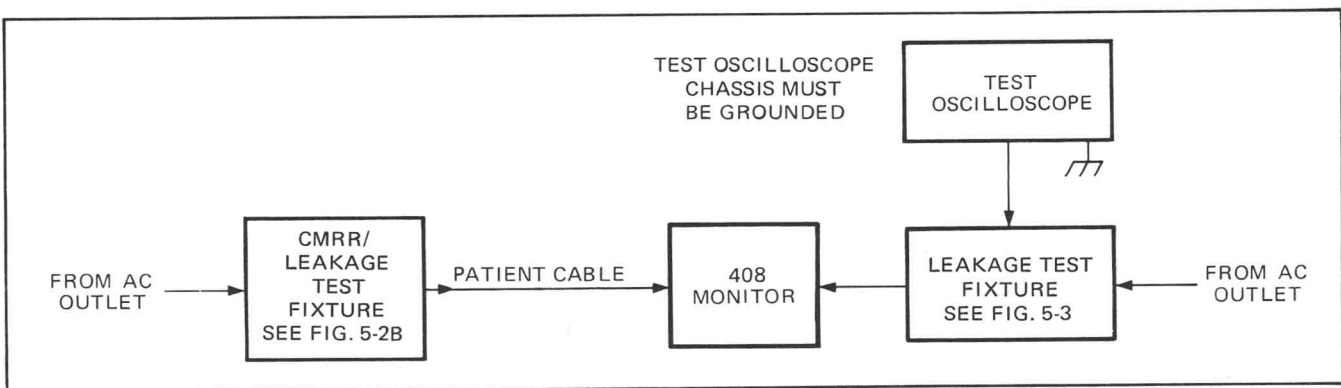


Fig. 5-11. Alternative method to check leakage current.

# ADJUSTMENT PROCEDURE

Before you begin, see **ADJUSTMENT LOCATIONS** in the pullout pages.

## INTRODUCTION

This procedure does not validate all published performance requirements. This Adjustment Procedure is intended to permit rapid touch-up of all internal adjustments, under the assumption the monitor is functioning correctly in all respects, and that the service person is familiar with the methods described in the Check/Adjustment Procedure.

This procedure is divided by circuit board to permit adjustment to individual circuits without having to perform a complete recalibration. However, if adjustments are made on the main board, the entire monitor should be readjusted.

## PRELIMINARY SETUP

POWER	On (pushed in)
ALARM LIMITS—LOW	ALARM OFF
Line Voltage Range	Correct Line Selection

Set the remaining controls as desired. Connect the monitor to the correct ac line source.

### NOTE

*Do not preset the internal controls.*

## MAIN BOARD

### NOTE

*When you make any adjustments on the main board, you should readjust the entire monitor.*

### 1. POWER SUPPLY (–12 V)

SETUP—Connect DVM, point A to TP-12V.

ADJUST— –12 V (R737): –12.00 V, ±50 mV.

### 2. TRACE ROTATION

SETUP—Loosen yoke clamp.

ADJUST—Yoke: non-tilted trace. Tighten clamp.

### NOTE

*Due to effects of earth's magnetic field, keep monitor upright when adjusting spot centering, Horizontal Position and Horizontal Width.*

### 3. SPOT CENTERING and FOCUS

SETUP—Unplug yoke (P641).

ADJUST—Yoke centering rings: Centered spot (at 150 mm<sub>Hg</sub> and 60 BEATS/MIN marks).

ADJUST—Focus (R841): Smallest round spot.

### 4. HORIZONTAL POSITION

SETUP—Plug in yoke (P641).

ADJUST—Horiz Position (R671): Trace beginning at left ends of graticule lines.

### 5. HORIZONTAL WIDTH

SETUP—Connect function generator through low-pass filter to ECG input. Display 4 cm, 3 Hz signal.

ADJUST—Width (R667): Align fourth pulse with 60 BEAT/MIN mark.

## ECG BOARD

### 6. INPUT OFFSET NULL

SETUP—Connect shorting plug to ECG INPUT. Connect test oscilloscope to TP178.

ADJUST—Input Offset Null (R170): 0 V, ±50 mV.

### 7. DC LEVEL

SETUP—Connect test oscilloscope to ECG OUTPUT (TIP-X1000).

ADJUST—DC Level (R185): 0 V, ±25 mV.

### 8. GAIN and ECG OUTPUT

SETUP—Connect function generator to test oscilloscope and through precision attenuator to ECG INPUT. Apply 1.0 V, 10 Hz square wave. Note reference amplitude on test oscilloscope. Then connect test oscilloscope to ECG OUTPUT (TIP-X1000).

ADJUST—Gain (R184): Output equal to reference amplitude. Output at RING X1 should equal reference voltage  $\div 1000$ .

### 9. QRS TIMING and WIDTH

SETUP—Connect ECG Lead Check signal through patient cable to ECG INPUT. Connect test oscilloscope to TP354.

ADJUST—QRS Timing (R354): 10 ms<sup>2</sup> timing pulse (see Fig. 5-7).

ADJUST—QRS Width (R357): 200 ms width pulse (see Fig. 5-8). Disconnect ECG Lead Check signal.

#### NOTE

*Safety isolation checks should be performed after recalibration. Refer to CHECK/ADJUSTMENT Procedure.*

<sup>2</sup> See note 1 in Check/Adjustment Procedure.



# 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
01002	GENERAL ELECTRIC COMPANY, INDUSTRIAL AND POWER CAPACITOR PRODUCTS DEPARTMENT	JOHN STREET	HUDSON FALLS, NY 12839
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
02660	BUNKER RAMO CORP., CONNECTOR DIVISION	2801 S 25TH AVENUE	BROADVIEW, IL 60153
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MURTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPARTMENT	NELA PARK	CLEVELAND, OH 44112
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
18178	VACTEC, INC.	2423 NORTHLINE INDUSTRIAL BLVD.	MARYLAND HEIGHTS, MO 63043
18324	SIGNETICS CORP.	811 E. ARQUES	SUNNYVALE, CA 94086
32997	HOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
53184	XCITON CORPORATION	5 HEMLOCK STREET	LATHAM, NY 12110
55210	GETTIG ENG. AND MFG. COMPANY	PO BOX 85, OFF ROUTE 45	SPRING MILLS, PA 16875
55292	LEDGO DIV., WILBRECHT ELECTRONICS, INC.	240 EAST PLATO BLVD.	ST. PAUL, MN 55107
56289	SPRAGUE ELECTRIC CO.		NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
72653	G. C. ELECTRONICS CO., A DIVISION OF HYDROMETALS, INC.	400 S. WYMAN ST.	ROCKFORD, IL 61101
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
74199	QUAM NICHOLS COMPANY	218 E MARQUETTE ROAD	CHICAGO, IL 60637
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
77342	AMF INC., POTTER AND BRUMFIELD DIV.	200 RICHLAND CREEK DRIVE	PRINCETON, IN 47671
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
81483	INTERNATIONAL RECTIFIER CORP.	9220 SUNSET BLVD.	LOS ANGELES, CA 90069
82389	SWITCHCRAFT, INC.	5555 N. ELSTON AVE.	CHICAGO, IL 60630
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 P. O. BOX 609	COLUMBUS, NE 68601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-2702-00	B010100	B049999	CKT CARD ASSY:ECG	80009	670-2702-00
A1	670-2702-01	B050500	B089999	CKT CARD ASSY:ECG	80009	670-2702-01
A1	670-2702-03	B090000	B119999	CKT CARD ASSY:ECG	80009	670-2702-03
A1	670-2702-04	B120000		CKT CARD ASSY:ECG	80009	670-2702-04
A2	670-2703-00	B010100	B079999	CKT CARD ASSY:ALARM LIMITS	80009	670-2703-00
A2	670-2703-02	B080000		CKT CARD ASSY:ALARM LIMITS	80009	670-2703-02
A3	670-2701-01	B010100	B079999	CKT CARD ASSY:MAIN	80009	670-2701-01
A3	670-2701-03	B080000	B109999	CKT CARD ASSY:MAIN	80009	670-2701-03
A3	670-2701-05	B110000	B120929	CKT CARD ASSY:MAIN	80009	670-2701-05
A3	670-2701-07	B120930	B139999	CKT CARD ASSY:MAIN	80009	670-2701-07
A3	670-2701-09	B140000	B149999	CKT CARD ASSY:MAIN	80009	670-2701-09
A3	670-2701-11	B150000	B159999	CKT CARD ASSY:MAIN	80009	670-2701-11
A3	670-2701-13	B160000		CKT CARD ASSY:MAIN	80009	670-2701-13
A4	670-4757-00	XB161670		CKT CARD ASSY:FUSE HOLDER	80009	670-4757-00
BT714 <sup>1</sup>	119-0441-00	B010100	B161669	BATTERY SET:"C" CELL	80009	119-0441-00
BT714 <sup>1</sup>	119-0441-01	B161670		BATTERY SET:"C" CELL	80009	119-0441-01
BT714 <sup>2</sup>	119-0443-00	B010100	B161669	BATTERY SET:"F" CELL	80009	119-0443-00
BT714 <sup>2</sup>	119-0443-01	B161670		BATTERY SET:"F" CELL	80009	119-0443-01
C105	283-0128-00			CAP.,FXD,CER DI:100PF,5%,500V	72982	871-536T2H101J
C107	283-0128-00			CAP.,FXD,CER DI:100PF,5%,500V	72982	871-536T2H101J
C109	283-0128-00			CAP.,FXD,CER DI:100PF,5%,500V	72982	871-536T2H101J
C125	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	56289	19C242B
C151	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C152	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C155	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C156	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C158	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C178	283-0238-00			CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N075X7R0103K
C179	283-0341-00			CAP.,FXD,CER DI:0.047UF,10%,100V	72982	8131N145X7R0473K
C181	285-0809-00			CAP.,FXD,PLSTC:1UF,10%,50V	56289	LP66A1A105K
C212	283-0212-00			CAP.,FXD,CER DI:2UF,20%,50V	72982	8141N064Z5U205M
C238	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C239	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C303	283-0339-00			CAP.,FXD,CER DI:0.22UF,10%,50V	72982	8131N075W5R224K
C304	283-0032-00			CAP.,FXD,CER DI:470PF,5%,500V	72982	831-500Z5D471J
C308	283-0238-00			CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N075X7R0103K
C315	283-0339-00	B010100	B119999	CAP.,FXD,CER DI:0.22UF,10%,50V	72982	8131N075W5R224K
C315	283-0190-00	B120000		CAP.,FXD,CER DI:0.47UF,5%,50V	72982	8141N077W5R474J
C324	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C325	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C327	283-0339-00			CAP.,FXD,CER DI:0.22UF,10%,50V	72982	8131N075W5R224K
C328	283-0341-00			CAP.,FXD,CER DI:0.047UF,10%,100V	72982	8131N145X7R0473K
C354	283-0238-00	B010100	B119999X	CAP.,FXD,CER DI:0.01UF,10%,50V	72982	8121N075X7R0103K
C357	283-0339-00	B010100	B119999X	CAP.,FXD,CER DI:0.22UF,10%,50V	72982	8131N075W5R224K
C367	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020FL
C373	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039 E 105Z
C382	285-0598-00	XB120000		CAP.,FXD,PLSTC:0.01UF,5%,100V	01002	61F10AC103
C384	290-0536-00	XB120000		CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C388	285-1076-00	XB120000		CAP.,FXD,PLSTC:0.2UF,5%,100V	14752	230B1B204J
C507	285-0894-00			CAP.,FXD,PLSTC:5UF,5%,50V	56289	LP66A1A505J002
C517	285-0894-00			CAP.,FXD,PLSTC:5UF,5%,50V	56289	LP66A1A505J002
C524	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C525	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P

<sup>1</sup>Consists of (4) 146-0023-00.  
<sup>2</sup>Option 3 only, consists of (4) 146-0024-00.

Replaceable Electrical Parts—408

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C526	290-0534-00			CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1
C527	290-0525-00			CAP., FXD, ELCTLT:4.7UF, 20%, 50V	56289	196D475X0050KA1
C542	290-0534-00			CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1
C544	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C594	290-0527-00			CAP., FXD, ELCTLT:15UF, 20%, 20V	90201	TDC156M020FL
C614	290-0533-00	B010100	B139999	CAP., FXD, ELCTLT:330UF, 20%, 6V	90201	TDC337M006WLD
C614	290-0722-00	B140000		CAP., FXD, ELCTLT:100UF, 20%, 10V	56289	196D107X0010PE3
C615	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C623	281-0525-00			CAP., FXD, CER DI:470PF, +/-94PF, 500V	04222	7001-1364
C639	283-0067-00			CAP., FXD, CER DI:0.001UF, 10%, 200V	72982	835-515B102K
C649	283-0067-00			CAP., FXD, CER DI:0.001UF, 10%, 200V	72982	835-515B102K
C652	281-0525-00			CAP., FXD, CER DI:470PF, +/-94PF, 500V	04222	7001-1364
C653	283-0238-00			CAP., FXD, CER DI:0.01UF, 10%, 50V	72982	8121N075X7R0103K
C656	290-0534-00			CAP., FXD, ELCTLT:1UF, 20%, 35V	56289	196D105X0035HA1
C658	283-0238-00			CAP., FXD, CER DI:0.01UF, 10%, 50V	72982	8121N075X7R0103K
C663	285-0784-03			CAP., FXD, PLSTC:10.1UF, 5%, 25V	80009	285-0784-03
C682	281-0525-00			CAP., FXD, CER DI:470PF, +/-94PF, 500V	04222	7001-1364
C683	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C685	290-0536-00			CAP., FXD, ELCTLT:10UF, 20%, 25V	90201	TDC106M025FL
C686	283-0067-00	B010100	B149999	CAP., FXD, CER DI:0.001UF, 10%, 200V	72982	835-515B102K
C686	283-0077-00	B150000		CAP., FXD, CER DI:330PF, 5%, 500V	56289	40C94A3
C693	283-0003-00			CAP., FXD, CER DI:0.01UF, +80-20%, 150V	72982	855-558Z5U-103Z
C694	283-0003-00			CAP., FXD, CER DI:0.01UF, +80-20%, 150V	72982	855-558Z5U-103Z
C712	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C713	290-0531-00			CAP., FXD, ELCTLT:100UF, 20%, 10V	90201	TDC107M010WLC
C722	290-0436-00			CAP., FXD, ELCTLT:10,000UF, 20%, 10V	56289	68D10467
C723	290-0536-00			CAP., FXD, ELCTLT:10UF, 20%, 25V	90201	TDC106M025FL
C724	290-0536-00			CAP., FXD, ELCTLT:10UF, 20%, 25V	90201	TDC106M025FL
C732	283-0003-00			CAP., FXD, CER DI:0.01UF, +80-20%, 150V	72982	855-558Z5U-103Z
C733	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C739	283-0003-00			CAP., FXD, CER DI:0.01UF, +80-20%, 150V	72982	855-558Z5U-103Z
C745	290-0531-00			CAP., FXD, ELCTLT:100UF, 20%, 10V	90201	TDC107M010WLC
C746	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C755	290-0536-00			CAP., FXD, ELCTLT:10UF, 20%, 25V	90201	TDC106M025FL
C764	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
C802	283-0280-00			CAP., FXD, CER DI:2200PF, 10%, 2000V	56289	29C558
C803	283-0280-00			CAP., FXD, CER DI:2200PF, 10%, 2000V	56289	29C558
C804	283-0280-00			CAP., FXD, CER DI:2200PF, 10%, 2000V	56289	29C558
C805	283-0280-00			CAP., FXD, CER DI:2200PF, 10%, 2000V	56289	29C558
C806	283-0280-00			CAP., FXD, CER DI:2200PF, 10%, 2000V	56289	29C558
C807	283-0280-00			CAP., FXD, CER DI:2200PF, 10%, 2000V	56289	29C558
C811	283-0006-00			CAP., FXD, CER DI:0.02UF, +80-20%, 500V	72982	841-541E203Z
C812	283-0006-00			CAP., FXD, CER DI:0.02UF, +80-20%, 500V	72982	841-541E203Z
C817	290-0519-00			CAP., FXD, ELCTLT:100UF, 20%, 20V	90201	TDC107M020WLD
C821	290-0662-00			CAP., FXD, ELCTLT:220UF, 20%, 10V	90201	TDC227M010WLD
C822	290-0662-00			CAP., FXD, ELCTLT:220UF, 20%, 10V	90201	TDC227M010WLD
C825	290-0662-00			CAP., FXD, ELCTLT:220UF, 20%, 10V	90201	TDC227M010WLD
C826	290-0662-00			CAP., FXD, ELCTLT:220UF, 20%, 10V	90201	TDC227M010WLD
C828	290-0519-00			CAP., FXD, ELCTLT:100UF, 20%, 20V	90201	TDC107M020WLD
C843	283-0111-00			CAP., FXD, CER DI:0.1UF, 20%, 50V	72982	8121-N088Z5U104M
CR107	152-0246-00			SEMICONV DEVICE:SILICON,400PIV,200MA	80009	152-0246-00
CR109	152-0246-00			SEMICONV DEVICE:SILICON,400PIV,200MA	80009	152-0246-00
CR114	152-0246-00			SEMICONV DEVICE:SILICON,400PIV,200MA	80009	152-0246-00

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR130	152-0141-02	XB120000		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR151	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR152	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR153	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR154	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR162	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR199	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR200	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR205	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR208	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR212	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR213	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR215	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR216	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR313	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR314	152-0141-02	XB120000		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR315	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR324	307-1025-00			OPT ISOLATOR:500 OHM AT 40MA	18178	VTL-2C2
CR332	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR333	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR335	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR336	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR338	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR339	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR354	152-0141-02	B010100	B119999X	SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR366	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR367	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR373	152-0141-02	B010100	B119999X	SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR384	152-0141-02	XB120000		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR508	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR518	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR524	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR526	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR532	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR533	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR534	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR535	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR542	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR544	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR547	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR548	152-0141-02	XB080000		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR549	152-0141-02	XB080000		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR614	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR615	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR617	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR628	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR657	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR682	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR684	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR685	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR686	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR687	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR703	152-0406-00			SEMICON D DEVICE:SILICON,200V,3A	80009	152-0406-00

Replaceable Electrical Parts—408.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR704	152-0406-00			SEMICON D DEVICE:SILICON,200V,3A	80009	152-0406-00
CR714	152-0423-00			SEMICON D DEVICE:SILICON,400V,3A	04713	1N5000
CR722	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR727	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR752	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR756	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR762	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR763	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR764	152-0141-02	XB160000		SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR765	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR766	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR802	152-0170-00			SEMICON D DEVICE:SILICON,1500V,10UA	80009	152-0170-00
CR803	152-0170-00			SEMICON D DEVICE:SILICON,1500V,10UA	80009	152-0170-00
CR804	152-0170-00			SEMICON D DEVICE:SILICON,1500V,10UA	80009	152-0170-00
CR805	152-0170-00			SEMICON D DEVICE:SILICON,1500V,10UA	80009	152-0170-00
CR806	152-0170-00			SEMICON D DEVICE:SILICON,1500V,10UA	80009	152-0170-00
CR807	152-0170-00			SEMICON D DEVICE:SILICON,1500V,10UA	80009	152-0170-00
CR811	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR812	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR817	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR818	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR821	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR822	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR825	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR826	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR827	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR828	152-0107-00			SEMICON D DEVICE:SILICON,400V,400MA	80009	152-0107-00
CR842	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR843	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
CR845	152-0141-02			SEMICON D DEVICE:SILICON,30V,150MA	07910	1N4152
DS105	150-0067-00	B010100	B119999	LAMP,GLOW:NEON	08806	5AH-5
DS105	150-0173-00	B120000		LAMP,GLOW:	08806	C2A-T
DS107	150-0067-00	B010100	B119999	LAMP,GLOW:NEON	08806	5AH-5
DS107	150-0173-00	B120000		LAMP,GLOW:	08806	C2A-T
DS109	150-0067-00	B010100	B119999	LAMP,GLOW:NEON	08806	5AH-5
DS109	150-0173-00	B120000		LAMP,GLOW:	08806	C2A-T
DS213	150-1004-00	B010100	B151469	LAMP,LED:RED,2.5V,15MA	08806	SSL-12
DS213	150-1031-00	B151470		LAMP,LED:RED,650NM,40MA MAX	53184	XC209R
DS542	150-0123-01	XB110000		LAMP,CARTRIDGE:14V,0.023A,YELLOW LENS	55292	71326-06
F701	159-0029-00	B010100	B079999	FUSE,CARTRIDGE:3AG,0.3A,250V,SLOW-BLOW	71400	MDL3/10
F701	159-0031-00	B080000		FUSE,CARTRIDGE:3AG,0.4A,250V,SLOW-BLOW	71400	MDL 4/10
J100	131-1378-00			CONNECTOR,RCPT,:5 CONTACT	02660	MS3102A-14S-5S
J556	131-0267-00	XB110000		PLUG TELEPHONE:3 CONDUCTOR	72653	33-708
K721	148-0091-00			RELAY,ARMATURE:52 OHM,6V	77342	R10-E1-Y4-V52
L840A,B	119-0468-00	B010100	B131279	COIL,TUBE DEFL:CRT YOKE	80009	119-0468-00
L840A,B	119-0468-01	B131280		COIL,TUBE DEFL:CRT YOKE	80009	119-0468-01
LS691	119-0131-00	B010100	B149999	LOUDSPEAKER,PM:	74199	22A052100
LS691	119-0716-02	B150000		LOUDSPEAKER,PM:WITH CABLE	80009	119-0716-02
M763	149-0031-03	B010100	B159999	METER,BTRY LEVEL:0-200VA,+/-15%	80009	149-0031-03
M763	149-0043-01	B160000		METER,BTRY LVL:W/BACKET,HOLDER AND CONN	80009	149-0043-01

Kct No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q110A,B	151-1049-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	80009	151-1049-00
Q130	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q156	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q158	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q162	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q164	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q182A,B	151-1049-00			TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL	80009	151-1049-00
Q218	151-1004-00			TRANSISTOR:SILICON,JFE,N-CHANNEL	80009	T128CS
Q232	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q234	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q236	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q238	151-0302-00			TRANSISTOR:SILICON,NPN	04713	2N2222A
Q254	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q308	151-0508-00			TRANSISTOR:SILICON,NPN,PROGRAMMABLE	03508	2N6027
Q316	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q336	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q344	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q366	151-0342-00			TRANSISTOR:SILICON,PNP	80009	151-0342-00
Q368	151-1022-00			TRANSISTOR:SILICON,JFE,SEL FROM 2N4392	80009	151-1022-00
Q372	151-1004-00			TRANSISTOR:SILICON,JFE,N-CHANNEL	80009	T128CS
Q382	151-0188-00	XB120000		TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q384	151-0342-00	XB120000		TRANSISTOR:SILICON,PNP	80009	151-0342-00
Q386	151-0190-00	XB120000		TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q504	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q506	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q516	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q542	151-0190-00	XB080000		TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q544	151-0188-00	XB080000		TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q546	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q548	151-0188-00	XB080000		TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q631	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q632	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q633	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q635	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q636	151-0350-00			TRANSISTOR:SILICON,PNP	80009	151-0350-00
Q637	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q638	151-0407-00			TRANSISTOR:SILICON,NPN	80009	151-0407-00
Q642	151-0350-00			TRANSISTOR:SILICON,PNP	80009	151-0350-00
Q646	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q648	151-0406-00			TRANSISTOR:SILICON,PNP	80009	151-0406-00
Q652	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q666	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q670	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q672	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q674	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q676	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q692	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q694	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q712	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q714	151-0373-00			TRANSISTOR:SILICON,PNP	80009	151-0373-00
Q716	151-0373-00			TRANSISTOR:SILICON,PNP	80009	151-0373-00
Q726	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q734	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00

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Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q736	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q742	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q744	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
Q746	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	80009	151-0349-00
Q748	151-0349-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE2801	80009	151-0349-00
Q754	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q756	151-0190-00			TRANSISTOR:SILICON,NPN	80009	151-0190-00
Q842	151-0350-00			TRANSISTOR:SILICON,PNP	80009	151-0350-00
Q844	151-0188-00			TRANSISTOR:SILICON,PNP	80009	151-0188-00
R102	315-0106-00	B010100	B089999	RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R102	302-0108-00	B090000	B119999X	RES.,FXD,COMP:1G OHM,20%,0.50W		
R104	315-0107-00	B010100	B089999	RES.,FXD,CMPSN:100M OHM,5%,0.25W	01121	CB1075
R104	314-0011-00	B090000		RES.,FXD,FILM:10G OHM,30%,0.5W	75042	GBT 1/2 1000730%
R107	321-0510-00			RES.,FXD,FILM:2M OHM,1%,0.125W	91637	HFF188G20003F
R108	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R112	315-0107-00	B010100	B089999	RES.,FXD,CMPSN:100M OHM,5%,0.25W	01121	CB1075
R112	314-0011-00	B090000		RES.,FXD,FILM:10G OHM,30%,0.5W	75042	GBT 1/2 1000730%
R114	321-0510-00			RES.,FXD,FILM:2M OHM,1%,0.125W	91637	HFF188G20003F
R115	321-0306-00			RES.,FXD,FILM:15K OHM,1%,0.125W	91637	MFF1816G15001F
R117	321-0419-00			RES.,FXD,FILM:226K OHM,1%,0.125W	91637	MFF1816G22602F
R120	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R125	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R127	321-0318-00			RES.,FXD,FILM:20K OHM,1%,0.125W	91637	MFF1816G20001F
R130	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R133	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
R136	321-0419-00			RES.,FXD,FILM:226K OHM,1%,0.125W	91637	MFF1816G22602F
R138	322-0222-00			RES.,FXD,FILM:2K OHM,1%,0.25W	75042	CEBT0-2001F
R154	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R155	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R160	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R162	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R165	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R170	311-1244-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3386X-T07-101
R172	323-0097-00	B010100	B049999	RES.,FXD,FILM:100 OHM,1%,0.50W	75042	CECT0-1000F
R172	323-0085-00	B050000		RES.,FXD,FILM:75 OHM,1%,0.50W	75042	CECT0-75R00F
R175	322-0193-00			RES.,FXD,FILM:1K OHM,1%,0.25W	75042	CEBT0-1001F
R178	315-0163-00			RES.,FXD,CMPSN:16K OHM,5%,0.25W	01121	CB1635
R179	321-0296-00			RES.,FXD,FILM:11.8K OHM,1%,0.125W	91637	MFF1816G11801F
R181	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R183	321-0291-00			RES.,FXD,FILM:10.5K OHM,1%,0.125W	91637	MFF1816G10501F
R184	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72X-27-0-502K
R185	311-1319-00			RES.,VAR,NONWIR:10K OHM,10%,0.75W	01121	4SP103
R186	321-0194-00			RES.,FXD,FILM:1.02K OHM,1%,0.125W	91637	MFF1816G10200F
R187	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R188	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R189	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R193	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R195	311-1524-00	B010100	B162400	RES.,VAR,NONWIR:20K OHM,10%,1W	01121	73A1G040L203U
R195	311-1995-00	B162401		RES.,VAR,NONWIR:20K OHM,10%,1W	01121	73A1G032L2303U
R196	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R197	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R199	315-0104-00	B010100	B119999	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R199	315-0513-00	B120000		RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135



Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R200	315-0913-00	B010100	B119999	RES.,FXD,CMPSN:91K OHM,5%,0.25W	01121	CB9135
R200	315-0433-00	B120000		RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
R201	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R203	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R205	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R207	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R208	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R211	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R212	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
R213	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R215	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R217	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R219	315-0824-00			RES.,FXD,CMPSN:820K OHM,5%,0.25W	01121	CB8245
R233	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R235	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R236	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
R238	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R303	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R304	315-0514-00	B010100	B119999	RES.,FXD,CMPSN:510K OHM,5%,0.25W	01121	CB5145
R304	315-0474-00	B120000		RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R305	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R306	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R307	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R308	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R313	315-0164-00			RES.,FXD,CMPSN:160K OHM,5%,0.25W	01121	CB1645
R315	315-0334-00			RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345
R318	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R322	315-0514-00			RES.,FXD,CMPSN:510K OHM,5%,0.25W	01121	CB5145
R323	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R325	315-0163-00			RES.,FXD,CMPSN:16K OHM,5%,0.25W	01121	CB1635
R326	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R327	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R328	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R332	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R333	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R334	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R335	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R336	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R337	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R338	316-0685-00			RES.,FXD,CMPSN:6.8M OHM,10%,0.25W	01121	CB6851
R339	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R344	315-0623-00	B010100	B119999	RES.,FXD,CMPSN:62K OHM,5%,0.25W	01121	CB6235
R344	315-0622-00	B120000		RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R345	315-0103-00	B010100	B119999	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R345	315-0102-00	B120000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R346	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R347	315-0913-00	B010100	B119999X	RES.,FXD,CMPSN:91K OHM,5%,0.25W	01121	CB9135
R348	315-0114-00	B010100	B119999X	RES.,FXD,CMPSN:110K OHM,5%,0.25W	01121	CB1145
R349	315-0334-00	B010100	B119999X	RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345
R354	311-1399-00	B010100	B119999X	RES.,VAR,NONWIR:5M OHM,20%,0.50W	73138	72Y-90-0-505K
R355	315-0154-00	B010100	B119999X	RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R357	311-1399-00	B010100	B119999X	RES.,VAR,NONWIR:5M OHM,20%,0.50W	73138	72Y-90-0-505K
R358	315-0334-00	B010100	B119999X	RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345

Replaceable Electrical Parts—408

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R364	316-0565-00			RES.,FXD,CMPSN:5.6M OHM,10%,0.25W	01121	CB5651
R365	315-0755-00			RES.,FXD,CMPSN:7.5M OHM,5%,0.25W	01121	CB7555
R366	315-0684-00			RES.,FXD,CMPSN:680K OHM,5%,0.25W	01121	CB6845
R367	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R368	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R372	315-0102-00	XB050000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R373	315-0153-00	B010100	B119999X	RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R381	315-0135-00	XB120000		RES.,FXD,CMPSN:1.3M OHM,5%,0.25W	01121	CB1355
R382	315-0104-00	XB120000		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R383	315-0104-00	XB120000		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R384	315-0564-00	XB120000		RES.,FXD,CMPSN:560K OHM,5%,0.25W	01121	CB5645
R385	315-0364-00	XB120000		RES.,FXD,CMPSN:360K OHM,5%,0.25W	01121	CB3645
R386	315-0125-00	XB120000		RES.,FXD,CMPSN:1.2M OHM,5%,0.25W	01121	CB1255
R387	315-0103-00	XB120000		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R388	315-0914-00	XB120000	B142004	RES.,FXD,CMPSN:910K OHM,5%,0.25W	01121	CB9145
R388	315-0684-00	B142005		RES.,FXD,CMPSN:680K OHM,5%,0.25W	01121	CB6845
R501	316-0334-00			RES.,FXD,CMPSN:330K OHM,10%,0.25W	01121	CB3341
R502	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
R503	321-0254-00			RES.,FXD,FILM:4.32K OHM,1%,0.125W	91637	MFF1816G43200F
R504	321-0160-00			RES.,FXD,FILM:453 OHM,1%,0.125W	91637	MFF1816G453ROF
R505 <sup>1</sup>	311-1522-00			RES.,VAR, NONWIR:50K OHM,5%,1W	01121	16M184
R507	321-0364-00			RES.,FXD,FILM:60.4K OHM,1%,0.125W	91637	MFF1816G60401F
R508	316-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R512	321-0255-00			RES.,FXD,FILM:4.42K OHM,1%,0.125W	91637	MFF1816G44200F
R513	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	91637	MFF1816G47500F
R514	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R515	311-1523-00			RES.,VAR, NONWIR:50K OHM,5%,1W	01121	11M-337
R517	321-0364-00			RES.,FXD,FILM:60.4K OHM,1%,0.125W	91637	MFF1816G60401F
R518	316-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R522	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R523	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R524	316-0475-00			RES.,FXD,CMPSN:4.7M OHM,10%,0.25W	01121	CB4751
R525	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R526	316-0825-00			RES.,FXD,CMPSN:8.2M OHM,10%,0.25W	01121	CB8251
R527	315-0395-00	B010100	B151519	RES.,FXD,CMPSN:3.9M OHM,5%,0.25W	01121	CB3955
R527	315-0625-00	B151520		RES.,FXD,CMPSN:6.2M OHM,(NOM VALUE),SEL	01121	CB6255
R532	316-0475-00			RES.,FXD,CMPSN:4.7M OHM,10%,0.25W	01121	CB4751
R534	316-0474-00			RES.,FXD,CMPSN:470K OHM,10%,0.25W	01121	CB4741
R541	315-0333-00	XB080000		RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R543	315-0333-00	XB080000		RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R544	316-0475-00			RES.,FXD,CMPSN:4.7M OHM,10%,0.25W	01121	CB4751
R545	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R546	315-0510-00	XB080000		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R547	316-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R548	316-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R580	315-0104-00	XB080000		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R581	315-0106-00	XB080000		RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
R584	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R585	316-0105-00	B010100	B079999X	RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R586	316-0106-00			RES.,FXD,CMPSN:10M OHM,10%,0.25W	01121	CB1061
R587	316-0106-00			RES.,FXD,CMPSN:10M OHM,10%,0.25W	01121	CB1061
R594	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
R595	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816G10002F

<sup>1</sup>Furnished as a unit with S505.

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R605	321-0612-02			RES.,FXD,FILM:500 OHM,0.5%,0.125W	91637	MFF1816D500ROD
R607	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	91637	MFF1816G49902F
R612	321-0033-00	B010100	B139999	RES.,FXD,FILM:21.5 OHM,1%,0.125W	91637	MFF1816G21R50F
R612	321-0001-00	B140000		RES.,FXD,FILM:10 OHM,1%,0.125W	75042	CEAT0-10R00F
R613	321-0033-00	B010100	B139999	RES.,FXD,FILM:21.5 OHM,1%,0.125W	91637	MFF1816G21R50F
R613	321-0030-00	B140000		RES.,FXD,FILM:20 OHM,1%,0.125W	91637	MFF1816G20R00F
R614	321-0452-00	B010100	B139999	RES.,FXD,FILM:499K OHM,1%,0.125W	91637	MFF1816G49902F
R614	321-0420-00	B140000		RES.,FXD,FILM:232K OHM,1%,0.125W	91637	MFF1816G23202F
R615	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R616	316-0395-00			RES.,FXD,CMPSN:3.9M OHM,10%,0.25W	01121	CB3951
R617	315-0684-00	B010100	B139999	RES.,FXD,CMPSN:680K OHM,5%,0.25W	01121	CB6845
R617	315-0334-00	B140000		RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345
R628	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R640	316-0472-00	B010100	B099999	RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
R640	316-0473-00	B100000		RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
R641	316-0472-00	B010100	B099999	RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
R641	316-0473-00	B100000		RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
R642	316-0330-00			RES.,FXD,CMPSN:33 OHM,10%,0.25W	01121	CB3301
R643	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R644	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R645	316-0330-00			RES.,FXD,CMPSN:33 OHM,10%,0.25W	01121	CB3301
R646	321-0142-00			RES.,FXD,FILM:294 OHM,1%,0.125W	91637	MFF1816G294ROF
R647	311-1222-00			RES.,VAR,NONWIR:100 OHM,20%,0.50W	32997	3386F-T04-101
R648	308-0574-00			RES.,FXD,WW:10 OHM,5%,2W	91637	RS2B162K10R00J
R649	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R651	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R652	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R653	315-0105-00	B010100	B151519	RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R653	315-0125-00	B151520		RES.,FXD,CMPSN:1.2M OHM,(NOM VALUE),SEL	01121	CB1255
R654	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R655	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R656	315-0625-00			RES.,FXD,CMPSN:6.2M OHM,5%,0.25W	01121	CB6255
R657	316-0473-00			RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
R658	315-0335-00	B010100	B120924	RES.,FXD,CMPSN:3.3M OHM,5%,0.25W	01121	CB3355
R658	316-0565-00	B120930	B151519	RES.,FXD,CMPSN:5.6M OHM,10%,0.25W	01121	CB5651
R658	315-0625-00	B151520		RES.,FXD,CMPSN:6.2M OHM,(NOM VALUE),SEL	01121	CB6255
R659	316-0223-00			RES.,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
R661	321-0431-00			RES.,FXD,FILM:301K OHM,1%,0.125W	91637	MFF1816G30102F
R662	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816G10002F
R663	321-0431-00			RES.,FXD,FILM:301K OHM,1%,0.125W	91637	MFF1816G30102F
R664	321-0431-00			RES.,FXD,FILM:301K OHM,1%,0.125W	91637	MFF1816G30102F
R665	321-0431-00			RES.,FXD,FILM:301K OHM,1%,0.125W	91637	MFF1816G30102F
R666	321-0431-00			RES.,FXD,FILM:301K OHM,1%,0.125W	91637	MFF1816G30102F
R667	311-1231-00			RES.,VAR,NONWIR:25K OHM,20%,0.50W	32997	3386F-T04-253
R668	321-0356-00			RES.,FXD,FILM:49.9K OHM,1%,0.125W	91637	MFF1816G49901F
R671	311-1235-00			RES.,VAR,NONWIR:100K OHM,20%,0.50W	32997	3386F-T04-104
R672	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	91637	MFF1816G49902F
R673	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R674	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816G10002F
R675	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	91637	MFF1816G49902F
R676	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816G10002F
R677	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816G10002F
R678	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021

Replaceable Electrical Parts—408

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R682	316-0105-00			RES.,FXD,CMPSN:1M OHM,10%,0.25W	01121	CB1051
R683	315-0105-00	B010100	B151519	RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R683	315-0155-00	B151520		RES.,FXD,CMPSN:1.5M OHM,(NOM VALUE),SEL	01121	CB1555
R684	316-0153-00			RES.,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
R686	316-0395-00			RES.,FXD,CMPSN:3.9M OHM,10%,0.25W	01121	CB3951
R687	315-0754-00	B010100	B149999	RES.,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
R687	315-0434-00	B150000		RES.,FXD,CMPSN:430K OHM,5%,0.25W	01121	CB4345
R692	311-1521-00			RES.,VAR,NONWIR:100K OHM,20%,1W	01121	73A1G0321104M
R693	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R694	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R695	311-1521-00			RES.,VAR,NONWIR:100K OHM,20%,1W	01121	73A1G0321104M
R696	316-0333-00	B010100	B109999	RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R696	131-0566-00	B110000		LINK,TERM,CONN:0.086 DIA X 2.375 INCH L	55210	L-2007-1
R697	316-0104-00	B010100	B149999	RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R697	315-0154-00	B150000		RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R710	302-0100-00			RES.,FXD,CMPSN:10 OHM,10%,0.50W	01121	EB1001
R711	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R712	316-0471-00			RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
R713	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R714	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R715	307-0108-00			RES.,FXD,CMPSN:6.8 OHM,5%,0.25W	80009	307-0108-00
R716	308-0686-00	B010100	B161759	RES.,FXD,WW:2.2 OHM,5%,2W	75042	BWH-2R200J
R716	308-0764-00	B161760		RES.,FXD,WW:2.7 OHM,5%,2W	75042	BWF-2R700J
R716 <sup>1</sup>	308-0459-00			RES.,FXD,WW:1.1 OHM,5%,3W	91637	RS2B-D1R100J
R722	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R723	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R724	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R725	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R726	316-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R727	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R731	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R732	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R733	316-0472-00			RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
R734	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R735	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R736	321-0333-00			RES.,FXD,FILM:28.7K OHM,1%,0.125W	91637	MFF1816G28701F
R737	311-1227-00			RES.,VAR,NONWIR:5K OHM,20%,0.50W	32997	3386F-T04-502
R738	321-0330-00			RES.,FXD,FILM:26.7K OHM,1%,0.125W	91637	MFF1816G26701F
R739	316-0101-00			RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
R743	316-0473-00			RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
R744	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R745	316-0103-00			RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
R746	316-0330-00			RES.,FXD,CMPSN:33 OHM,10%,0.25W	01121	CB3301
R752	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R753	316-0222-00			RES.,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
R754	316-0683-00			RES.,FXD,CMPSN:68K OHM,10%,0.25W	01121	CB6831
R755	316-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
R756	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R762	315-0104-00	B010100	B159999	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R762	315-0273-00	B160000		RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
R763	321-0210-00			RES.,FXD,FILM:1.5K OHM,1%,0.125W	91637	MFF1816G15000F
R764	321-0352-00	B010100	B159999	RES.,FXD,FILM:45.3K OHM,1%,0.125W	91637	MFF1816G45301F
R764	321-0408-00	B160000		RES.,FXD,FILM:174K OHM,1%,0.125W	91637	MFF1816G17402F

<sup>1</sup>Option 3 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R766	321-0393-00			RES.,FXD,FILM:121K OHM,1%,0.125W	91637	MPF1816G12102F
R767	321-0352-00			RES.,FXD,FILM:45.3K OHM,1%,0.125W	91637	MPF1816G45301F
R802	316-0683-00			RES.,FXD,CMPSN:68K OHM,10%,0.25W	01121	CB6831
R803	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R804	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R805	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R806	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R807	316-0225-00			RES.,FXD,CMPSN:2.2M OHM,10%,0.25W	01121	CB2251
R811	316-0392-00			RES.,FXD,CMPSN:3.9K OHM,10%,0.25W	01121	CB3921
R812	316-0102-00			RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
R817	307-0114-00			RES.,FXD,CMPSN:6.2 OHM,5%,0.25W	01121	CB62G5
R828	307-0114-00			RES.,FXD,CMPSN:6.2 OHM,5%,0.25W	01121	CB62G5
R841	311-1255-00			RES.,VAR, NONWIR:2M OHM,20%,0.50W	32997	3386F-T04-205
R842	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R843	316-0104-00			RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
R844	316-0825-00			RES.,FXD,CMPSN:8.2M OHM,10%,0.25W	01121	CB8251
S110	260-1545-00	B010100	B162406	SWITCH,PUSH:ECG	80009	260-1545-00
S110	260-1545-01	B162407		SWITCH,PUSH:ECG	80009	260-1545-01
S505 <sup>1</sup>						
S547	260-1530-00	B010100	B162406	SWITCH,PUSH:RESET	80009	260-1530-00
S547	260-1530-01	B162407		SWITCH,PUSH:RESET	80009	260-1530-01
S661	260-1572-00	B010100	B162406	SWITCH,PUSH:	80009	260-1572-00
S661	260-1572-01	B162407		SWITCH,PUSH:	80009	260-1572-01
S701	260-1300-01			SWITCH,SLIDE:DPDT,3A,125V	82389	11A-1354
S703	260-1486-00			SWITCH,PUSH:	80009	260-1486-00
T155	120-0867-00	B010100	B059999	XFMR:SIGNAL POT CORE	80009	120-0867-00
T155	120-0947-00	B060000		XFMR:SIGNAL POT CORE	80009	120-0947-00
T701	120-0866-00	B010100	B079999	XFMR:POWER	80009	120-0866-00
T701	120-0866-01	B080000		XFMR,PWR,STPDN:	80009	120-0866-01
T801	120-0868-00			XFMR:INVERTER POT CORE	80009	120-0868-00
U120	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U174	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U182	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U204	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U216	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U324	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U336	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U356	156-0350-00	B010100	B119999X	MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	02735	CD4011AE
U388	156-0402-00	XB120000		MICROCIRCUIT,DI:TIMER	18324	NE555V
U504	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U518	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U522	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U524	156-0349-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0349-00
U538	156-0349-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0349-00
U542	156-0350-00			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	02735	CD4011AE
U592	156-0067-00			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-00
U628	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U652	156-0349-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0349-00
U656	156-0349-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0349-00
U662	156-0349-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0349-00
U664	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
U668	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00

<sup>1</sup>Furnished as a unit with R505.

# Replaceable Electrical Parts—408

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U686	156-0349-00			MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE	80009	156-0349-00
U764	156-0158-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-00
V840	154-0508-01			ELECTRON TUBE:CRT,RECT,ALUMINIZED SCREEN	80009	154-0508-01
VR120	152-0195-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0195-00
VR122	152-0195-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0195-00
VR235	152-0175-00	B010100	B119999	SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	80009	152-0175-00
VR235	152-0175-01	B120000		SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	80009	152-0175-01
VR238	152-0175-00	B010100	B119999	SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	80009	152-0175-00
VR238	152-0175-01	B120000		SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	80009	152-0175-01
VR334	152-0195-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0195-00
VR733	152-0166-00			SEMICONV DEVICE:ZENER,0.4W,6.2V,5%	81483	69-9035

# 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 ( $\mu$ F).
- Resistors = Ohms ( $\Omega$ ).

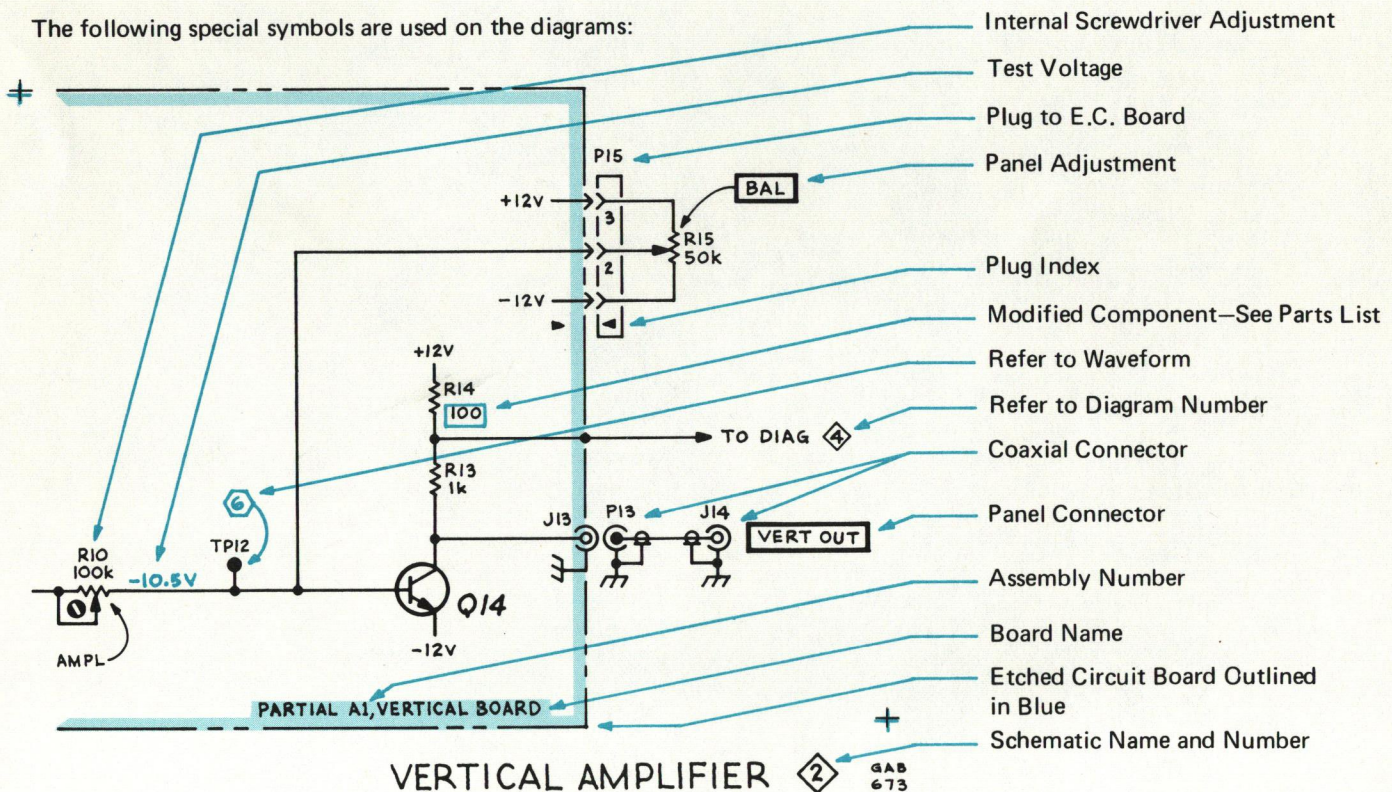
Symbols used on the diagrams are based on USA Standard Y32.2-1967.

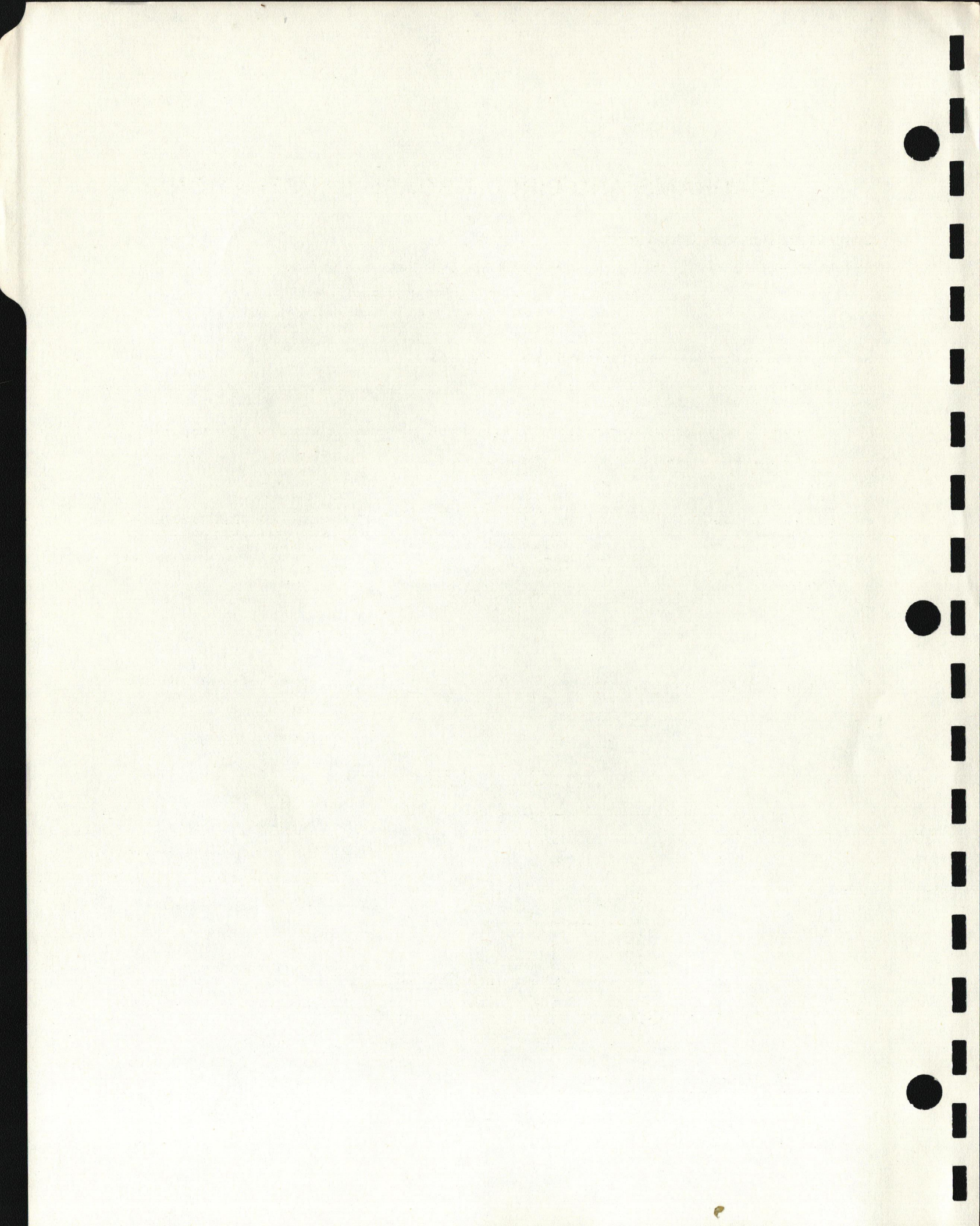
Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

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

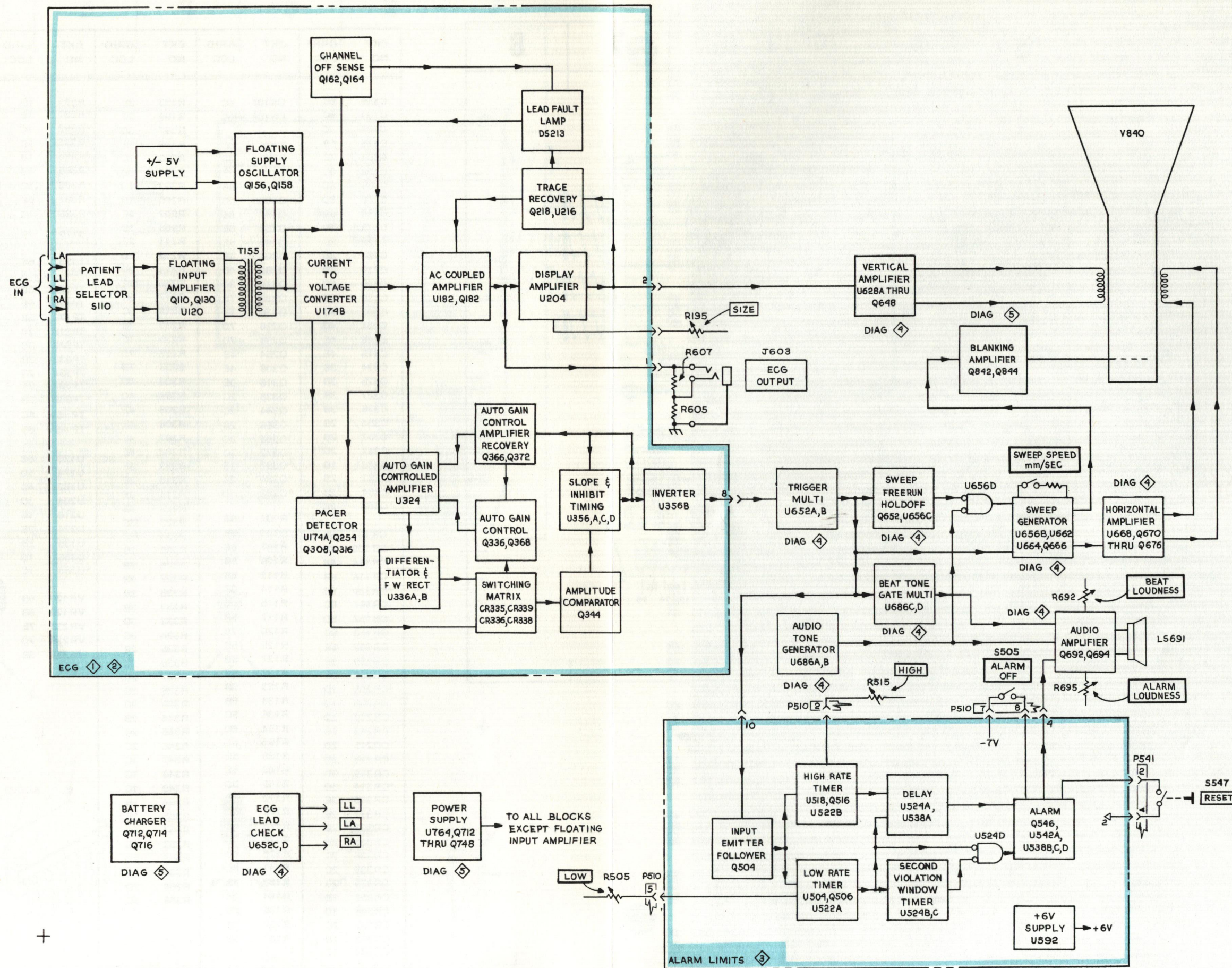
A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	RT	Thermistor
AT	Attenuator, fixed or variable	HR	Heater	S	Switch
B	Motor	HY	Hybrid circuit	T	Transformer
BT	Battery	J	Connector, stationary portion	TC	Thermocouple
C	Capacitor, fixed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

The following special symbols are used on the diagrams:



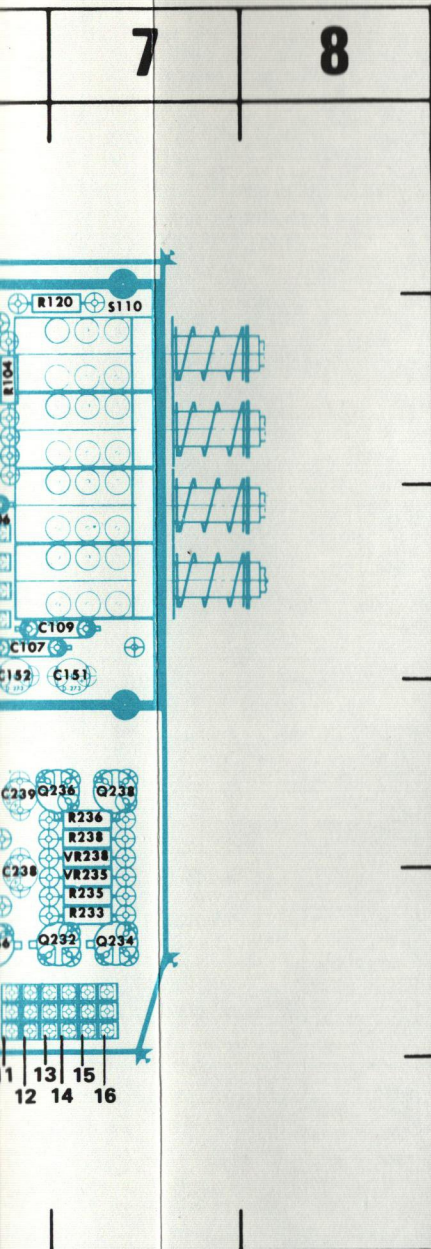






BLOCK DIAGRAM





CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C105	6C	DS107	6C	R193	3E	R373	1D
C107	6C	DS109	6C	R196	3E	*R381	1B
C109	7C			R197	3D	*R382	1C
C125	5B	P106	6C	R199	3E	*R383	1C
C151	7C	P200	3D	R200	3E	*R384	1B
C152	6C	*P210	3E	R201	3D	*R385	1B
C155	6D	Q110	5B	R203	1D	*R386	1C
C156	6D	Q130	5B	R205	1D	*R387	2E
C158	6D	Q156	6E	R207	2E	*R388	1C
C178	3D	Q158	6E	R208	1D	S110	7B
C179	3C	Q162	5E	R211	2E	T155	5E
C181	3D	Q164	4E	R212	2D		
C212	2D	Q182	4C	R213	2D		
C238	6D	Q218	3D	R215	2E	TP136	5B
C239	6D	Q232	7E	R217	3C	TP170	5E
C303	4D	Q234	7E	R219	3C	TP178	3B
C304	4D	Q236	7D	R223	7E	TP318	2B
C308	4E	Q238	7D	R235	7E	TP322	3B
C315	4E	Q254	4E	R236	7D	TP333	3B
C324	3B	Q308	4E	R238	7D	TP354	2B
C325	3B	Q316	3E	R303	4D	*TP382	3E
C327	3B	Q336	2C	R304	4D	*TP388	2B
C328	3B	Q344	2C	R305	4E	TP +5V	4C
C354	2B	Q366	2D	R306	4E	TP -5V	3C
C357	2B	Q368	2C	R307	4E		
C367	2C	Q372	3C	R308	4E	U120	5B
C373	1D	*Q382	1B	R313	3E	U174	5D
*C382	2B	*Q384	2B	R315	3E	U182	4C
*C384	2B	*Q386	1D	R318	3E	U204	3D
*C388	2C			R322	3B	U216	1E
		R102	6B	R323	3C	U324	3B
CR107	6B	R104	6B	R324	3C	U336	2B
CR109	6B	R107	6B	R325	3C	U356	1B
CR114	6B	R108	5B	R326	3B	*U388	1C
CR116	6B	R112	6B	R327	3B		
*CR130	5B	R114	6B	R328	3B	VR120	6B
CR151	6C	R115	5B	R332	3B	VR122	6B
CR152	5D	R117	5B	R333	3B	VR235	7E
CR162	5E	R120	7B	R334	3C	VR238	7D
CR199	3E	R125	5B	R335	2B	VR334	3B
CR200	3E	R127	5B	R336	2C		
CR205	1D	R130	5B	R337	2C		
CR208	1D	R136	5B	R338	2C		
CR212	2D	R138	5C	R339	2C		
CR213	2D	R154	6D	R344	2B		
CR215	2D	R155	6E	R345	2C		
CR216	2D	R160	5E	R346	2C		
CR313	3D	R162	5E	R347	1C		
*CR314	3D	R165	5D	R348	1C		
CR315	3E	R170	4D	R349	1C		
CR332	2B	R172	5E	R354	1B		
CR333	2B	R175	4E	R355	1B		
CR335	2B	R178	3D	R357	2B		
CR336	2C	R179	4C	R358	1B		
CR338	2C	R181	4C	R364	2D		
CR339	2B	R183	4B	R365	1D		
CR354	1B	R184	3B	R366	2D		
CR366	1D	R185	4B	R368	3C		
CR367	2C	R186	4B				
CR373	1D	R187	3B				
*CR384	1B						
DS105	6C						

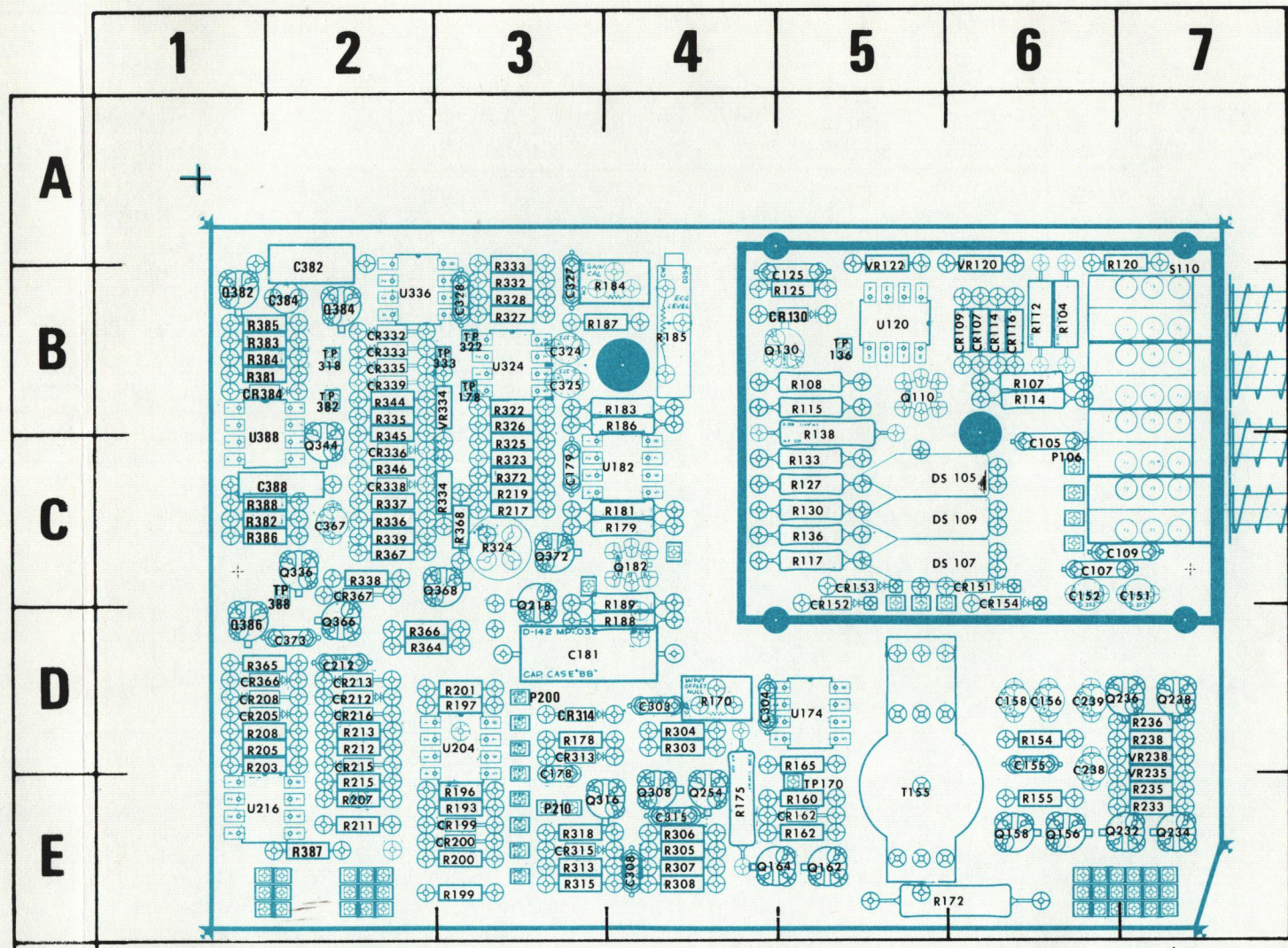


Fig. 7-1A. A1-ECG circuit board (SN B120926 & BELOW).

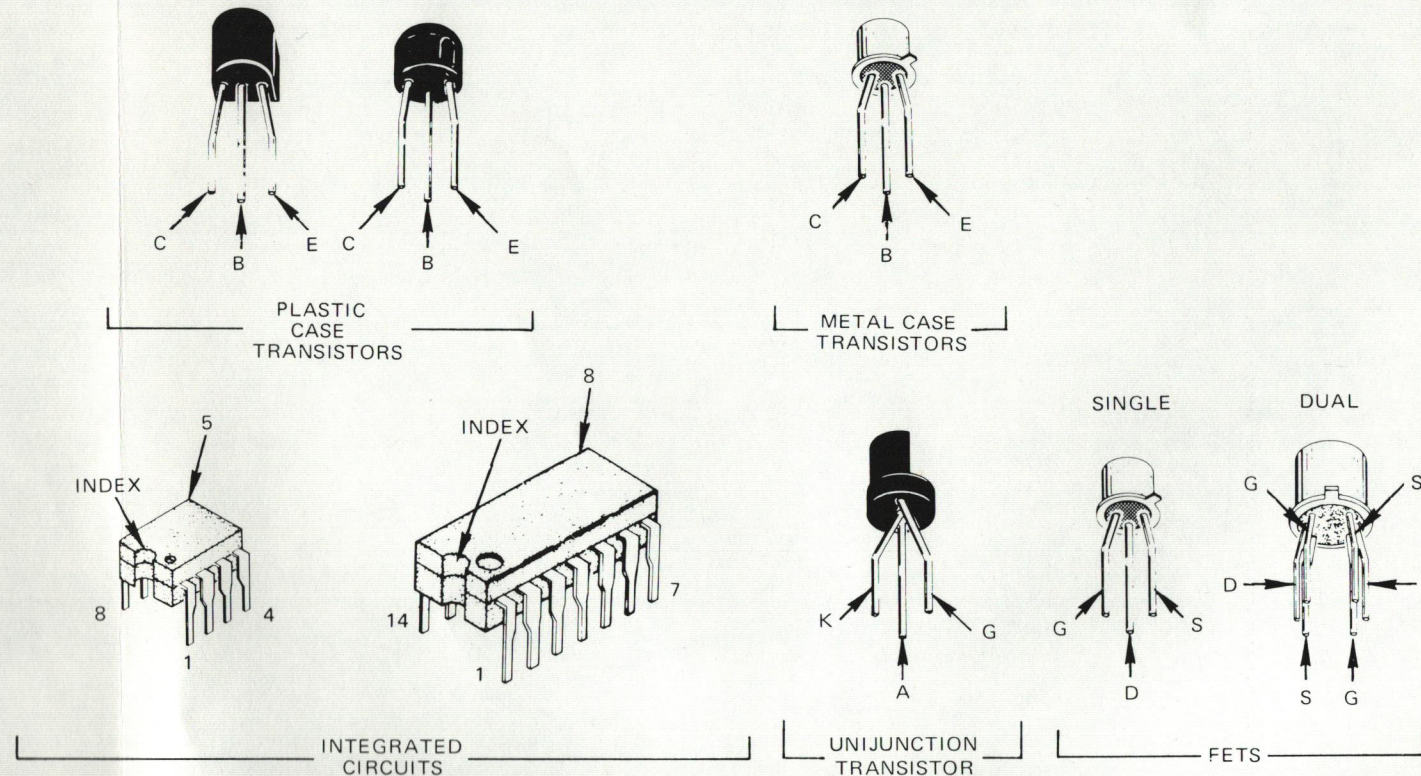


Fig. 7-2. Semiconductor lead configurations.

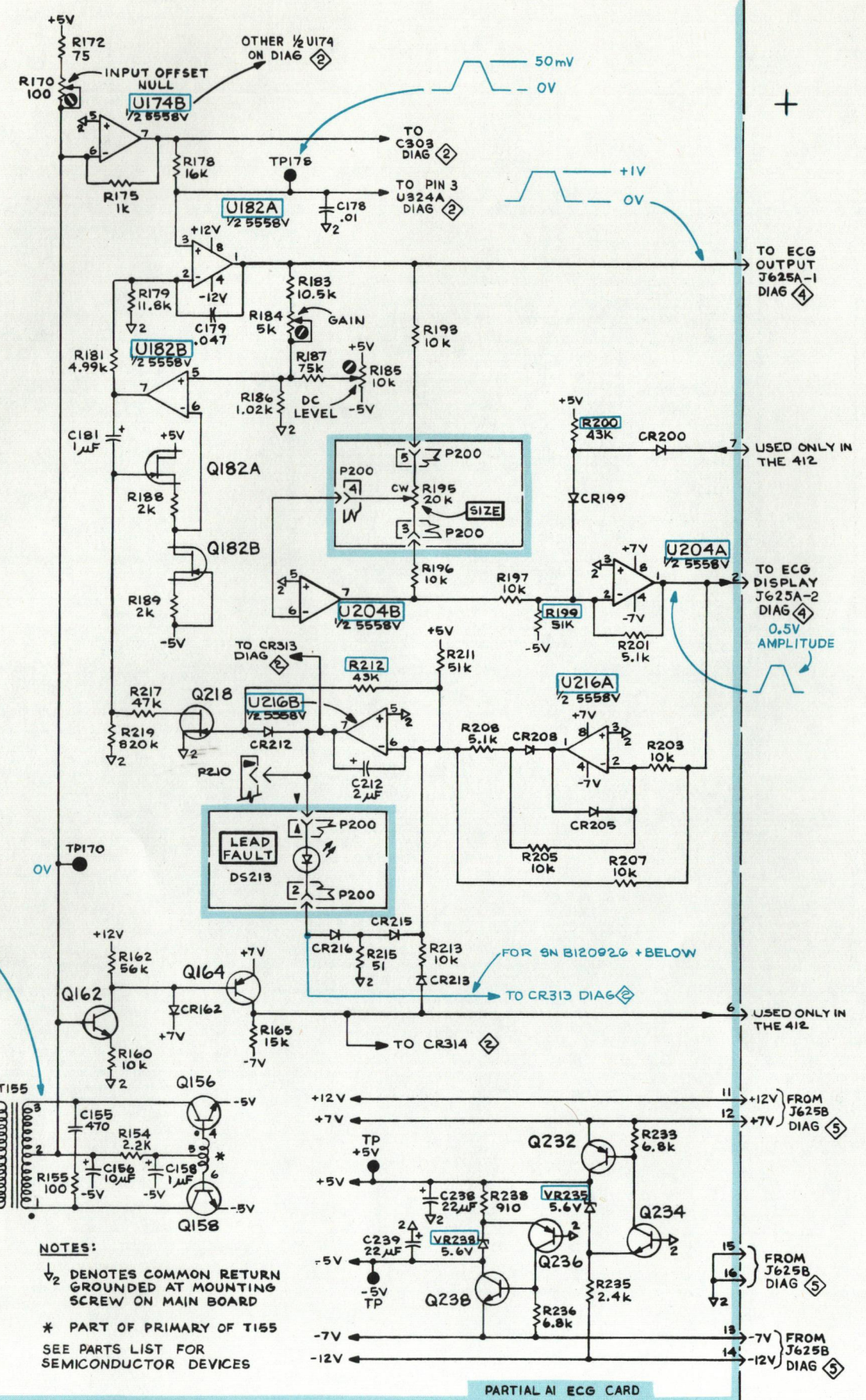
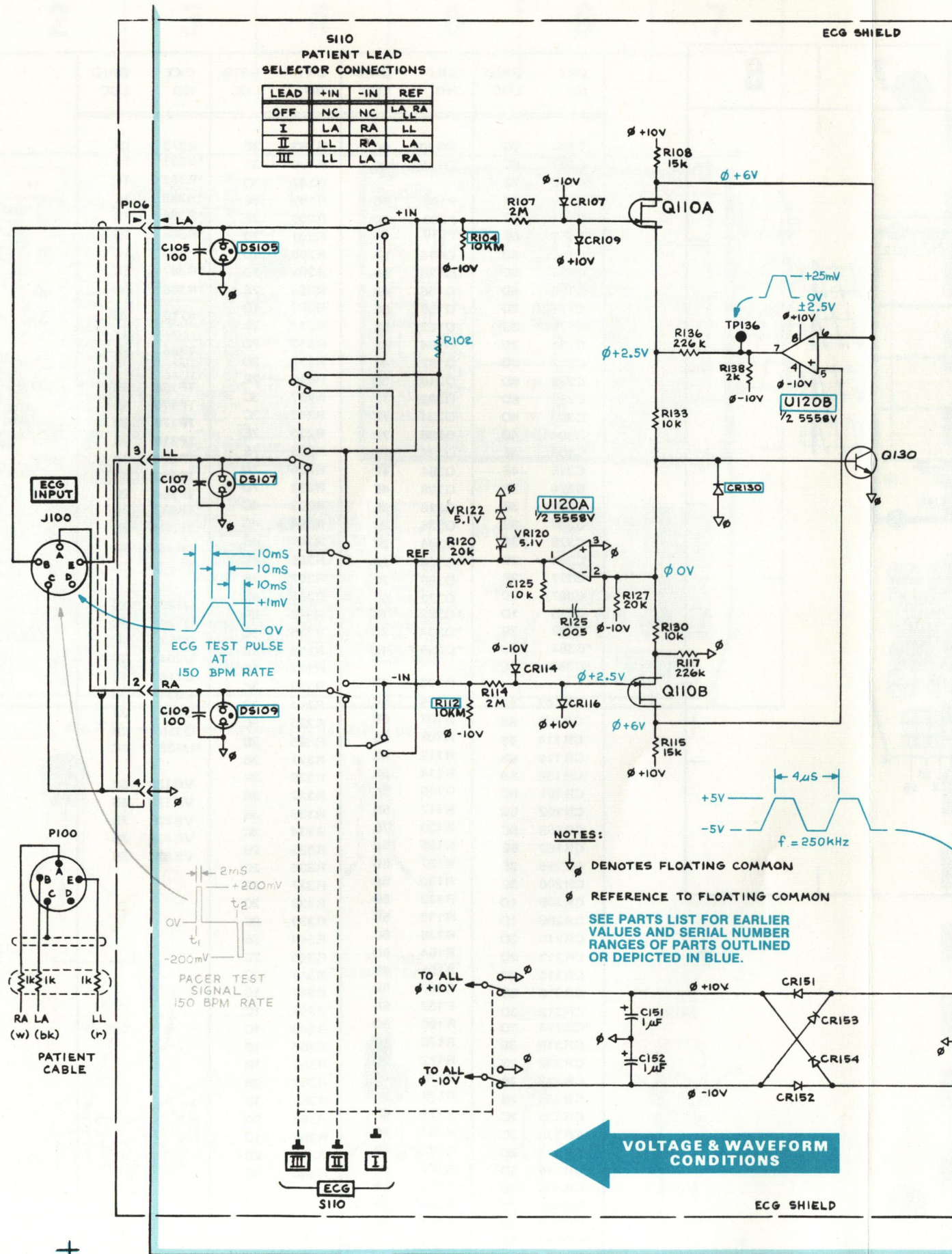
## ECG CHANNEL VOLTAGE AND WAVEFORM CONDITIONS

DC voltages are design center values and may vary from measured values. Voltages are referenced to chassis ground at the mounting screw on the main board unless noted otherwise.

Waveforms shown are idealized and may vary from test-oscilloscope waveforms.

### 408 SETTINGS AND INPUTS

ECG	Lead II
SIZE	Mid-Range (20 mm/mV)
ECG INPUT	(a) 1 mV, 150 bpm ECG Test Pulse applied between LL (pin E) and RA (pin A)
	(b) Pin A shorted to pin B.
	(c) For Pacer test, substitute Pacer Test Pulse for ECG Test Pulse; Resultant waveforms are shown in gray.



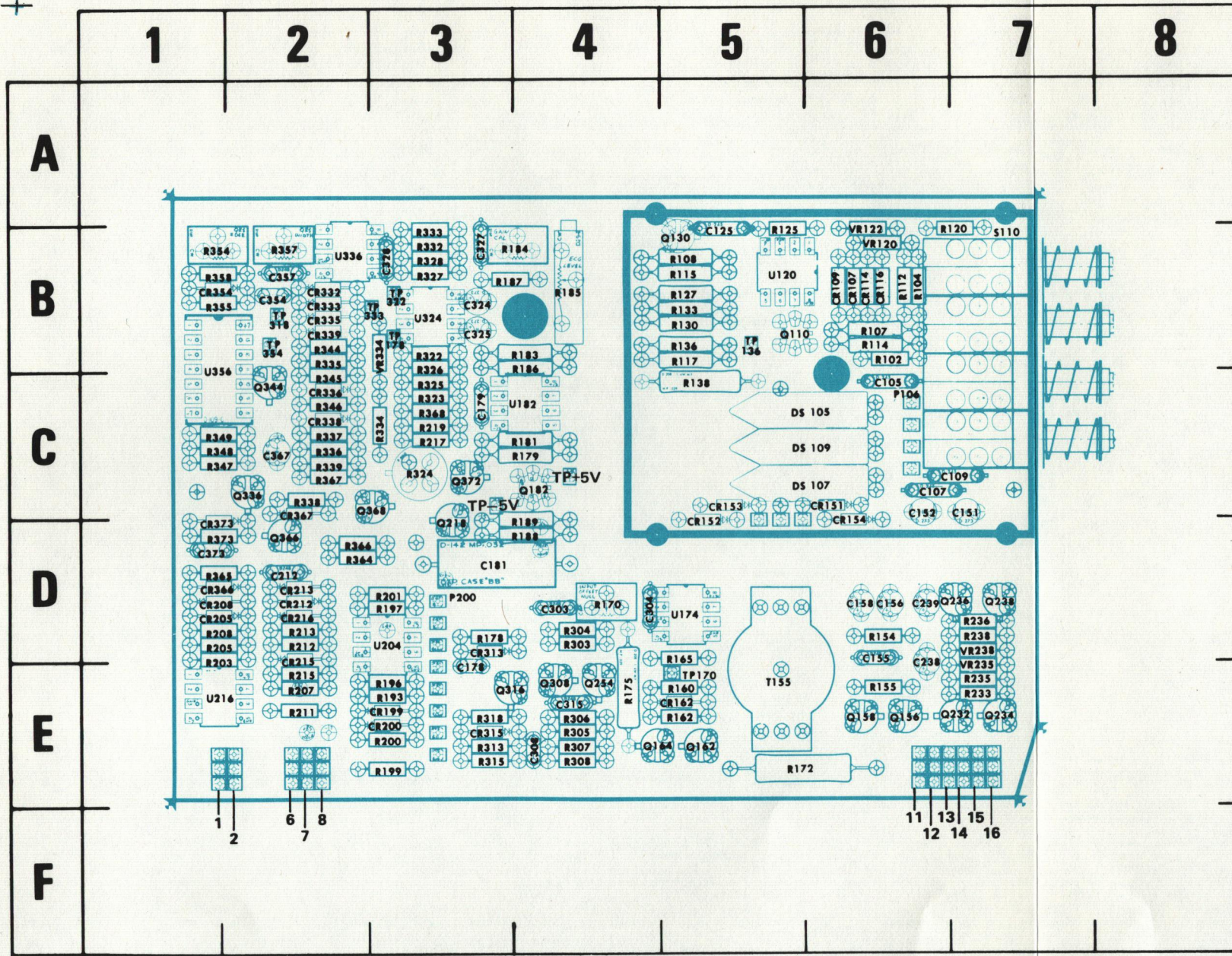
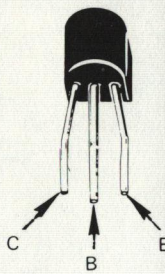
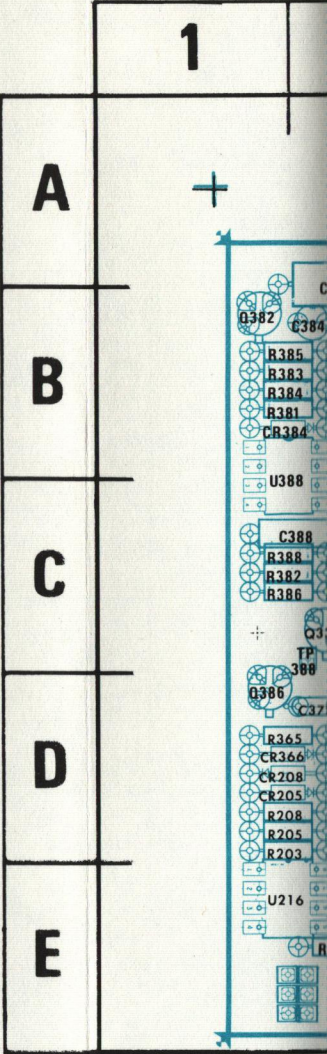


Fig. 7-3. A1—ECG circuit board (SN B120927 & UP).

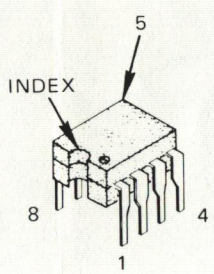


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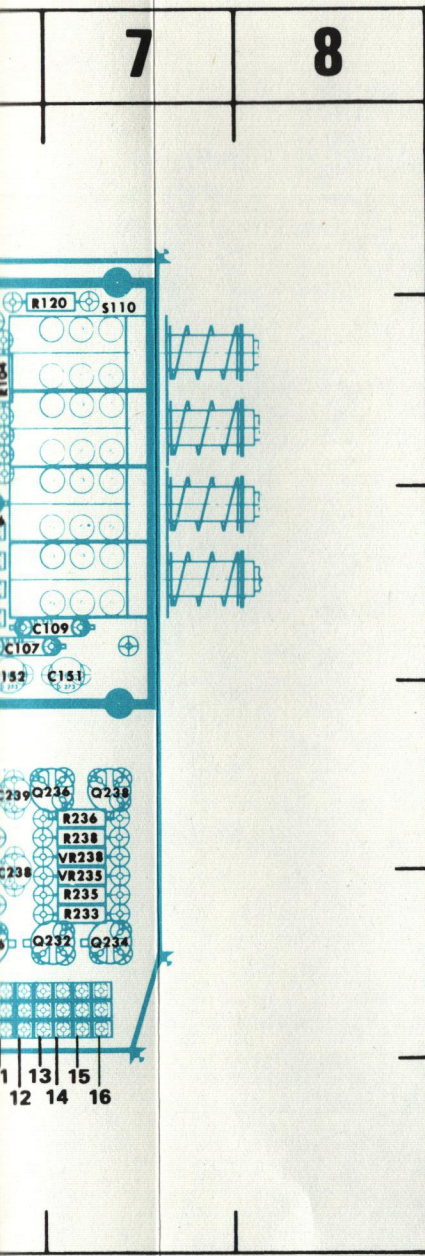
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C105	6C	DS107	6C	R193	3E	R373	1D
C107	6C	DS109	6C	R196	3E	*R381	1B
C109	7C			R197	3D	*R382	1C
C125	5B	P106	6C	R199	3E	*R383	1C
C151	7C	P200	3D	R200	3E	*R384	1B
C152	6C	*P210	3E	R201	3D	*R385	1B
C155	6D	Q110	5B	R203	1D	*R386	1C
C156	6D	Q130	5B	R205	1D	*R387	2E
C158	6D	Q156	6E	R207	2E	*R388	1C
C178	3D	Q158	6E	R208	1D		
C179	3C	Q162	5E	R211	2E	S110	7B
C181	3D	Q164	4E	R212	2D	T155	5E
C212	2D	Q182	4C	R213	2D		
C238	6D	Q218	3D	R215	2E	TP136	5B
C239	6D	Q232	7E	R217	3C	TP170	5E
C303	4D	Q234	7E	R219	3C	TP178	3B
C304	4D	Q236	7D	R233	7E	TP318	2B
C308	4E	Q238	7D	R235	7E	TP322	3B
C315	4E	Q254	4E	R236	7D	TP333	3B
C324	3B	Q308	4E	R238	7D	TP354	2B
C325	3B	Q316	3E	R303	4D	*TP382	3E
C327	3B	Q336	2C	R304	4D	*TP388	2B
C328	3B	Q344	2C	R305	4E	TP +5V	4C
C354	2B	Q366	2D	R306	4E	TP -5V	3C
C357	2B	Q368	2C	R307	4E		
C367	2C	Q372	3C	R308	4E	U120	5B
C373	1D	*Q382	1B	R313	3E	U174	5D
*C382	2B	*Q384	2B	R315	3E	U182	4C
*C384	2B	*Q386	1D	R318	3E	U204	3D
*C388	2C			R322	3B	U216	1E
		R102	6B	R323	3C	U324	3B
CR107	6B	R104	6B	R324	3C	U336	2B
CR109	6B	R107	6B	R325	3C	U356	1B
CR114	6B	R108	5B	R326	3B	*U388	1C
CR116	6B	R112	6B	R327	3B		
*CR130	5B	R114	6B	R328	3B	VR120	6B
CR151	6C	R115	5B	R332	3B	VR122	6B
CR152	5D	R117	5B	R333	3B	VR235	7E
CR153	5C	R120	7B	R334	3C	VR238	7D
CR162	5E	R125	5B	R335	2B	VR334	3B
CR199	3E	R127	5B	R336	2C		
CR200	3E	R130	5B	R337	2C		
CR205	1D	R133	5B	R338	2C		
CR208	1D	R136	5B	R339	2C		
CR212	2D	R138	5C	R344	2B		
CR213	2D	R154	6D	R345	2C		
CR215	2D	R155	6E	R346	2C		
CR216	2D	R160	5E	R347	1C		
CR313	3D	R162	5E	R348	1C		
*CR314	3D	R165	5D	R349	1C		
CR315	3E	R170	4D	R354	1B		
CR332	2B	R172	5E	R355	1B		
CR333	2B	R175	4E	R357	2B		
CR335	2B	R178	3D	R358	1B		
CR336	2C	R179	4C	R364	2D		
CR338	2C	R181	4C	R365	1D		
CR339	2B	R183	4B	R366	2D		
CR354	1B	R184	3B	R368	3C		
CR366	1D	R185	4B				
CR367	2C	R186	4B				
CR373	1D	R187	3B				
*CR384	1B						
DS105	6C						



PLASTIC CASE TRANSISTOR



INT...  
CI...



CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C105	6C	DS107	6C	R193	3E	R373	1D
C107	6C	DS109	6C	R196	3E	*R381	1B
C109	7C			R197	3D	*R382	1C
C125	5B	P106	6C	R199	3E	*R383	1C
C151	7C	P200	3D	R200	3E	*R384	1B
C152	6C	*P210	3E	R201	3D	*R385	1B
C155	6D	Q110	5B	R203	1D	*R386	1C
C156	6D	Q130	5B	R205	1D	*R387	2E
C158	6D	Q156	6E	R207	2E	*R388	1C
C178	3D	Q158	6E	R208	1D		
C179	3C	Q162	5E	R211	2E	S110	7B
C181	3D	Q164	4E	R212	2D	T155	5E
C212	2D	Q182	4C	R213	2D		
C238	6D	Q218	3D	R215	2E	TP136	5B
C239	6D	Q232	7E	R217	3C	TP170	5E
C303	4D	Q234	7E	R219	3C	TP178	3B
C304	4D	Q236	7D	R233	7E	TP318	2B
C308	4E	Q238	7D	R235	7E	TP322	3B
C315	4E	Q254	4E	R236	7D	TP333	3B
C324	3B	Q308	4E	R238	7D	TP354	2B
C325	3B	Q316	3E	R303	4D	*TP382	3E
C327	3B	Q336	2C	R304	4D	*TP388	2B
C328	3B	Q344	2C	R305	4E	TP +5V	4C
C354	2B	Q366	2D	R306	4E	TP -5V	3C
C357	2B	Q368	2C	R307	4E		
C367	2C	Q372	3C	R308	4E	U120	5B
C373	1D	*Q382	1B	R313	3E	U174	5D
*C382	2B	*Q384	2B	R315	3E	U182	4C
*C384	2B	*Q386	1D	R318	3E	U204	3D
*C388	2C			R322	3B	U216	1E
		R102	6B	R323	3C	U324	3B
CR107	6B	R104	6B	R324	3C	U336	2B
CR109	6B	R107	6B	R325	3C	U356	1B
CR114	6B	R108	5B	R326	3B	*U388	1C
CR116	6B	R112	6B	R327	3B		
*CR130	5B	R114	6B	R328	3B	VR120	6B
CR151	6C	R115	5B	R332	3B	VR122	6B
CR152	5D	R117	5B	R333	3B	VR235	7E
CR153	5C	R120	7B	R334	3C	VR238	7D
CR162	5E	R125	5B	R335	2B	VR334	3B
CR199	3E	R127	5B	R336	2C		
CR200	3E	R130	5B	R337	2C		
CR205	1D	R133	5B	R338	2C		
CR208	1D	R136	5B	R339	2C		
CR212	2D	R138	5C	R344	2B		
CR213	2D	R154	6D	R345	2C		
CR215	2D	R155	6E	R346	2C		
CR216	2D	R160	5E	R347	1C		
CR313	3D	R162	5E	R348	1C		
*CR314	3D	R165	5D	R349	1C		
CR315	3E	R170	4D	R354	1B		
CR332	2B	R172	5E	R355	1B		
CR333	2B	R175	4E	R357	2B		
CR335	2B	R178	3D	R358	1B		
CR336	2C	R179	4C	R364	2D		
CR338	2C	R181	4C	R365	1D		
CR339	2B	R183	4B	R366	2D		
CR354	1B	R184	3B	R368	3C		
CR366	1D	R185	4B				
CR367	2C	R186	4B				
CR373	1D	R187	3B				
*CR384	1B						
DS105	6C						

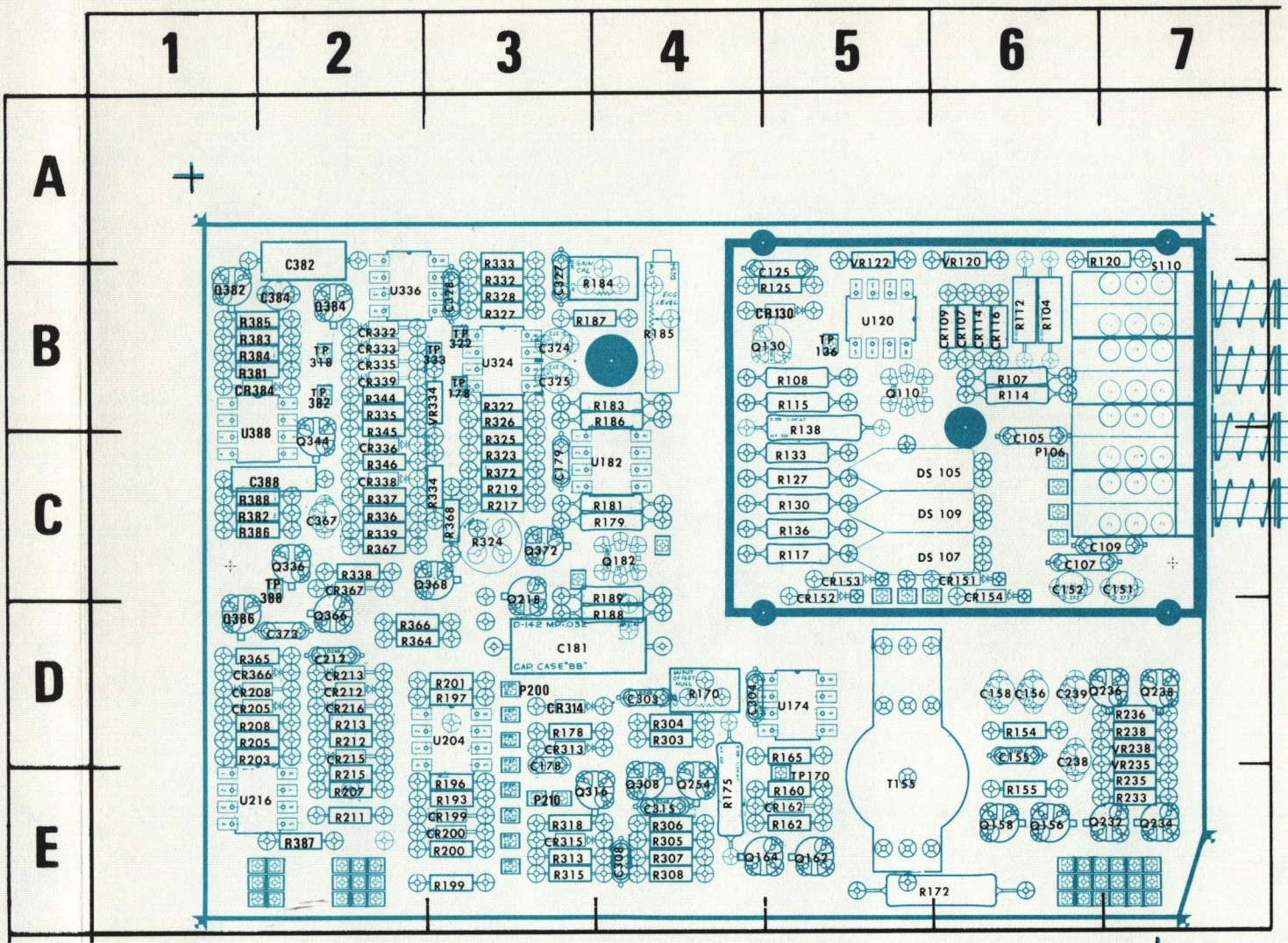


Fig. 7-3A. A1-ECG circuit board (SN B120926 & BELOW).

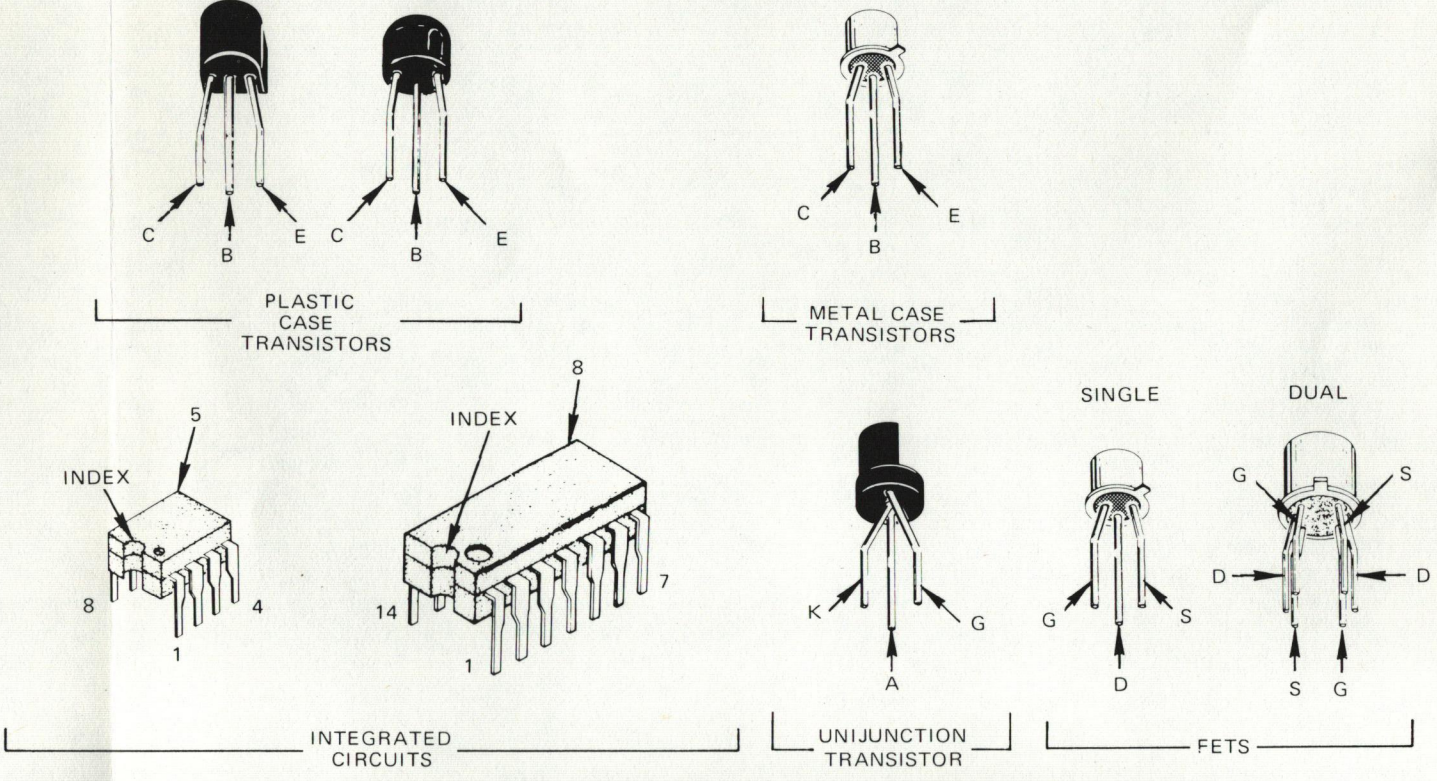


Fig. 7-4. Semiconductor Lead configurations.

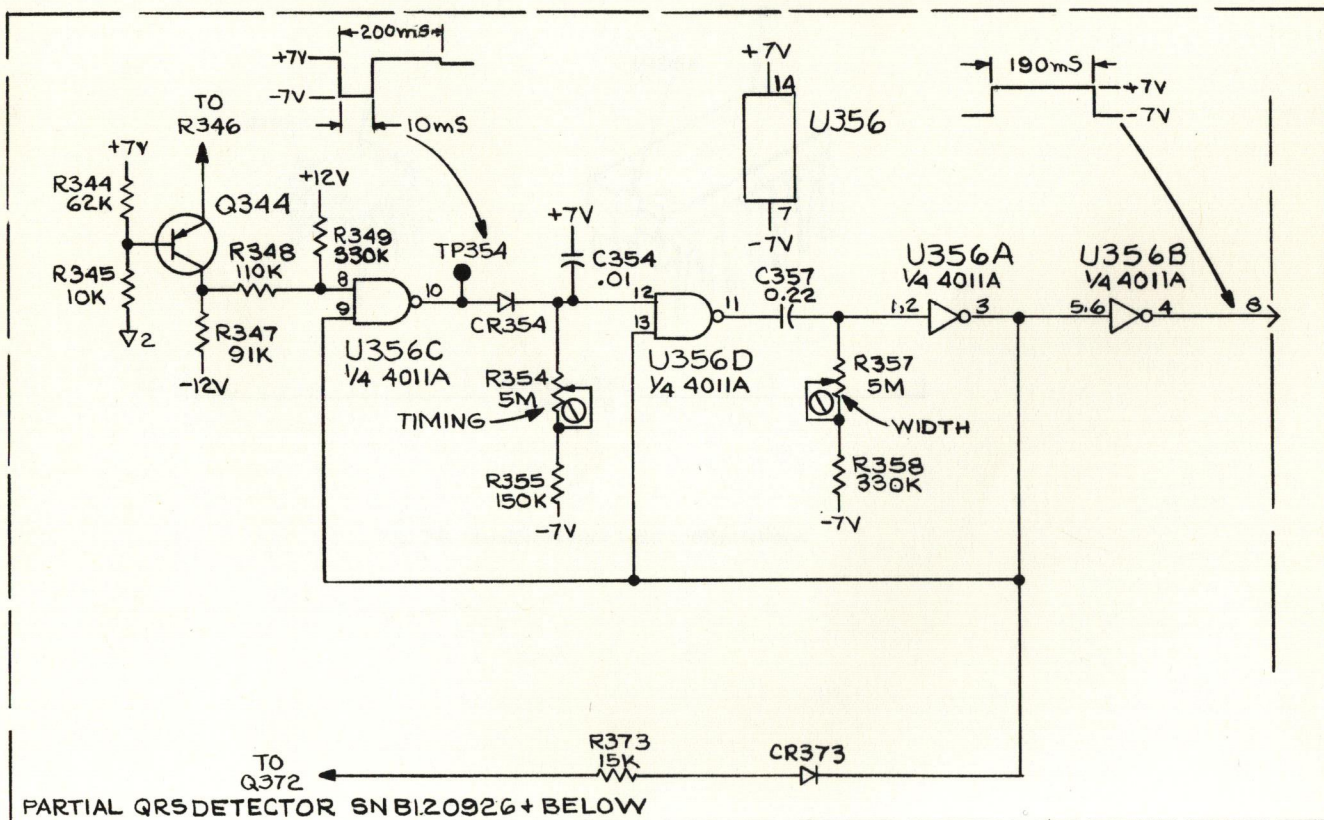
### ECG CHANNEL VOLTAGE AND WAVEFORM CONDITIONS

DC voltages are design center values and may vary from measured values. Voltages are referenced to chassis ground at the mounting screw on the main board unless noted otherwise.

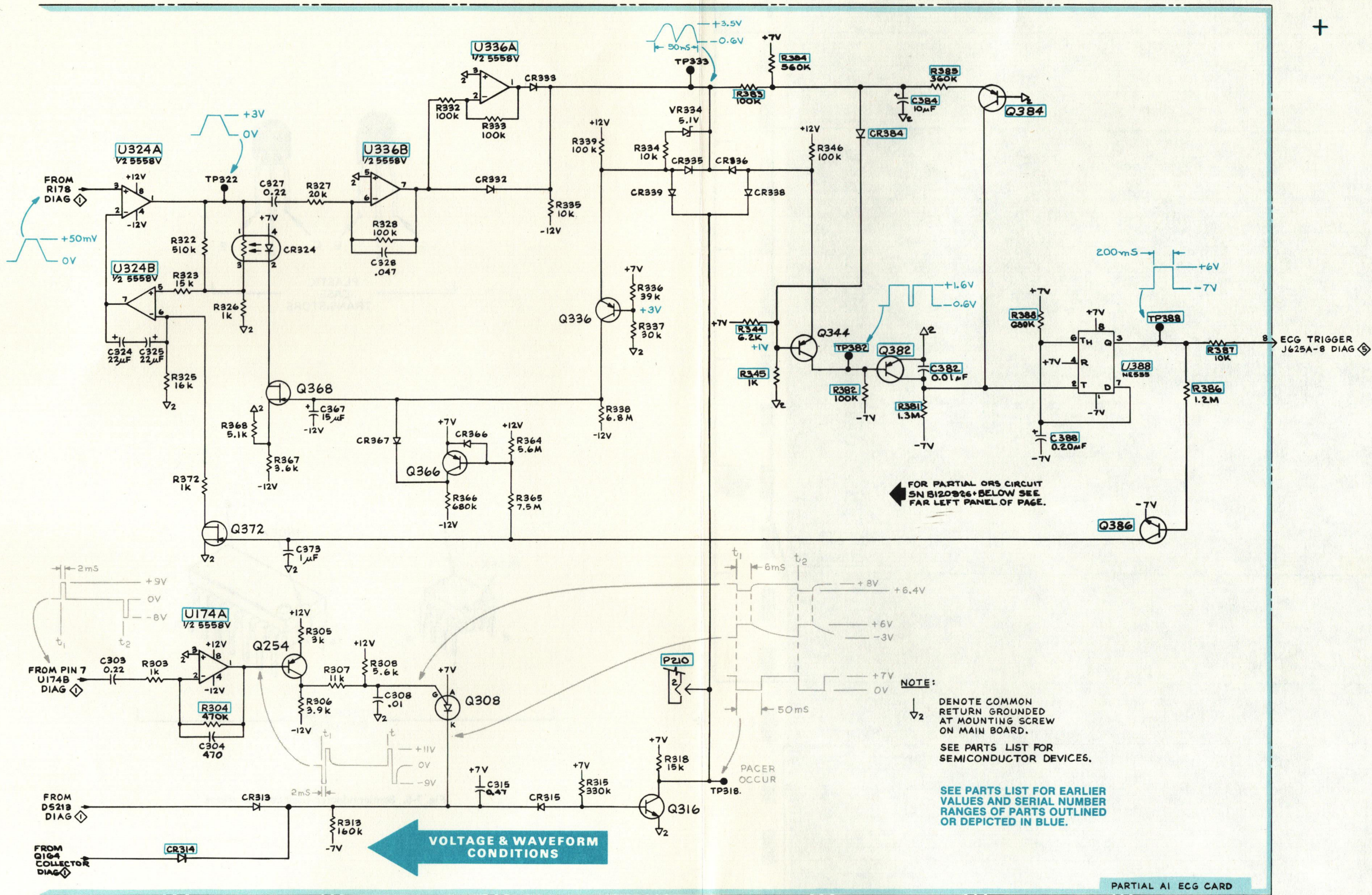
Waveforms shown are idealized and may vary from test-oscilloscope waveforms.

#### 408 SETTINGS AND INPUTS

ECG	Lead II
SIZE	Mid-Range (20 mm/mV)
ECG INPUT	(a) 1 mV, 150 bpm ECG Test Pulse applied between LL (pin E) and RA (pin A)
	(b) Pin A shorted to pin B.
	(c) For Pacer test, substitute Pacer Test Pulse for ECG Test Pulse; Resultant waveforms are shown in gray.







FOR PARTIAL ORS CIRCUIT SN 8120926 BELOW SEE FAR LEFT PANEL OF PAGE.

NOTE:  
 ↓ DENOTE COMMON RETURN GROUNDED AT MOUNTING SCREW ON MAIN BOARD.  
 SEE PARTS LIST FOR SEMICONDUCTOR DEVICES.

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

VOLTAGE & WAVEFORM CONDITIONS

PARTIAL AI ECG CARD

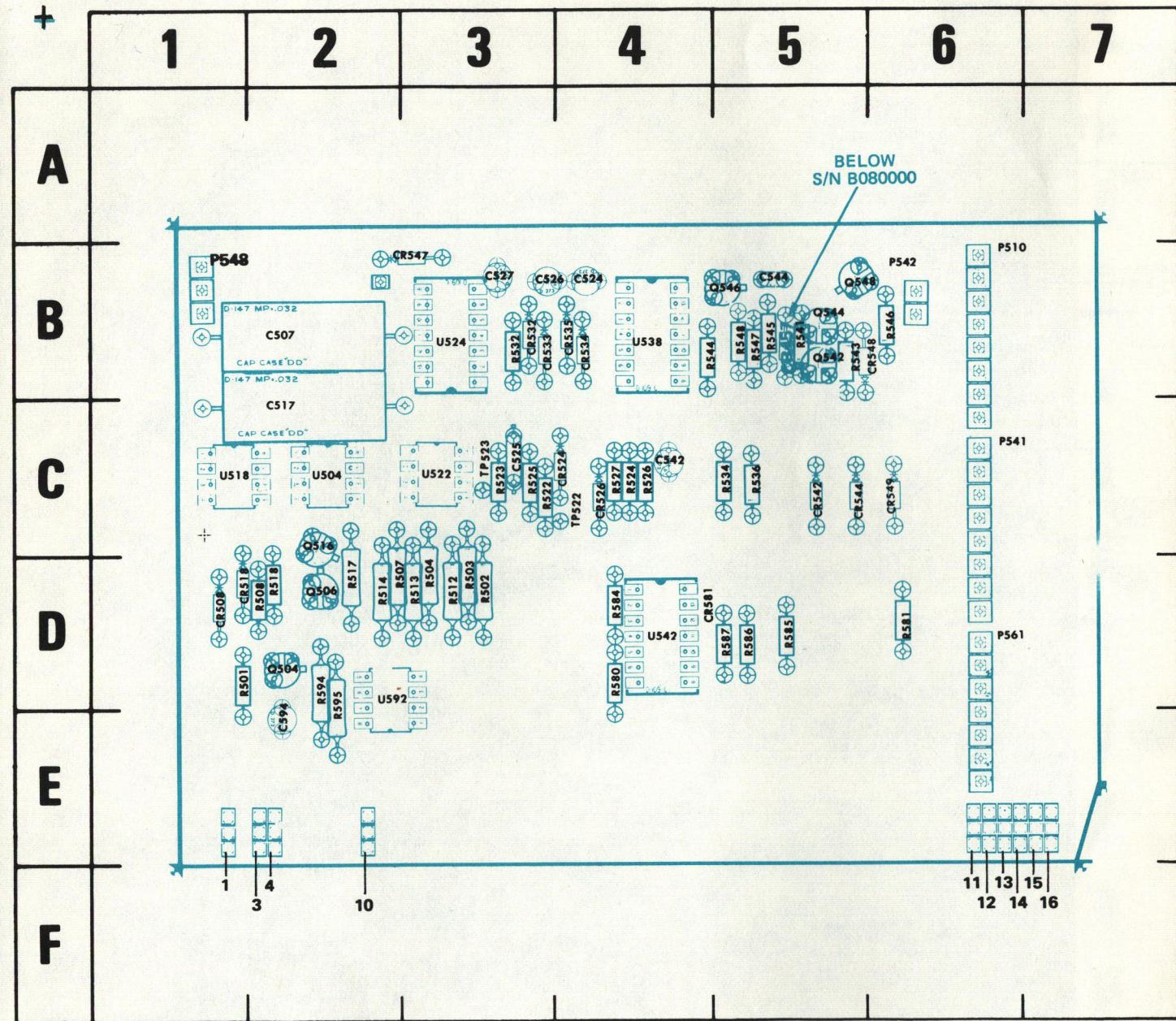


Fig. 7-5. A2-Alarm Limits circuit board.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C507	2B	CR524	3C	P541	6C	R502	3D	R526	4C	R584	4D
C517	2C	CR526	4C	P548	1B	R503	3D	R527	4C	R585	5D
C524	4B	CR532	3B	P561	6D	R504	3D	R532	3B	R586	5D
C525	3C	CR533	3B			R507	2D	R534	4C	R587	4D
C526	3B	CR534	4B	Q504	2B	R508	1D	R536	5C	R594	2D
C527	3B	CR535	3B	Q506	2D	R512	3D	R543	6B	R595	2D
C542	5C	CR542	5C	Q516	2C	R513	2D	R544	4B	TP522	4C
C544	5B	CR544	5C	Q540	5B	R514	2D	R545	5B	TP523	3C
C579	5D	CR547	5B	Q542	5B	R517	2D	R547	5B	U504	2C
C583	5D	*CR547	3B	Q544	5B	R518	2D	R548	5B	U518	1C
C594	2E	CR548	5B	Q546	4B	R522	3C	R579	4D	U522	3C
		CR549	6C	Q548	5B	R523	3C	R580	4D	U524	3B
CR508	1D					R524	4C	R581	6D	U538	4B
CR518	1D	P510	6B	R501	1D	R525	3C	R583	5D	U542	4D
										U592	2D

\*BELOW S/N B080000

MORE

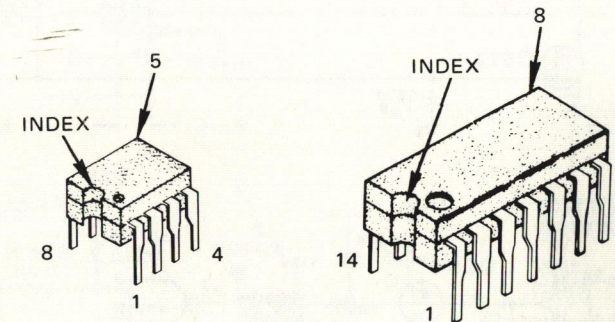
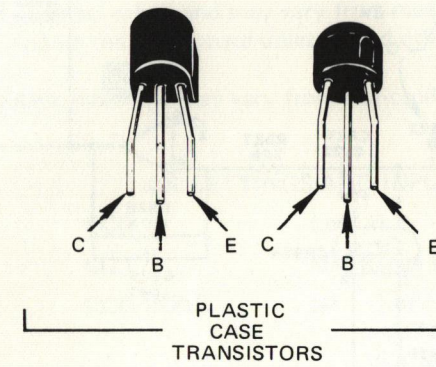


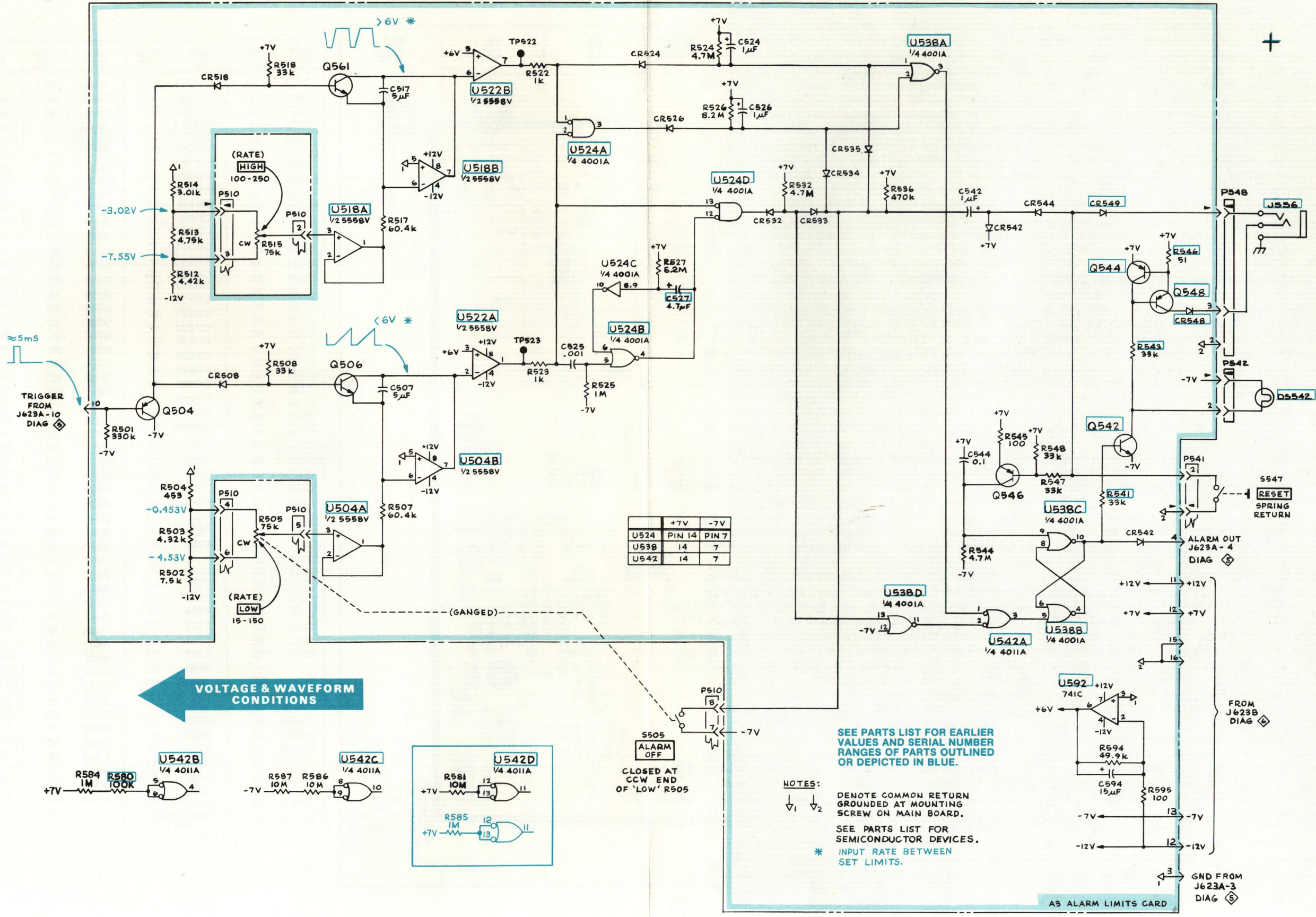
Fig. 7-6. Semiconductor Lead configurations.

### VOLTAGE AND WAVEFORM CONDITIONS

Voltages are design center values and may vary from measured values. Voltages are referenced to chassis ground at the mounting screw on the main board unless noted otherwise.

Waveforms shown are idealized and may vary from test-oscilloscope waveforms.

See circuit description for truth table.



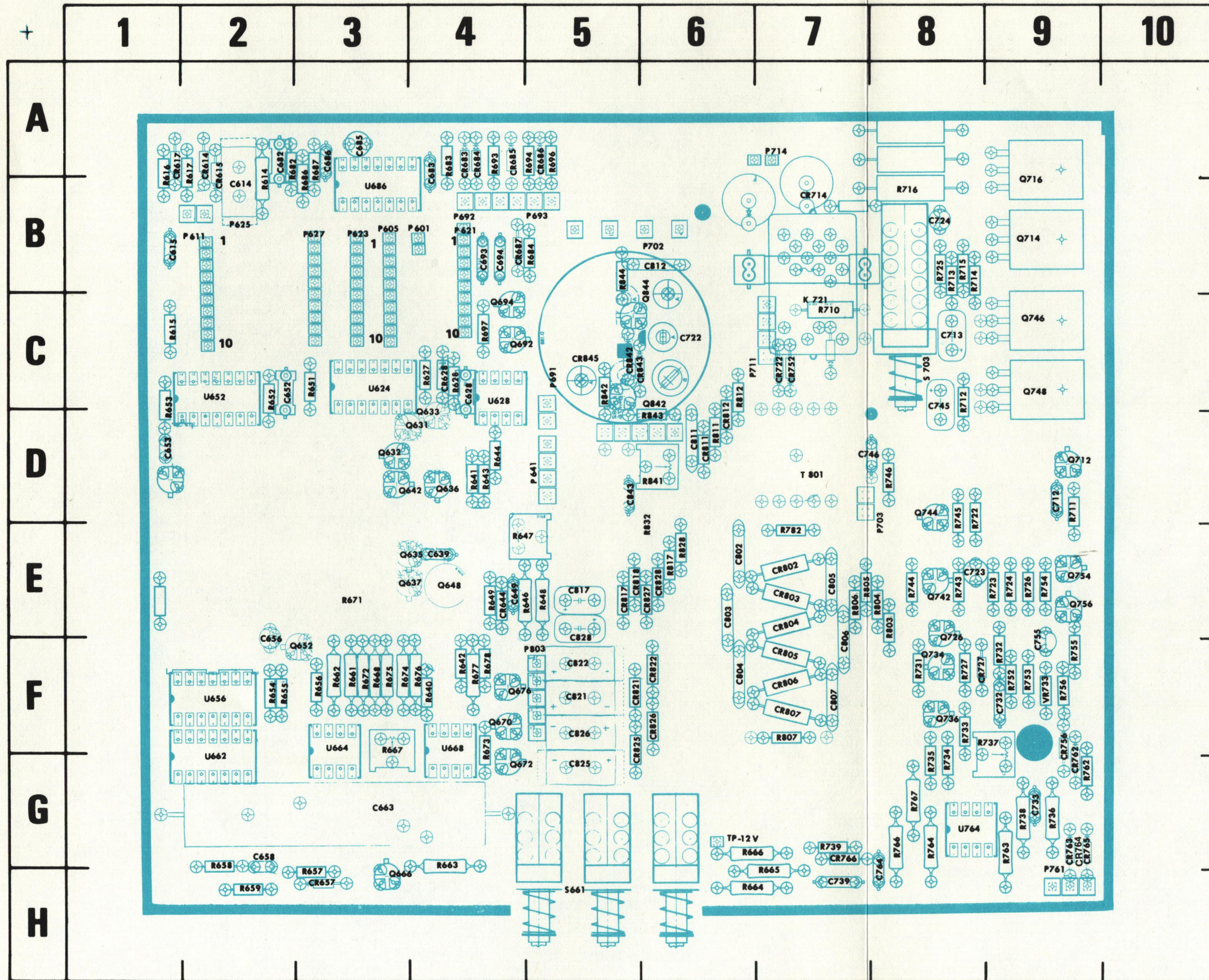


Fig. 7-10. A3-Main circuit board.

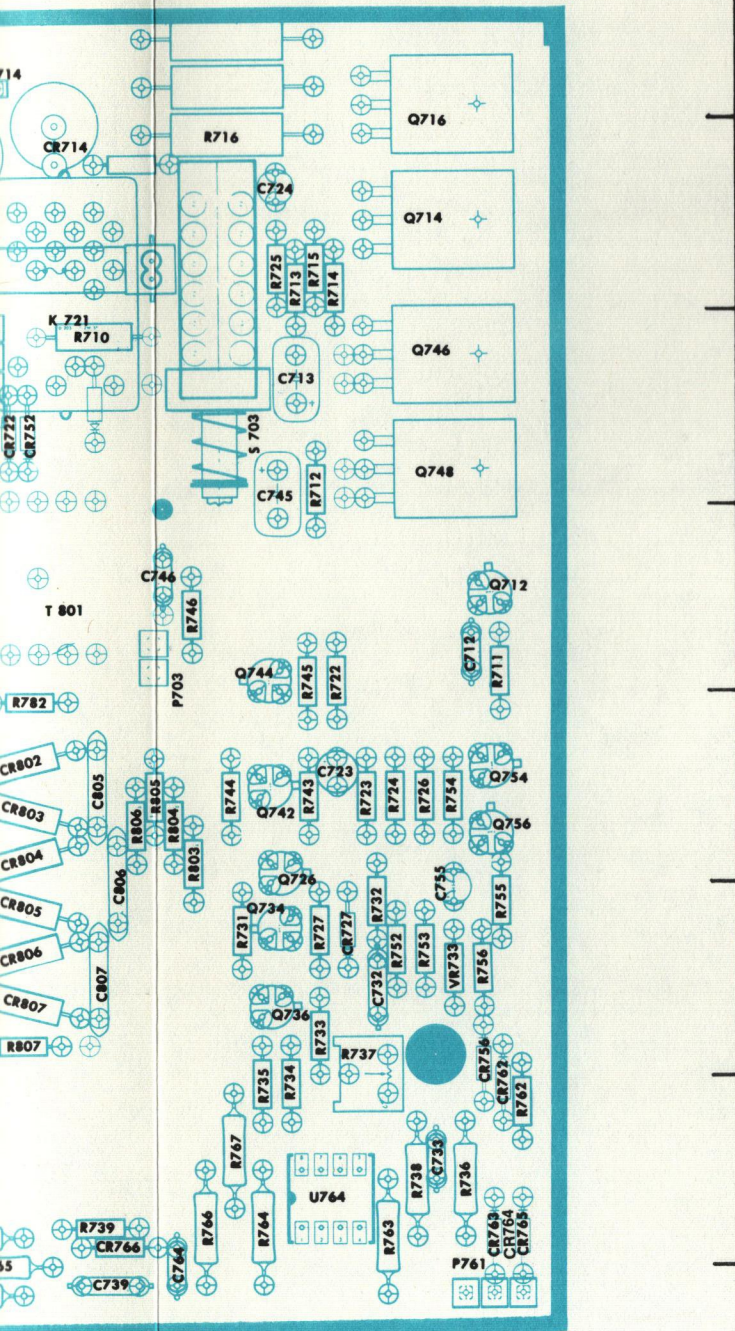
1525-25



CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C614	2B	CR727	8F	Q648	4E	R652	2C	R738	9G
C615	1B	CR756	9F	Q652	3F	R653	1D	R739	7G
C639	4E	CR762	9F	Q666	3H	R654	2F	R743	8E
C649	4E	CR763	9G	Q670	4F	R655	2F	R744	8E
C652	2C	CR764*	9G	Q672	4G	R656	3F	R745	8D
C653	1D	CR765	9G	Q674	4F	R657	3G	R746	8D
C656	2E	CR766	7G	Q676	4F	R658	2G	R752	9F
C658	2G	CR802	7E	Q692	4C	*R659	2H	R753	9F
C663	3G	CR803	7E	Q694	4C	R661	3F	R754	9E
C682	2A	CR804	7E	Q712	9D	R662	3F	R755	9F
C683	4A	CR805	7F	Q714	9B	R663	4G	R756	9F
C685	3A	CR806	7F	Q716	9A	R664	6H	R762	9G
C686	3A	CR807	7F	Q726	8E	R665	7G	R763	9G
C693	4B	CR811	6D	Q734	8F	R666	6G	R764	8G
C694	4B	CR812	6D	Q736	8F	R667	3F	R766	8G
C712	9D	CR817	5E	Q742	8E	R668	3F	R767	8G
C713	8C	CR818	5E	Q744	8D	R671	3E	R803	8E
C722	6C	CR821	5F	Q746	9C	R672	3F	R804	8E
C723	8E	CR822	6F	Q748	9C	R673	4F	R805	7E
C724	8B	CR825	5F	Q754	9E	R674	3F	R806	7E
C732	9F	CR826	6F	Q756	9E	R675	3F	R807	7F
C733	9G	CR827	6E	Q842	6C	R676	4F	R811	6D
C739	7H	CR828	6E	Q844	6B	R677	4F	R812	6C
C745	8C	CR842	5C			R678	4F	R817	6E
C746	7D	CR843	5C	R614	2A	R682	2A	R828	6E
C755	9E	CR845	5C	R615	1C	R683	4A	R841	6D
C764	8G			R616	1A	R684	4B	R842	5C
C802	6E	K721	7C	R617	1A	R686	3A	R843	6D
C803	6E	P601	3B	R620	2E	R687	3A	R844	5B
C804	6F	P605	3B	R621	3E	R693	4A		
C805	7E	P611	2B	R622	3E	R694	4A	S661	5H
C806	7E	P621	4B	R624	2D	R696	5A	S703	8C
C807	7F	P623	3B	R625	2D	R697	4C	T801	7D
C811	6D	P625	2B	R627	4C	R710	7C		
C812	6B	*P627	3B	R628	4C	R711	9D	TP631	2D
C817	5E	P641	5D	R631	2F	R712	9D	TP632	2D
C821	5F	P691	5C	R632	2E	R713	8B	TP633	2E
C822	5F	P692	4B	R633	2E	R714	8B	TP637	2E
C825	5G	P693	5B	R634	2F	R715	8B	TP-12V	6G
C826	5F	P702	6B	R635	2E	R716	8B		
C828	5E	P703	8D	R636	3E	R722	8D	U628	4C
C843	5D	P711	6C	R637	3E	R723	9E	U652	2C
		P761	9G	R638	3D	R724	9E	U656	2F
		P803	5F	R640	4F	R725	8B	U662	2F
		P841	5D	R641	4D	R726	9E	U664	3F
CR614	2A			R642	4F	R727	8F	U668	4F
CR615	2A	Q631	3D	R643	4D	R731	8F	U686	3B
CR617	1A	Q632	3D	R644	4D	R732	9F	U764	8G
CR628	4C	Q633	4D	R645	4D	R733	8F		
CR657	3H	Q635	3E	R646	4E	R734	8F	VR733	9F
CR684	4A	Q636	4D	R647	4E	R735	8F		
CR685	4A	Q637	3E	R648	5E	R736	9G		
CR686	5A	Q638	4D	R649	4E	R737	9F		
CR687	4B	Q642	3D	R651	3C				
CR714	7B	Q646	4E						
CR722	7C								

\*See Parts List for serial number ranges.

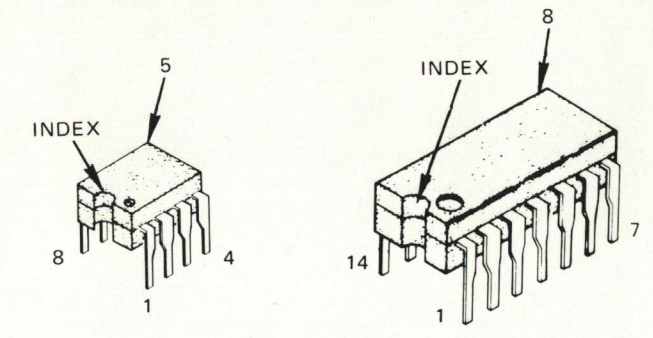
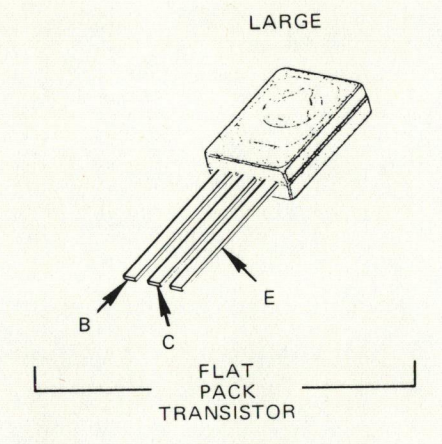
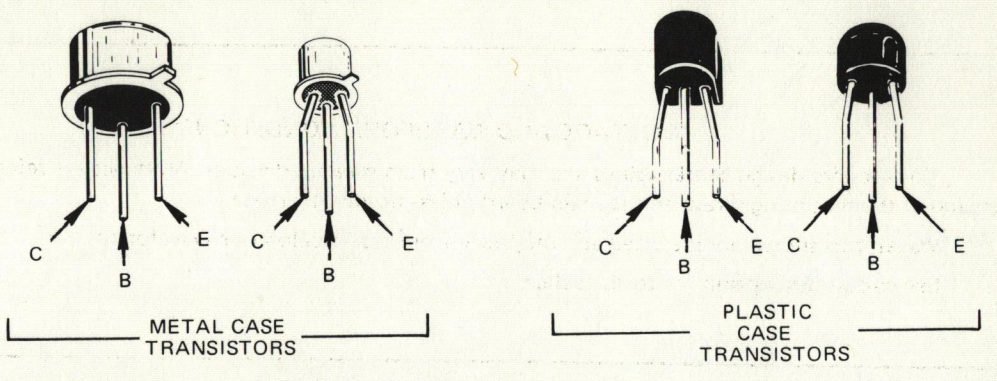
7                8                9                10



CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C614	2B	CR727	8F	Q648	4E	R652	2C	R738	9G
C615	1B	CR756	9F	Q652	3F	R653	1D	R739	7G
C639	4E	CR762	9F	Q666	3H	R654	2F	R743	8E
C649	4E	CR763	9G	Q670	4F	R655	2F	R744	8E
C652	2C	CR764*	9G	Q672	4G	R656	3F	R745	8D
C653	1D	CR765	9G	Q674	4F	R657	3G	R746	8D
C656	2E	CR766	7G	Q676	4F	R658	2G	R752	9F
C658	2G	CR802	7E	Q692	4C	*R659	2H	R753	9F
C663	3G	CR803	7E	Q694	4C	R661	3F	R754	9E
C682	2A	CR804	7E	Q712	9D	R662	3F	R755	9F
C683	4A	CR805	7F	Q714	9B	R663	4G	R756	9F
C685	3A	CR806	7F	Q716	9A	R664	6H	R762	9G
C686	3A	CR807	7F	Q726	8E	R665	7G	R763	9G
C693	4B	CR811	6D	Q734	8F	R666	6G	R764	8G
C694	4B	CR812	6D	Q736	8F	R667	3F	R766	8G
C712	9D	CR817	5E	Q742	8E	R668	3F	R767	8G
C713	8C	CR818	5E	Q744	8D	R671	3E	R803	8E
C722	6C	CR821	5F	Q746	9C	R672	3F	R804	8E
C723	8E	CR822	6F	Q748	9C	R673	4F	R805	7E
C724	8B	CR825	5F	Q754	9E	R674	3F	R806	7E
C732	9F	CR826	6F	Q756	9E	R675	3F	R807	7F
C733	9G	CR827	6E	Q842	6C	R676	4F	R811	6D
C739	7H	CR828	6E	Q844	6B	R677	4F	R812	6C
C745	8C	CR842	5C			R678	4F	R817	6E
C746	7D	CR843	5C	R614	2A	R682	2A	R828	6E
C755	9E	CR845	5C	R615	1C	R683	4A	R841	6D
C764	8G			R616	1A	R684	4B	R842	5C
C802	6E	K721	7C	R617	1A	R686	3A	R843	6D
C803	6E	P601	3B	R620	2E	R687	3A	R844	5B
C804	6F	P605	3B	R621	3E	R693	4A		
C805	7E	P621	4B	R624	2D	R694	4A	S661	5H
C806	7E	P623	3B	R625	2D	R696	5A	S703	8C
C807	7F	P625	2B	R627	4C	R697	4C	T801	7D
C811	6D	*P627	3B	R628	4C	R710	7C		
C812	6B	P641	5D	R631	2F	R711	9D	TP631	2D
C817	5E	P691	5C	R632	2E	R712	8C	TP632	2D
C821	5F	P692	4B	R633	2E	R713	8B	TP633	2E
C822	5F	P693	5B	R634	2F	R714	8B	TP637	2E
C825	5G	P702	6B	R635	2E	R715	8B	TP-12V	6G
C826	5F	P703	8D	R636	3E	R716	8B		
C828	5E	P711	6C	R637	3E	R722	8D	U628	4C
C843	5D	P761	9G	R638	3D	R723	9E	U652	2C
		P803	5F	R640	4F	R724	9E	U656	2F
		P841	5D	R641	4D	R725	8B	U662	2F
CR614	2A	Q631	3D	R642	4F	R726	9E	U664	3F
CR615	2A	Q632	3D	R643	4D	R727	8F	U668	4F
CR617	1A	Q633	4D	R644	4D	R731	8F	U686	3B
CR628	4C	Q635	3E	R645	4D	R732	9F	U764	8G
CR657	3H	Q636	4D	R646	4E	R733	8F		
CR684	4A	Q637	3E	R647	4E	R734	8F	VR733	9F
CR685	4A	Q638	4D	R648	5E	R735	8F		
CR686	5A	Q642	3D	R649	4E	R736	9G		
CR687	4B	Q646	4E	R651	3C	R737	9F		
CR714	7B								
CR722	7C								

\*See Parts List for serial number ranges.

1525-25



INTEGRATED CIRCUITS

Fig. 7-8. Semiconductor Lead configurations.

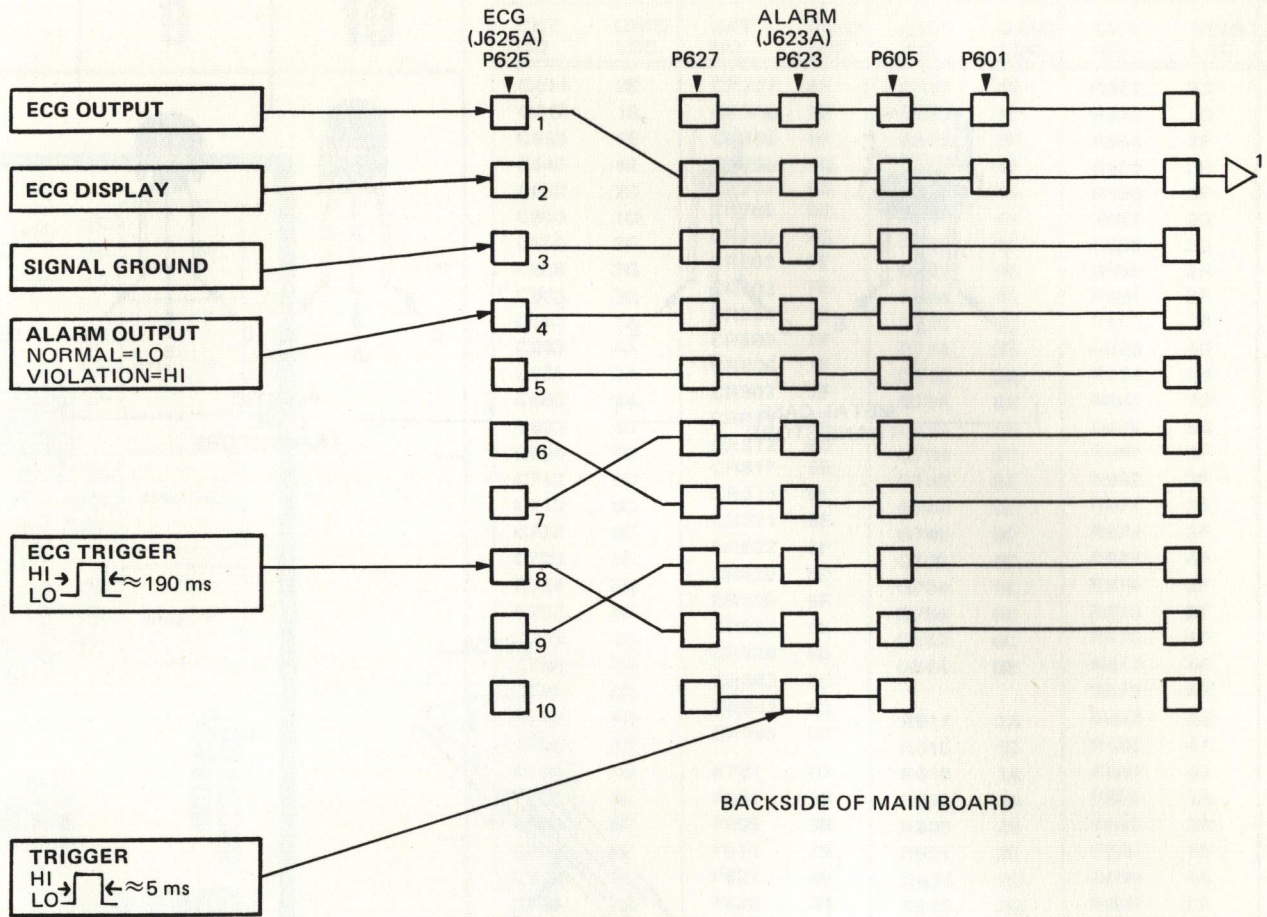
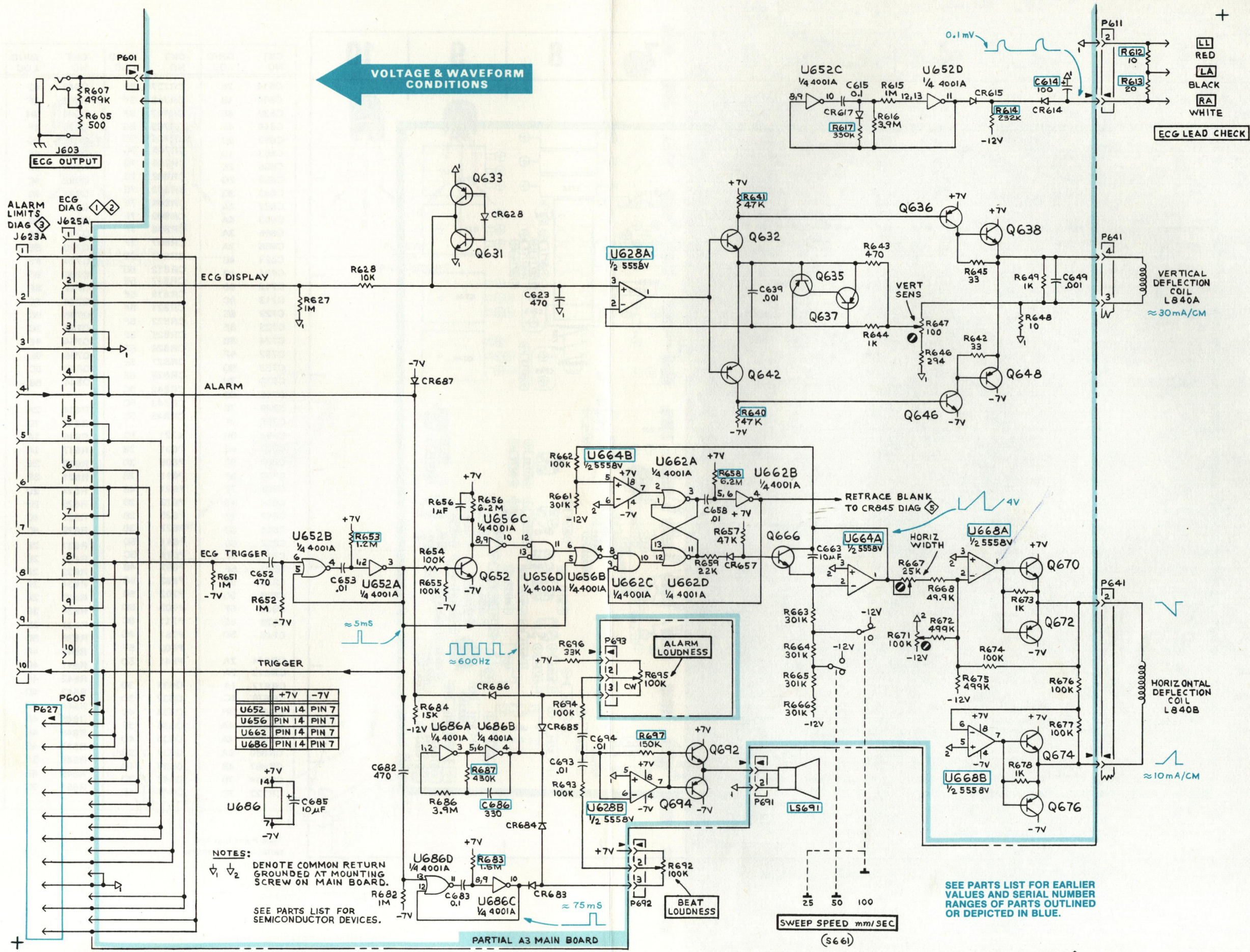


Fig. 7-9. Signals at circuit board interconnecting pins.

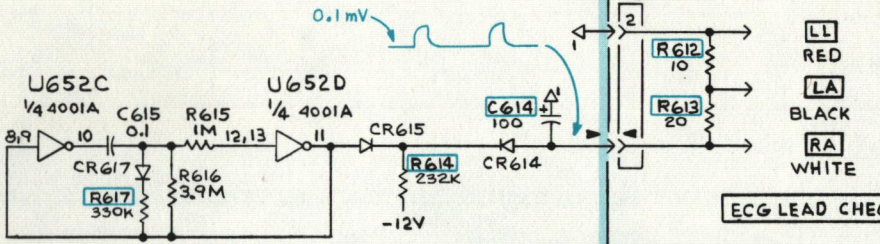
### CURRENT, VOLTAGE AND WAVEFORM CONDITIONS

Currents and voltages are design center values and may vary from measured values. Voltages are referenced to chassis ground at the mounting screw on the main board unless noted otherwise.

Waveforms shown are idealized and may vary from test-oscilloscope waveforms.



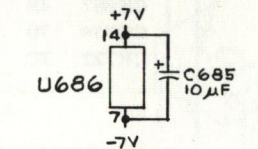
VOLTAGE & WAVEFORM CONDITIONS



- LL RED
- LA BLACK
- RA WHITE

ECG LEAD CHECK

	+7V	-7V
U652	PIN 14	PIN 7
U656	PIN 14	PIN 7
U662	PIN 14	PIN 7
U686	PIN 14	PIN 7



NOTES:  
 ↓ ↓  
 DENOTE COMMON RETURN GROUNDED AT MOUNTING SCREW ON MAIN BOARD.  
 SEE PARTS LIST FOR SEMICONDUCTOR DEVICES.

PARTIAL A3 MAIN BOARD

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

SWEEP SPEED mm/SEC

(S66)

VERTICAL AND HORIZONTAL AMPLIFIER

VERTICAL AND HORIZONTAL AMPLIFIER

4



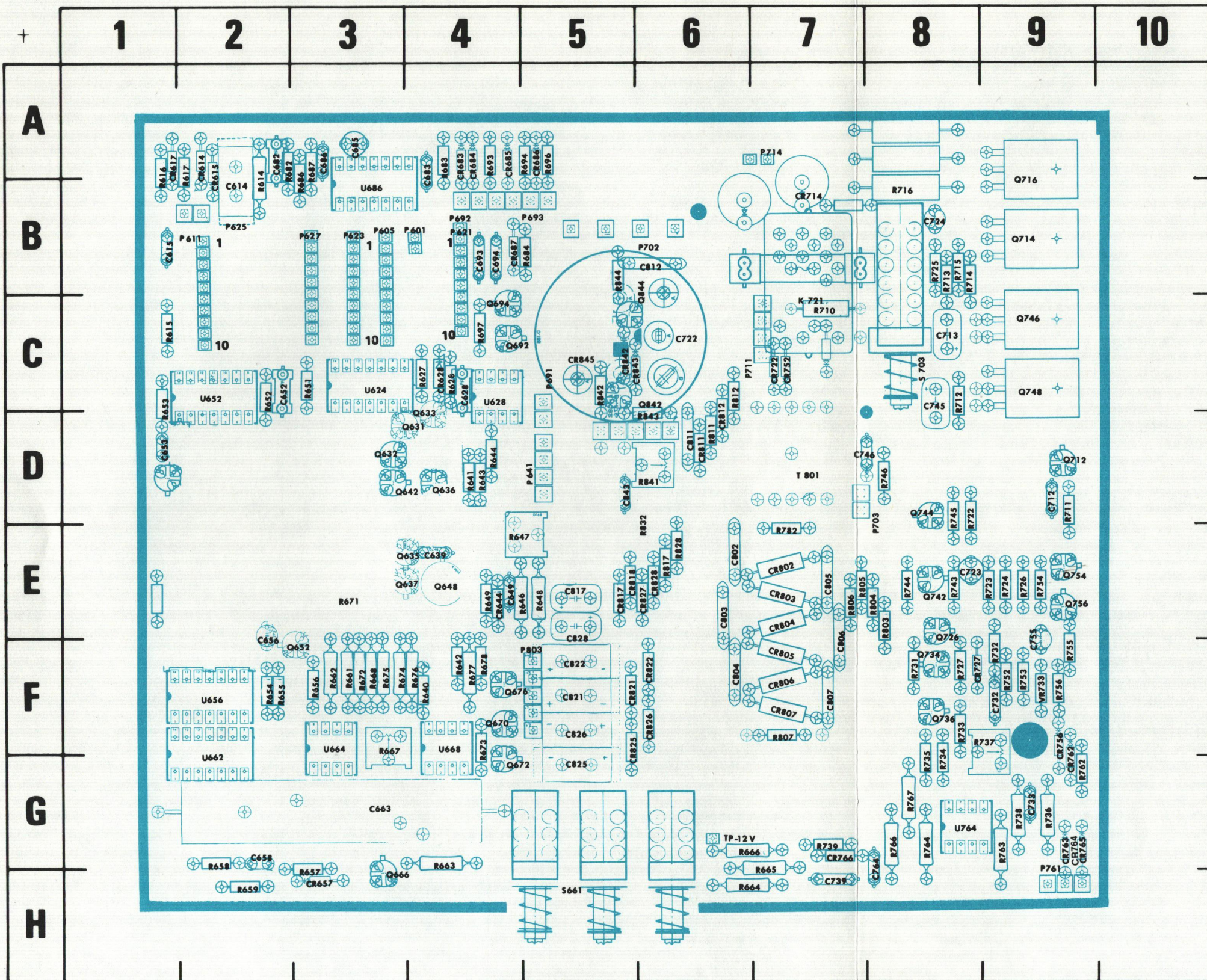


Fig. 7-7. A3-Main circuit board.



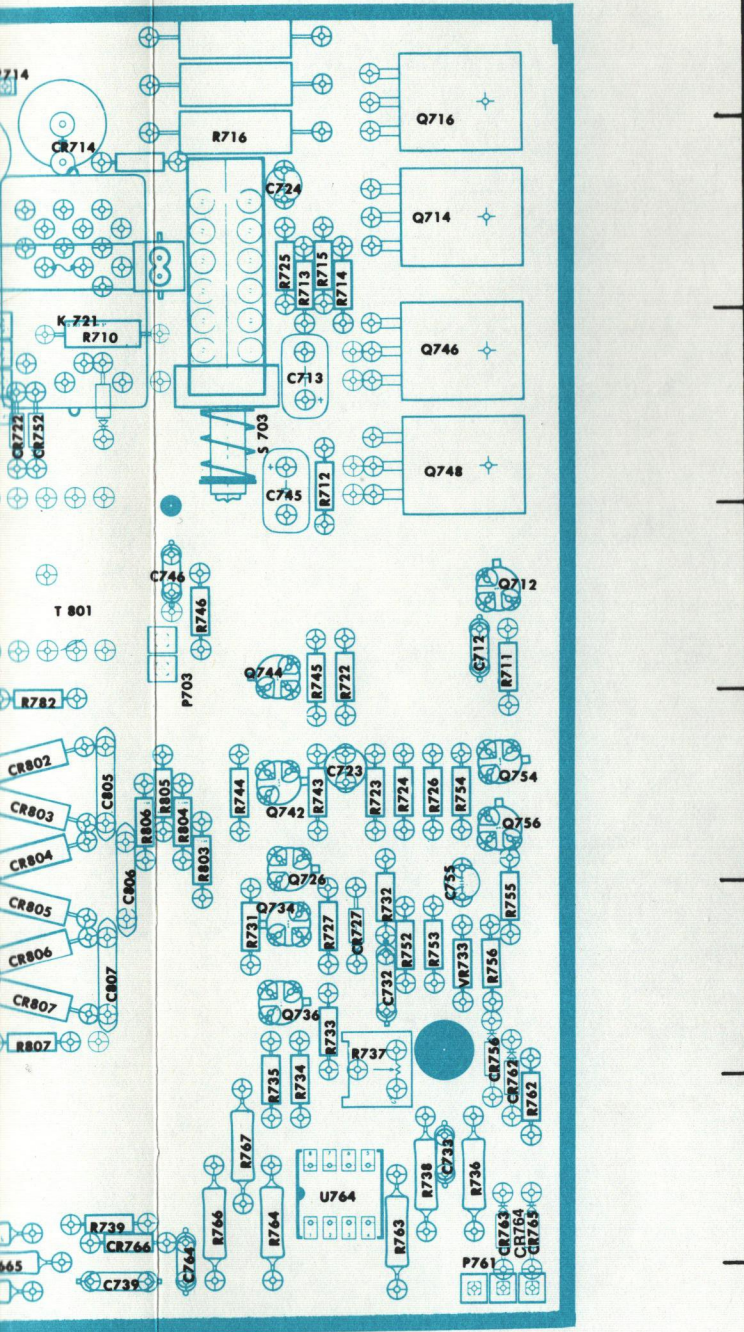
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C614	2B	CR727	8F	Q648	4E	R652	2C	R738	9G
C615	1B	CR756	9F	Q652	3F	R653	1D	R739	7G
C639	4E	CR762	9F	Q666	3H	R654	2F	R743	8E
C649	4E	CR763	9G	Q670	4F	R655	2F	R744	8E
C652	2C	CR764*	9G	Q672	4G	R656	3F	R745	8D
C653	1D	CR765	9G	Q674	4F	R657	3G	R746	8D
C656	2E	CR766	7G	Q676	4F	R658	2G	R752	9F
C658	2G	CR802	7E	Q692	4C	*R659	2H	R753	9F
C663	3G	CR803	7E	Q694	4C	R661	3F	R754	9E
C682	2A	CR804	7E	Q712	9D	R662	3F	R755	9F
C683	4A	CR805	7F	Q714	9B	R663	4G	R756	9F
C685	3A	CR806	7F	Q716	9A	R664	6H	R762	9G
C686	3A	CR807	7F	Q726	8E	R665	7G	R763	9G
C693	4B	CR811	6D	Q734	8F	R666	6G	R764	8G
C694	4B	CR812	6D	Q736	8F	R667	3F	R766	8G
C712	9D	CR817	5E	Q742	8E	R668	3F	R767	8G
C713	8C	CR818	5E	Q744	8D	R671	3E	R803	8E
C722	6C	CR821	5F	Q746	9C	R672	3F	R804	8E
C723	8E	CR822	6F	Q748	9C	R673	4F	R805	7E
C724	8B	CR825	5F	Q754	9E	R674	3F	R806	7E
C732	9F	CR826	6F	Q756	9E	R675	3F	R807	7F
C733	9G	CR827	6E	Q842	6C	R676	4F	R811	6D
C739	7H	CR828	6E	Q844	6B	R677	4F	R812	6C
C745	8C	CR842	5C			R678	4F	R817	6E
C746	7D	CR843	5C	R614	2A	R682	2A	R828	6E
C755	9E	CR845	5C	R615	1C	R683	4A	R841	6D
C764	8G	K721	7C	R616	1A	R684	4B	R842	5C
C802	6E	P601	3B	R617	1A	R686	3A	R843	6D
C803	6E	P605	3B	R620	2E	R687	3A	R844	5B
C804	6F	P611	2B	R621	3E	R693	4A		
C805	7E	P621	4B	R624	2D	R694	4A	S661	5H
C806	7E	P623	3B	R625	2D	R696	5A	S703	8C
C807	7F	P625	2B	R627	4C	R697	4C		
C811	6D	*P627	3B	R628	4C	R710	7C	T801	7D
C812	6B	P641	5D	R631	2F	R711	9D	TP631	2D
C817	5E	P691	5C	R632	2E	R712	8C	TP632	2D
C821	5F	P692	4B	R633	2E	R713	8B	TP633	2E
C822	5F	P693	5B	R634	2F	R714	8B	TP637	2E
C825	5G	P702	6B	R635	2E	R715	8B	TP-12V	6G
C826	5F	P703	8D	R636	3E	R716	8B		
C828	5E	P711	6C	R637	3E	R722	8D	U628	4C
C843	5D	P761	9G	R638	3D	R723	9E	U652	2C
		P803	5F	R640	4F	R724	9E	U656	2F
		P841	5D	R641	4D	R725	8B	U662	2F
CR614	2A			R642	4F	R726	9E	U664	3F
CR615	2A			R643	4D	R727	8F	U668	4F
CR617	1A	Q631	3D	R644	4D	R731	8F	U686	3B
CR628	4C	Q632	3D	R645	4D	R732	9F	U764	8G
CR657	3H	Q633	4D	R646	4E	R733	8F		
CR684	4A	Q635	3E	R646	4E	R733	8F	VR733	9F
CR685	4A	Q636	4D	R647	4E	R734	8F		
CR686	5A	Q637	3E	R648	5E	R735	8F		
CR687	4B	Q638	4D	R649	4E	R736	9G		
CR714	7B	Q642	3D	R651	3C	R737	9F		
CR722	7C	Q646	4E						

\*See Parts List for serial number ranges.

1525-25



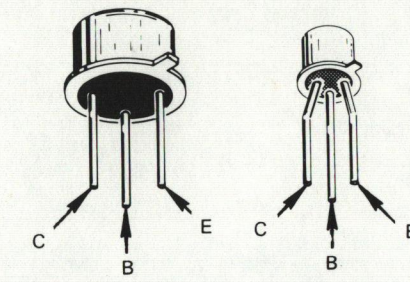
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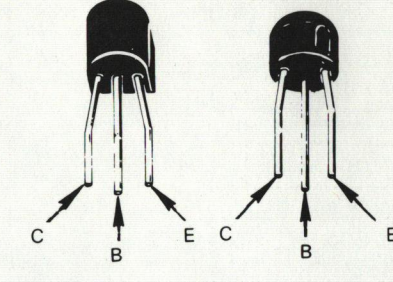
1525-25

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C614	2B	CR727	8F	Q648	4E	R652	2C	R738	9G
C615	1B	CR756	9F	Q652	3F	R653	1D	R739	7G
C639	4E	CR762	9F	Q666	3H	R654	2F	R743	8E
C649	4E	CR763	9G	Q670	4F	R655	2F	R744	8E
C652	2C	CR764*	9G	Q672	4G	R656	3F	R745	8D
C653	1D	CR765	9G	Q674	4F	R657	3G	R746	8D
C656	2E	CR766	7G	Q676	4F	R658	2G	R752	9F
C658	2G	CR802	7E	Q692	4C	*R659	2H	R753	9F
C663	3G	CR803	7E	Q694	4C	R661	3F	R754	9E
C682	2A	CR804	7E	Q712	9D	R662	3F	R755	9F
C683	4A	CR805	7F	Q714	9B	R663	4G	R756	9F
C685	3A	CR806	7F	Q716	9A	R664	6H	R762	9G
C686	3A	CR807	7F	Q726	8E	R665	7G	R763	9G
C693	4B	CR811	6D	Q734	8F	R666	6G	R764	8G
C694	4B	CR812	6D	Q736	8F	R667	3F	R766	8G
C712	9D	CR817	5E	Q742	8E	R668	3F	R767	8G
C713	8C	CR818	5E	Q744	8D	R671	3E	R803	8E
C722	6C	CR821	5F	Q746	9C	R672	3F	R804	8E
C723	8E	CR822	6F	Q748	9C	R673	4F	R805	7E
C724	8B	CR825	5F	Q754	9E	R674	3F	R806	7E
C732	9F	CR826	6F	Q756	9E	R675	3F	R807	7F
C733	9G	CR827	6E	Q842	6C	R676	4F	R811	6D
C739	7H	CR828	6E	Q844	6B	R677	4F	R812	6C
C745	8C	CR842	5C			R678	4F	R817	6E
C746	7D	CR843	5C	R614	2A	R682	2A	R828	6E
C755	9E	CR845	5C	R615	1C	R683	4A	R841	6D
C764	8G	K721	7C	R616	1A	R684	4B	R842	5C
C802	6E	P601	3B	R617	1A	R686	3A	R843	6D
C803	6E	P605	3B	R620	2E	R687	3A	R844	5B
C804	6F	P611	2B	R621	3E	R693	4A	S661	5H
C805	7E	P621	4B	R624	2D	R694	4A	S703	8C
C806	7E	P623	3B	R625	2D	R696	5A	T801	7D
C807	7F	P625	2B	R627	4C	R697	4C		
C811	6D	*P627	3B	R628	4C	R710	7C		
C812	6B	P641	5D	R631	2F	R711	9D	TP631	2D
C817	5E	P691	5C	R632	2E	R712	8C	TP632	2D
C821	5F	P692	4B	R633	2E	R713	8B	TP633	2E
C822	5F	P693	5B	R634	2F	R714	8B	TP637	2E
C825	5G	P702	6B	R635	2E	R715	8B	TP-12V	6G
C826	5F	P703	8D	R636	3E	R716	8B	U628	4C
C828	5E	P711	6C	R637	3E	R722	8D	U652	2C
C843	5D	P761	9G	R638	3D	R723	9E	U656	2F
		P803	5F	R640	4F	R724	9E	U662	2F
		P841	5D	R641	4D	R725	8B	U664	3F
CR614	2A			R642	4F	R726	9E	U668	4F
CR615	2A			R643	4D	R727	8F	U686	3B
CR617	1A	Q631	3D	R644	4D	R731	8F	U764	8G
CR628	4C	Q632	3D	R645	4D	R732	9F		
CR657	3H	Q633	4D	R646	4E	R733	8F		
CR684	4A	Q635	3E	R646	4E	R734	8F		
CR685	4A	Q636	4D	R647	4E	R735	8F	VR733	9F
CR686	5A	Q637	3E	R648	5E	R736	8F		
CR687	4B	Q638	4D	R649	4E	R736	9G		
CR714	7B	Q642	3D	R651	3C	R737	9F		
CR722	7C	Q646	4E						

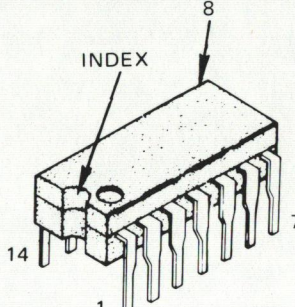
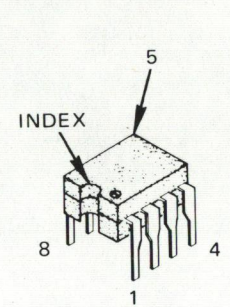
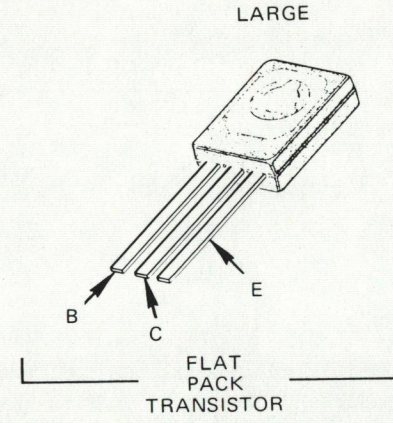
\*See Parts List for serial number ranges.



METAL CASE TRANSISTORS



PLASTIC CASE TRANSISTORS



INTEGRATED CIRCUITS

Fig. 7-11 Semiconductor Lead configurations.

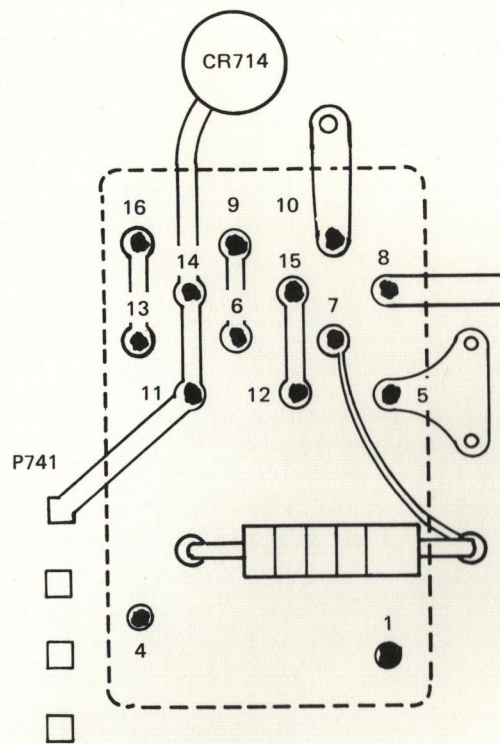
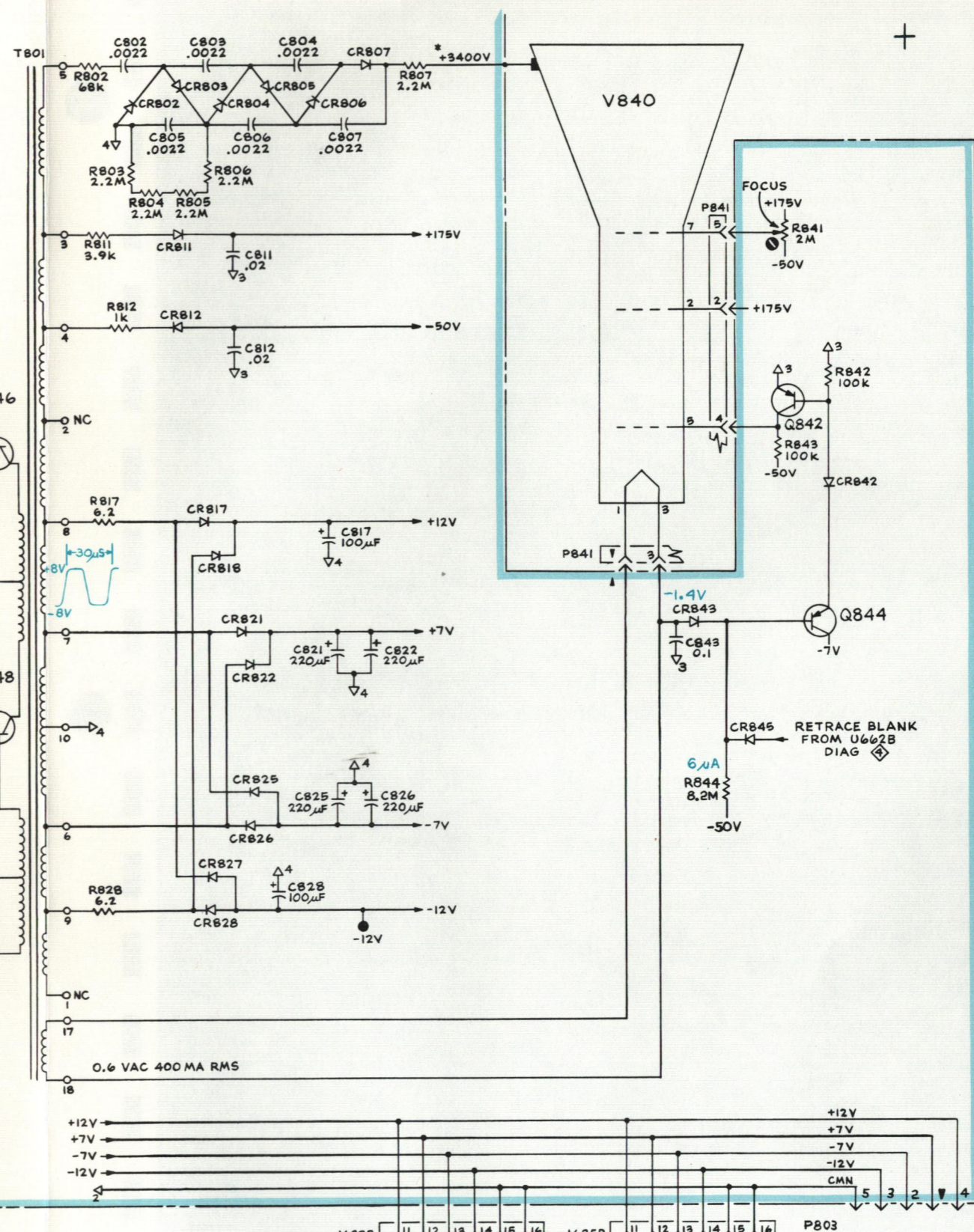
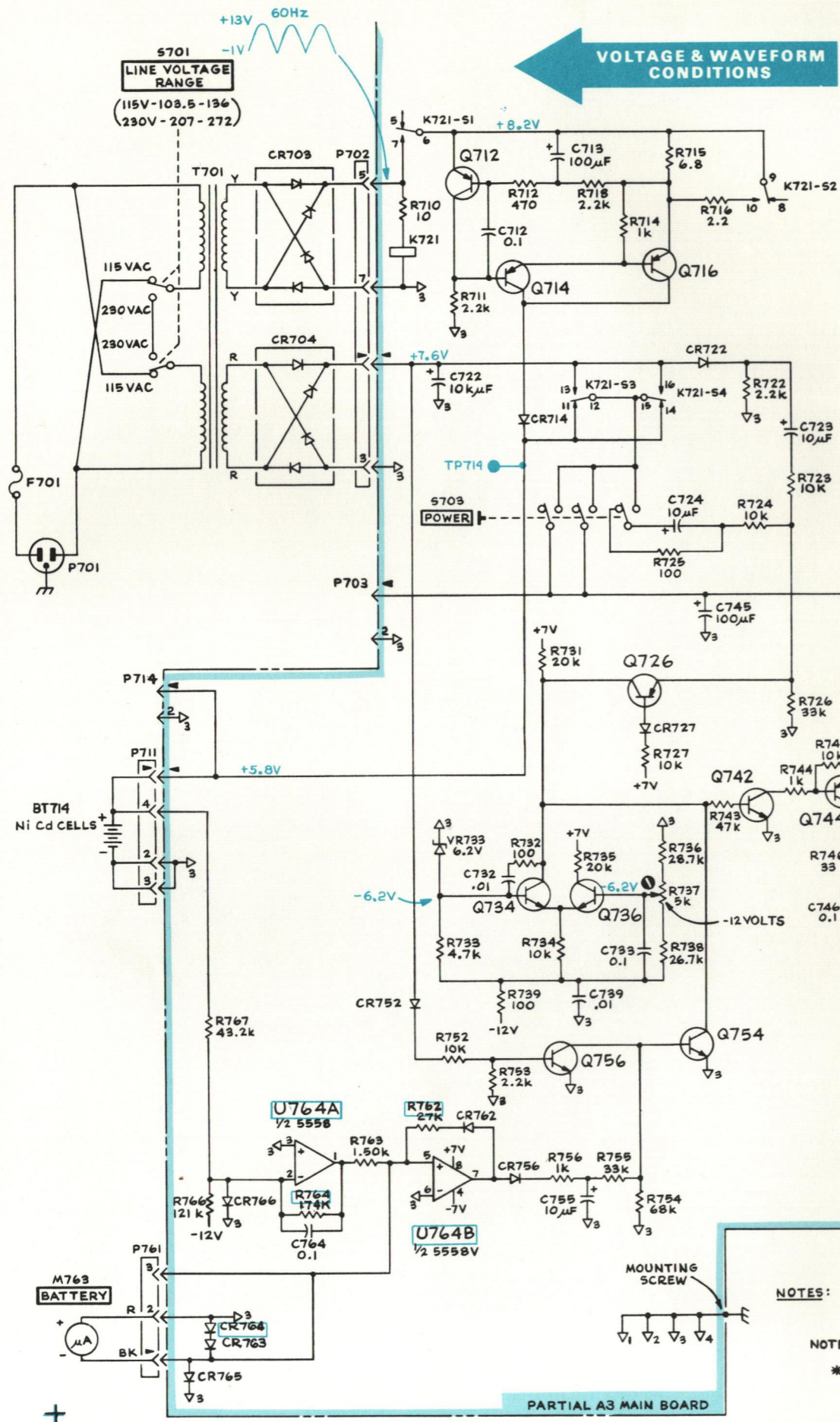


Fig. 7-12. K721 Relay pin configurations.

#### CURRENT, VOLTAGE AND WAVEFORM CONDITIONS

Monitor is operating on 115 VAC line with fully charged battery. Currents and voltages are design center values and may vary from measured values. Voltages are referenced to chassis ground at the mounting screw on the main board unless noted otherwise.

Waveforms shown are idealized and may vary from test-oscilloscope waveforms.



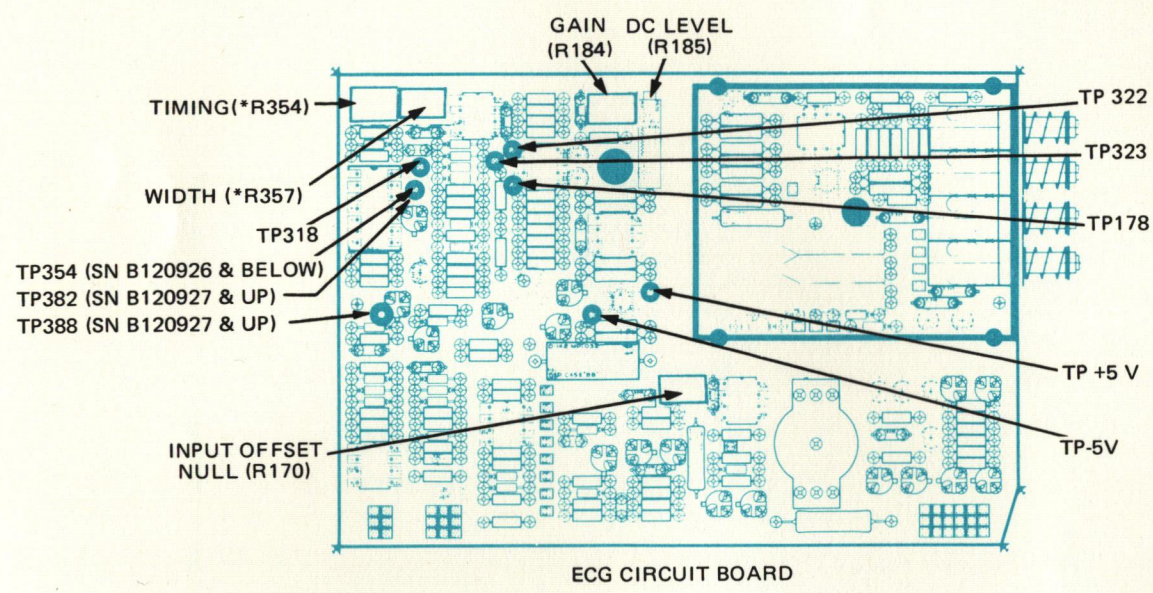
**NOTES:**

NOTE \* READS APPROXIMATELY +3200V WHEN MEASURED WITH 20kΩ/V METER. SEE PARTS LIST FOR SEMICONDUCTOR DEVICES.

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS MARKED WITH BLUE OUTLINE.

408 MONITOR

POWER SUPPLY 5



\*See Parts List for serial number ranges.

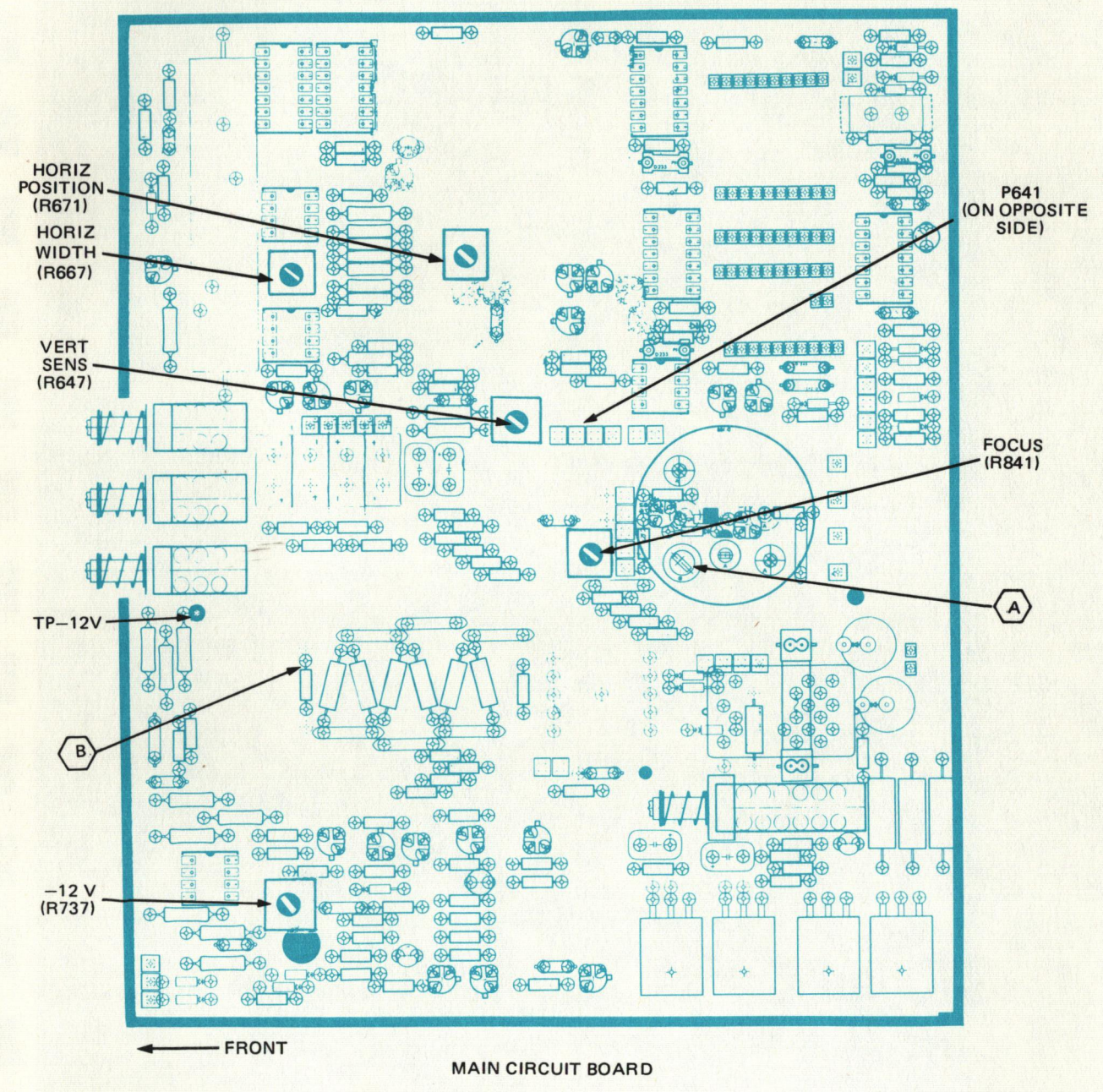
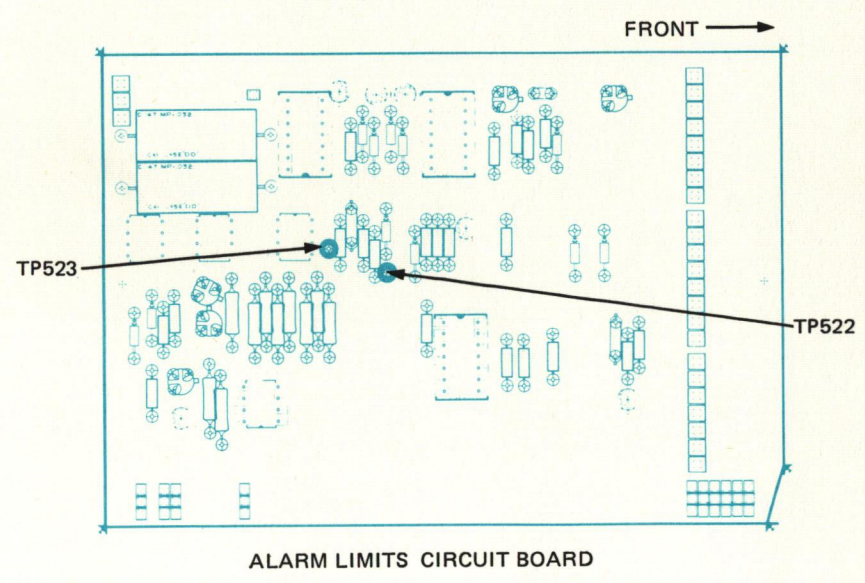


Fig. 7-13. Adjustment and test point locations.

# REPLACEABLE MECHANICAL PARTS

## PARTS ORDERING INFORMATION

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

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

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

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

## SPECIAL NOTES AND SYMBOLS

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

## FIGURE AND INDEX NUMBERS

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

## INDENTATION SYSTEM

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

```

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

```

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

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

## ITEM NAME

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

## ABBREVIATIONS

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02288	GOULD INC., ALLIED CONTROL DIVISION	100 RELAY ROAD	PLANTSVILLE, CT 06479
02318	AMERICAN HOSPITAL SUPPLY CORPORATION	1740 RIDGE AVENUE	EVANSTON, IL 60204
02660	BUNKER RAMO CORP., CONNECTOR DIVISION	2801 S 25TH AVENUE	BROADVIEW, IL 60153
06090	RAYCHEM CORPORATION	300 CONSTITUTION DRIVE	MENLO PARK, CA 94025
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
09823	BURGESS INC.	FOOT OF EXCHANGE STREET	FREEPORT, IL 61032
11897	PLASTIGLIDE MFG. CORPORATION	P O BOX 867, 1757 STANFORD ST.	SANTA MONICA, CA 90406
12136	PHILADELPHIA HANDLE COMPANY, INC.	1643 HADDON AVENUE	CAMDEN, NJ 08103
12360	ALBANY PRODUCTS CO., DIV. OF PNEUMO DYNAMICS CORPORATION	145 WOODWARD AVENUE	SOUTH NORWALK, CT 06586
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
28520	HEYMAN MFG. CO.	147 N. MICHIGAN AVE.	KENILWORTH, NJ 07033
31343	AIR-O-PLASTIK CORP.	ASIA PLACE	CARLSTADT, NJ 07072
55210	GETTIG ENG. AND MFG. COMPANY	PO BOX 85, OFF ROUTE 45	SPRING MILLS, PA 16875
55292	LEDKO DIV., WILBRECHT ELECTRONICS, INC.	240 EAST PLATO BLVD.	ST. PAUL, MN 55107
70485	ATLANTIC INDIA RUBBER WORKS, INC.	571 W. POLK ST.	CHICAGO, IL 60607
71183	BRYANT ELECTRIC CO.	1421 STATE	BRIDGEPORT, CT 06602
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
72653	G. C. ELECTRONICS CO., A DIVISION OF HYDROMETALS, INC.	400 S. WYMAN ST.	ROCKFORD, IL 61101
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV.	34 FOREST STREET	ATTLEBORO, MA 02703
74199	QUAM NICHOLS COMPANY	218 E MARQUETTE ROAD	CHICAGO, IL 60637
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
74921	ITEN FIBRE CO., THE	4001 BENEFIT AVE., P O BOX 9	ASHTABULA, OH 44004
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
77132	DOT FASTENER CO., A UNITED-CARR DIV. OF TRW INC.	ROUND HOUSE INDL PK, PO BOX 710	WATERBURY, CT 06720
77342	AMF INC., POTTER AND BRUMFIELD DIV.	200 RICHLAND CREEK DRIVE	PRINCETON, IN 47671
77969	RUBBERCRAFT CORP. OF CALIF., LTD.	1800 W. 220TH ST.	TORRANCE, CA 90507
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80112	G. C. ELECTRONICS COMPANY, A DIVISION OF HYDROMETALS, INC.	3225 EXPOSITION PLACE	LOS ANGELES, CA 90018
82389	SWITCHCRAFT, INC.	5555 N. ELSTON AVE.	CHICAGO, IL 60630
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
88245	LITTON SYSTEMS, INC., USECO DIV.	13536 SATICOY ST.	VAN NUYS, CA 91409
98388	ROYAL INDUSTRIES, ACCURATE PRODUCTS DIV.	4370 JUTLAND DRIVE	SAN DIEGO, CA 92117

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-1	366-1495-00			4		KNOB:GRAY	80009	366-1495-00
	213-0153-00			4		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-2	200-1547-00	B010100	B110699	1		BEZEL,CRT:	80009	200-1547-00
	200-1547-01	B110700		1		BEZEL,CRT:	80009	200-1547-01
						(ATTACHING PARTS)		
-3	211-0107-00	B010100	B109999	4		SCREW,MACHINE:1-72 X 0.312 INCH,RDH SST	12360	OBD
	211-0646-00	B110000		4		SCREW,MACHINE:2-56 X 0.375 INCH,SLOT,STL		
						-----*		
	337-1813-00	B010100	B030239	1		SHLD,IMPLOSION:	80009	337-1813-00
-4	337-1813-01	B030240	B129999	1		SHLD,IMPLOSION:	80009	337-1813-01
	337-2290-00	B130000		1		SHLD,IMPLOSION:	80009	337-2290-00
-5	-----			1		METER,BTRY LVL:(SEE M763 EPL)		
	-----			-		. METER INCLUDES:		
-6	131-0621-00			2		. CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
-7	352-0199-00			1		. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0199-00
-8	352-0243-01	B010100	B159999X	1		. HOLDER,INDICATOR:BATTERY LEVEL INDICATOR	80009	352-0243-01
-9	426-0681-00			5		FR,PUSH BUTTON:GRAY PLASTIC	80009	426-0681-00
-10	426-0568-00			3		FR,PUSHBUTTON:PANEL MOUNT	80009	426-0568-00
-11	-----			1		RES.,VAR,NONWIR:(SEE R692 EPL)		
						(ATTACHING PARTS)		
-12	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-13	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
						-----*		
	175-0826-00			FT		WIRE,ELECTRICAL:3 WIRE RIBBON	08261	OBD
	131-0621-00			3		CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	352-0199-00			1		CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0199-00
-14	-----			1		RES.,VAR,NONWIR:(SEE R505 EPL)		
						(ATTACHING PARTS)		
-15	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-16	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
						-----*		
-17	-----			1		RES.,VAR,NONWIR:(SEE R515 EPL)		
						(ATTACHING PARTS)		
-18	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-19	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
						-----*		
	175-0828-00			FT		WIRE,ELECTRICAL:5 WIRE RIBBON	08261	OBD
	175-0826-00			FT		WIRE,ELECTRICAL:3 WIRE RIBBON	08261	OBD
	131-0621-00			8		CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	352-0204-00			1		CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0204-00
-20	-----			1		RES.,VAR,NONWIR:(SEE R195 EPL)		
						(ATTACHING PARTS)		
-21	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-22	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	OBD
						-----*		
-23	366-1489-23			1		PUSH BUTTON:GRAY--RESET	80009	366-1489-23
-24	-----			1		SWITCH,PUSH:(SEE S547 EPL)		
						(ATTACHING PARTS)		
-25	211-0097-00			2		SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
						-----*		
-26	333-1746-00	B010100	B109999	1		PANEL,FRONT:	80009	333-1746-00
	333-1746-02	B110000	B159999	1		PANEL,FRONT:	80009	333-1746-02
	333-1746-04	B160000		1		PANEL,FRONT:	80009	333-1746-04
	175-0828-00			FT		WIRE,ELECTRICAL:5 WIRE RIBBON	08261	OBD
	175-0825-00			FT		WIRE,ELECTRICAL:2 WIRE RIBBON	08261	OBD
	131-0621-00			7		CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	352-0201-00			1		CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0201-00
	352-0198-00			1		CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0198-00
-27	200-0935-00			1		BASE,LAMPHOLDER:0.29 OD X 0.19 CASE	80009	200-0935-00
-28	378-0741-00	B010100	B151470X	1		LENS,LIGHT:	80009	378-0741-00
-29	352-0157-00			1		LAMPHOLDER:WHITE PLASTIC	80009	352-0157-00
	162-0581-00			FT		INS,SLV,ELEC:7 INCH LONG	06090	OBD
	150-0123-01	XB110000		1		LAMP,CARTRIDGE:14V,0.023A,YELLOW LENS	55292	71326-06



Replaceable Mechanical Parts—408

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
1-	352-0198-00	XB110000	1						CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0198-00
	131-0621-00	XB110000	2						CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
-30	252-0571-00		FT						RUB.SPL SHAPED:CHANNEL,0.344 FT LONG	77969	1353
-31	343-0427-00		1						RTRNR,ELCTRN TUB:FRONT	80009	343-0427-00
									(ATTACHING PARTS)		
-32	211-0021-00		4						SCREW,MACHINE:4-40 X 1.25 INCH,PNH STL	83385	OBD
									- - - - *		
	136-0551-00		1						SOCKET,PLUG-IN:CRF	80009	136-0551-00
			-						. SOCKET ASSY INCLUDES:		
-33	131-0621-00		5						. CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
-34	352-0201-00		1						. CONN BODY,PL,EL:5 WIRE BLACK	80009	352-0201-00
-35	175-0828-00		FT						. WIRE,ELECTRICAL:5 WIRE RIBBON	08261	OBD
-36	136-0253-02	B010100 B141369	1						. SKT HALF,CRF:REAR	80009	136-0253-02
-37	131-0506-00	B010100 B141369	5						. CONTACT,ELEC:	80009	131-0506-00
-38	136-0253-01	B010100 B141369	1						. SKT HALF,CRF:FRONT	80009	136-0253-01
	136-0669-00	B141370	1						SKT,PL-IN ELEK:CRF,5 CONTACTS	80009	136-0669-00
-39	343-0428-00		1						CLAMP,COIL ASSY:CRF DEFLECTION	80009	343-0428-00
									(ATTACHING PARTS)		
-40	211-0097-00		1						SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL	83385	OBD
									- - - - *		
-41	343-0429-00	B010100 B040299	1						CUSHION,CRF:REAR	80009	343-0429-00
	343-0429-01	B040300	1						CUSHION,CRF:REAR		
-42			1						COIL ASSY,TUBE:(SEE L840A,B EPL)		
	175-0827-00		FT						. WIRE,ELECTRICAL:4 WIRE RIBBON	08261	OBD
	131-0621-00		4						. CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	352-0200-00		1						. CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0200-00
-43			1						ELECTRON TUBE:CRF(SEE V840 EPL)		
-44	348-0352-00		4						PAD,CUSHIONING:CRF FRONT CORNER	80009	348-0352-00
-45	337-1865-00		1						SHLD,CONNECTOR:ECG,TOP	80009	337-1865-00
									(ATTACHING PARTS)		
-46	211-0007-00		2						SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
									- - - - *		
-47	131-1378-00		1						CONNECTOR,RCPT,:5 CONTACT	02660	MS3102A-14S-5S
									(ATTACHING PARTS)		
-48	213-0267-00		2						SCREW,MACHINE:4-24 X 0.375 INCH,PNH STL	83385	OBD
-49	210-0201-00		1						TERMINAL,LUG:SE #4	78189	2104-04-00-2520N
									- - - - *		
-50	348-0055-00		1						GROMMET,PLASTIC:0.25 INCH DIA	80009	348-0055-00
-51	337-1866-00		1						SHLD,CONNECTOR:ECG,BOTTOM	80009	337-1866-00
-52	342-0189-00		1						INSULATOR,CONN:ECG	80009	342-0189-00
									(ATTACHING PARTS)		
-53	213-0012-00		2						SCREW,MACHINE:4-40 X 0.375 INCH,FLH STL	83385	OBD
									- - - - *		
	175-0330-00		FT						CABLE,SP,ELEC:	80009	175-0330-00
	131-0621-00		3						CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	131-0792-00		1						CONTACT,ELEC:0.577"L,18-20 AWG WIRE	22526	46221
	352-0200-00		1						CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0200-00
-54	386-2593-00	B010100 B109999	1						SUBPANEL,FRONT:	80009	386-2593-00
	386-2593-01	B110000 B159999	1						SUBPANEL,FRONT:	80009	386-2593-01
	386-2593-02	B160000	1						SUBPANEL,FRONT:	80009	386-2593-02
									(ATTACHING PARTS)		
-55	210-0586-00		4						NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
									- - - - *		
-56	348-0366-00		2						FOOT:PUSH-IN MOUNTING	98388	4179/455
-57	355-0184-00		4						STUD,SNAP FSTNR:MALE	77132	BS-10370
									(ATTACHING PARTS)		
-58	211-0105-00		4						SCREW,MACHINE:4-40 X 0.188"100 DEG,FLH STL	83385	OBD
									- - - - *		
-59	342-0212-00		1						INSULATOR,FILM:TRANSISTOR	80009	342-0212-00
-60	390-0364-00	B010100 B139999	1						CABINET,TOP:	80009	390-0364-00
	390-0364-01	B140000	1						CABINET,TOP:	80009	390-0364-01
									(ATTACHING PARTS)		
-61	211-0565-00		4						SCREW,MACHINE:6-32 X 0.250 INCH,TRH STL	83385	OBD
									- - - - *		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-	390-0363-01			1		COVER, MONITOR: BOTTOM	80009	390-0363-01
	211-0008-00			8		. SCREW, MACHINE: 4-40 X 0.25 INCH, PNH STL	83385	OBD
	348-0089-00			4		. BUMPER, PLASTIC: BLACK VINYL	80009	348-0089-00
	348-0282-00			1		. BUMPER, PLASTIC: BLACK VINYL	80009	348-0282-00
	348-0414-00			2		. BUMPER, PLASTIC: PUSH	80009	348-0414-00
	348-0380-01			2		. FOOT: CABINET	80009	348-0380-01
	390-0363-00			1		. COVER, MONITOR: BOTTOM	80009	390-0363-00
-62	348-0414-00			2		BUMPER, PLASTIC: PUSH	80009	348-0414-00
-63	348-0089-00			1		BUMPER, PLASTIC: BLACK VINYL	80009	348-0089-00
-64	348-0380-01			4		FOOT: CABINET	80009	348-0380-01
						(ATTACHING PARTS)		
-65	211-0008-00			8		SCREW, MACHINE: 4-40 X 0.25 INCH, PNH STL	83385	OBD
	-----					----- * -----		
						. EACH FOOT INCLUDES:		
	348-0089-00			1		. BUMPER, PLASTIC: BLACK VINYL	80009	348-0089-00
-66	348-0282-00			1		STAND, ELEC EQPT:	80009	348-0282-00
-67	390-0363-00			1		CABINET, BOTTOM:	80009	390-0363-00
						(ATTACHING PARTS)		
-68	211-0565-00			4		SCREW, MACHINE: 6-32 X 0.250 INCH, TRH STL	83385	OBD
						----- * -----		
-69	344-0098-00			2		CLIP, DECORATIVE:	12136	OBD
						(ATTACHING PARTS)		
-70	212-0518-00	B010100	B110689	2		SCREW, MACHINE: 10-32 X 0.312 INCH, PNH STL	83385	OBD
	213-0089-00	B110690		2		SCREW, MACHINE: 10-32 X 0.375 INCH, HEX	74445	OBD
	210-0010-00	B110690		2		WASHER, LOCK: INT, 0.20 ID X 0.376" OD, STL	78189	1210-00-00-0541C
						----- * -----		
-71	367-0037-00			1		HANDLE, LUGGAGE:	12136	OBD
-72	131-1371-00			3		TERM., FEEDTHRU:	80009	131-1371-00
						(ATTACHING PARTS)		
-73	358-0176-00			3		INSULATOR, BSHG:	88245	421472
						----- * -----		
	175-0825-00			FT		WIRE, ELECTRICAL: 2 WIRE RIBBON	08261	OBD
	131-0621-00			2		CONTACT, ELEC: 0.577" L, 22-26 AWG WIRE	22526	75694-006
	352-0198-00			1		CONN BODY, PL, EL: 2 WIRE BLACK	80009	352-0198-00
-74	119-0441-00			1		BATTERY SET: FOUR CELLS	80009	119-0441-00
	119-0443-00 <sup>1</sup>			1		BATTERY SET: FOUR CELLS	80009	119-0443-00
						(ATTACHING PARTS)		
-75	211-0101-00			2		SCREW, MACHINE: 4-40 X 0.25" 100 DEG, FLH STL	83385	OBD
						----- * -----		
						. BATTERY PACK INCLUDES:		
-76	380-0329-00	B010100	B161669	1		. HOUSING, BTRY:	80009	380-0329-00
	380-0329-02	B161670		1		. HOUSING, BATTERY: W/BACKET	80009	380-0329-02
	380-0345-00 <sup>1</sup>	B010100	B161669	1		. HOUSING, BTRY:	80009	380-0345-00
	380-0345-02	B161670		1		. HOUSING, BATTERY: W/BACKET	80009	380-0345-02
						(ATTACHING PARTS)		
-77	210-0586-00			4		. NUT, PLAIN, EXT W: 4-40 X 0.25 INCH, STL	78189	OBD
						----- * -----		
-78	342-0190-00			1		. INSUL, BTRY PACK:	80009	342-0190-00
	342-0204-00 <sup>1</sup>			1		. INSUL, BTRY PACK:	80009	342-0204-00
	210-0202-00	XB016670		1		. TERMINAL, LUG: SE #6	78189	2104-06-00-2520N
-79	131-0621-00	B010100	B110589	4		. CONTACT, ELEC: 0.577" L, 22-26 AWG WIRE	22526	75694-006
	131-0707-00	B110590	B161669	4		. CONNECTOR, TERM.: 0.48" L, 22-26AWG WIRE	22526	75691-005
-80	352-0200-00	B010100	B110589	1		. CONN BODY, PL, EL: 4 WIRE BLACK	80009	352-0200-00
	204-0646-00	B110590	B161669	1		. CONN, PLUG, ELEC: FEMALE, 4 CONTACT	22526	65286-031
-81	175-0827-00	B010100	B161669	FT		. WIRE, ELECTRICAL: 4 WIRE RIBBON	08261	OBD
	162-0526-00	B010100	B161669X	FT		. INSUL, SLVG, ELEC: 4 INCHES	06090	OBD
	198-3394-00	B161670		1		. WIRE SET, ELEC:	80009	198-3394-00
	131-0707-00	B161670		4		. . CONNECTOR, TERM.: 0.48" L, 22-26AWG WIRE	22526	75691-005
	204-0646-00	B161670		1		. . BODY, CONN, RCPT: FOR 3 FEM CONT	22526	65486-005
	175-0827-00	B161670		FT		. . WIRE, ELECTRICAL: 4 WIRE RIBBON	08261	OBD
				1		. CKT BOARD ASSY: (SEE A4 EPL)		
	159-0145-00	XB161670		2		. . FUSE, CARTRIDGE: 15A, 32V, 10 SECONDS	75915	276015
-82	146-0023-00			4		. BATTERY, STORAGE: 1.2V, 4.4 AMP HR, NKL CD	19209	WGCW4.0 ST
	146-0024-00 <sup>1</sup>			4		. BATTERY, STORAGE: 1.2V, 7000 MAH	09823	7.OSC

<sup>1</sup>Option 3 only

Replaceable Mechanical Parts—408

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont					
1-83	200-1548-00	B010100	B161669	1	.	COVER,BTRY PACK:	80009	200-1548-00
	200-1548-01	B16670		1	.	COVER,BTRY PACK:D CELLS	80009	200-1548-01
	200-1570-00 <sup>1</sup>	B010100	B161669	1	.	COVER,BTRY PACK:	80009	200-1570-00
	200-1570-01	B161670		1	.	COVER,BTRY PACK:F CELLS	80009	200-1570-01
-84	334-2149-00			1	.	LABEL,INFO:CKT BOARD CAUTION	80009	334-2149-00
	334-2830-00	XB141230	B161819	1	.	MARKER,IDENT:MKD CANADIAN STD INFO	80009	334-2830-00
-85	334-2830-01	B161820		1	.	MARKER,IDENT:MARKED CANADIAN STANDARDS	80009	334-2830-01
	426-1034-00	B010100	B161799	1	.	FR ASSY,MONITOR:	80009	426-1034-00
	426-1034-01	B161800		1	.	FRAME ASSY,CAB.:	80009	426-1034-01
	-----			-	.	FRAME ASSY INCLUDES:		
	252-0603-00			FT	.	PLASTIC STRIP:0.125 X 0.25 INCH,ADH BACK	31343	OBD
	426-0997-01	B010100	B161799	2	.	FRAME,CABINET:FRONT-REAR	80009	426-0997-01
426-0997-02	B161800		2	.	FRAME SECT,CAB.:FRONT AND REAR	80009	426-0997-02	
426-1032-00	B010100	B161799	1	.	FR SECT,CAB:RIGHT	80009	426-1032-00	
426-1032-01	B161800		1	.	FRAME SECT,CAB.:RIGHT	80009	426-1032-01	
426-1033-00	B010100	B161799	1	.	FR SECT,CAB:LEFT	80009	426-1033-00	
426-1033-01	B161800		1	.	FRAME SECT,CAB.:LEFT	80009	426-1033-01	

<sup>1</sup>Option 3 only

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-1	348-0362-00	B010100	B162160	1		PAD,CUSHIONING:2 X 6 X 0.25 INCH,ADH BACK	80009	348-0362-00
	348-0559-00	B0162161		1		PAD,CUSHIONING:3.0 X 1.0 X 0.312,NPRN FOAM	80009	348-0559-00
-2	343-0432-00			1		RETAINER,CKT BD:	80009	343-0432-00
-3	366-1402-95			1		PUSH BUTTON:GRAY--I	80009	366-1402-95
-4	366-1402-96			1		PUSH BUTTON:GRAY-II	80009	366-1402-96
-5	366-1402-97			1		PUSH BUTTON:GRAY-III	80009	366-1402-97
-6	384-1099-00			3		EXTENSION SHAFT:PUSH BUTTON,1.54 INCH LONG	80009	384-1099-00
-7	129-0363-00			1		POST,ELEC-MECH:HEX.,0.25 X 0.436 INCH LONG (ATTACHING PARTS)	80009	129-0363-00
-8	211-0116-00	B010100	B141319	1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	129-0613-00	B141320		1		SPACER,POST:0.25 X 0.8 INCH LONG,4-40 THD	80009	129-0613-00
	211-0101-00			1		SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL -----*	83385	OBD
-9	348-0003-00			1		GROMMET,RUBBER:0.312 INCH DIAMETER	70485	1411B6040
-10	337-1816-00			1		SHIELD,ELEC:ECG FRONT (ATTACHING PARTS)	80009	337-1816-00
-11	211-0008-00			1		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL -----*	83385	OBD
-12	337-1817-00			1		SHIELD,ELEC:ECG REAR (ATTACHING PARTS)	80009	337-1817-00
-13	129-0338-00			1		POST,ELEC-MECH:HEX.,0.188 X 0.64 INCH LONG -----*	80009	129-0338-00
-14	-----			1		CKT BOARD ASSY:ECG(SEE A1 EPL)		
	-----			-		. CKT BOARD ASSY INCLUDES:		
-15	131-0589-00	B010100	B119999	18		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0589-00	B120000		22		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-16	131-1261-00			11		. CONTACT,ELEC:F-SHAPED	00779	1-380953-0
-17	136-0252-04	B010100	B119999	70		. SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
	136-0252-04	B120000		79		. SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
-18	136-0269-02	B010100	B119999	1		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C951401
-19	136-0514-00	B010100	B119999	7		. SOCKET,PLUG IN:MICROCIRCUIT,8 CONTACT	73803	C950802
	136-0514-00	B120000		8		. SOCKET,PLUG IN:MICROCIRCUIT,8 CONTACT	73803	C950802
-20	260-1545-00			1		. SWITCH,PUSH:ECG	80009	260-1545-00
-21	361-0384-00	B010100	B162406	4		. SPACER,PB SW:0.133 INCH LONG	80009	361-0384-00
	361-0385-00	B162407		4		. SPACER,PB SW:0.164 INCH LONG	80009	361-0385-00
-22	-----			1		CKT BOARD ASSY:ALARM LIMITS(SEE A2 EPL)		
	-----			-		. CKT BOARD ASSY INCLUDES:		
-23	131-0566-00			1		. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	L-2007-1
-24	131-0589-00	B010100	B079999	12		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0589-00	B080000		17		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-25	131-1261-00			10		. CONTACT,ELEC:F-SHAPED	00779	1-380953-0
	136-0220-00	XB080000	B141379	3		. SOCKET,PLUG-IN:3 PIN,SQUARE	71785	133-23-11-034
-26	136-0252-04	B010100	B141379	12		. SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
	136-0252-04	B141380		21		. SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
-27	136-0269-02			3		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C951401
-28	136-0514-00			4		. SOCKET,PLUG IN:MICROCIRCUIT,8 CONTACT	73803	C950802
-29	386-1558-00			1		. SPACER,CKT BOARD:PLASTIC	80009	386-1558-00
	162-0581-00			FT		INS,SLV,ELEC:7 INCH LONG	06090	OBD
	150-0123-01	XB110000		1		LAMP,CARTRIDGE:14V,0.023A,YELLOW LENS	55292	71326-06
	352-0198-00	XB110000		1		CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0198-00
	131-0621-00	XB110000		2		CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
-30	366-1161-52			1		PUSH BUTTON:GRAY--25	80009	366-1161-52
-31	366-1161-53			1		PUSH BUTTON:GRAY--50	80009	366-1161-53
-32	366-1161-54			1		PUSH BUTTON:GRAY--100	80009	366-1161-54
-33	366-1402-93			1		PUSH BUTTON:GRAY--POWER	80009	366-1402-93
-34	384-1099-00			3		EXTENSION SHAFT:PUSH BUTTON,1.54 INCH LONG	80009	384-1099-00
-35	384-1100-00			1		EXTENSION SHAFT:0.13 SQ X 6.215" LONG,PLSTC	80009	384-1100-00
-36	195-0125-00			1		LEAD,ELECTRICAL:HIGH VOLTAGE	80009	195-0125-00
-37	385-0014-00			1		INSULATOR,STDF:0.781 INCH DIA,TAPPED 4-40 (ATTACHING PARTS)	80009	385-0014-00
-38	211-0116-00			1		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS -----*	83385	OBD

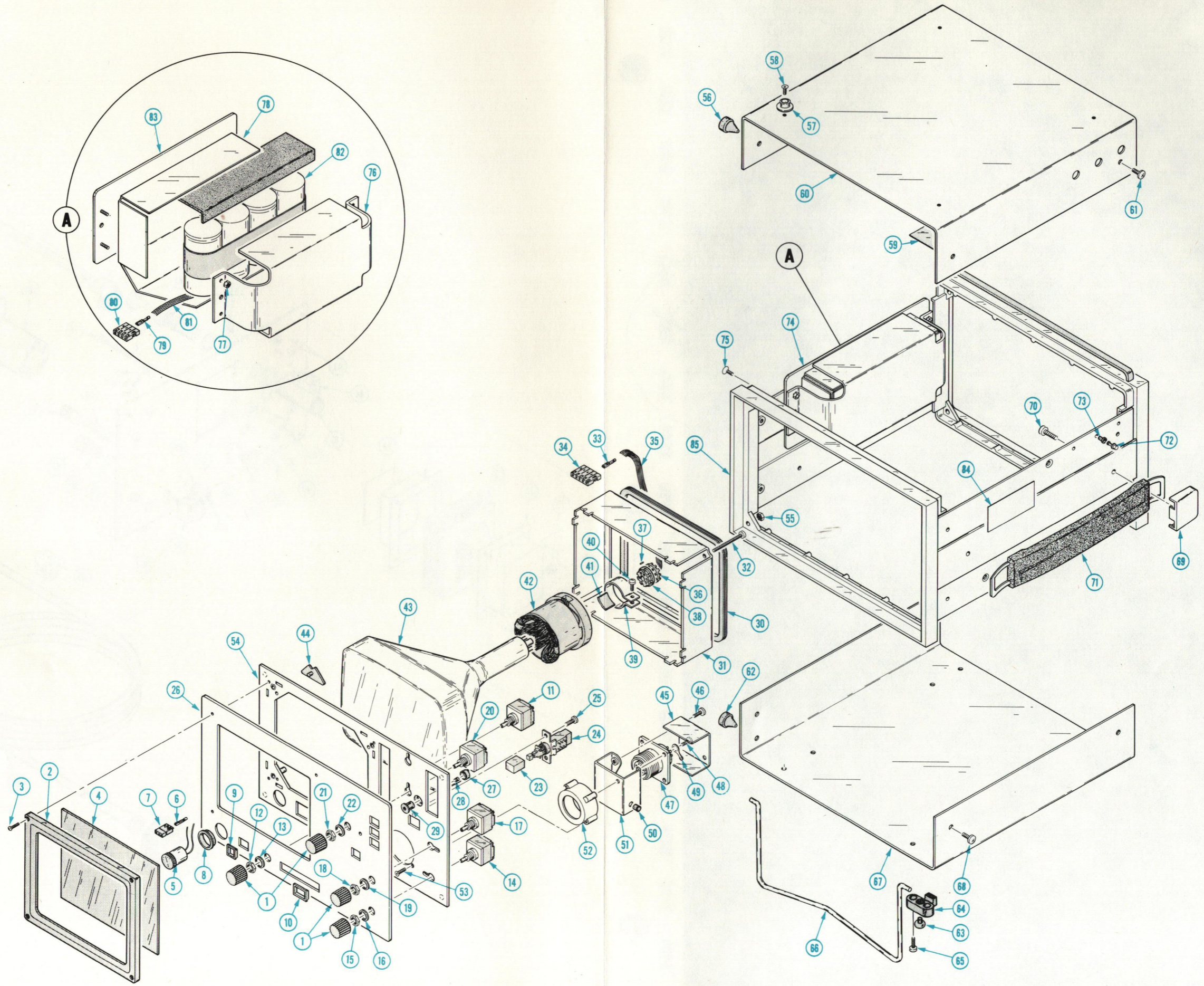
Replaceable Mechanical Parts—408

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-39	-----	-----		4		TRANSISTOR:(SEE Q714,Q716,Q746,Q748 EPL) (ATTACHING PARTS)		
-40	211-0578-00			4		SCREW,MACHINE:6-32 X 0.438 INCH,PNH STL	83385	OBD
-41	210-0071-00			4		WASHER,SPR TNSN:0.146 ID X 0.323" OD,STL	78189	4706-05-01-0531
-42	210-0457-00			4		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
						-----*		
-43	342-0194-00			2		INSULATOR,PLATE:TRANSISTOR	80009	342-0194-00
-44	214-1867-00			1		HEAT SINK,ELEC: (ATTACHING PARTS)	80009	214-1867-00
	211-0038-00			2		SCREW,MACHINE:4-40 X 0.312"100 DEG,FLH STL	83385	OBD
						-----*		
-45	-----	-----		1		CKT BOARD ASSY:MAIN(SEE A3 EPL) (ATTACHING PARTS)		
-46	211-0116-00			5		SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
						-----*		
-47	131-0566-00	B010100	B109999	3		. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	L-2007-1
	131-0566-00	B110000		4		. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	L-2007-1
-48	131-0589-00	B010100	B079999	39		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0589-00	B080000		40		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0608-00	B010100	B079999	12		. CONTACT,ELEC:0.365 L X 0.25 PH BRZ GOLD PL	22526	47357
	131-0608-00	B080000		22		. CONTACT,ELEC:0.365 L X 0.25 PH BRZ GOLD PL	22526	47357
-49	136-0252-04			72		. SOCKET,PIN TERM:0.188 INCH LONG	22526	75060
-50	136-0269-02			4		. SOCKET,PLUG-IN:14 CONTACT,LOW CLEARANCE	01295	C951401
-51	136-0393-00			1		. SOCKET,PLUG-IN:16 PIN	77342	27E129
-52	136-0514-00			4		. SOCKET,PLUG IN:MICROCIRCUIT,8 CONTACT	73803	C950802
-53	136-0558-00			2		. SOCKET,PLUG-IN:6 CONTACT	00779	5-380949-6
-54	136-0559-00			2		. SOCKET,PLUG-IN:10 PIN,FEMALE	00779	6-380949-0
	214-2283-00	XB080385		FT		. INSUL,TAPE ELEC:CKT CARD,5000V L TERM	80009	214-2283-00
-55	214-0539-00			1		. RTNR,ELEC RELAY:	02288	T154CC-CC30040
-56	260-1486-00			1		. SWITCH,PUSH:	80009	260-1486-00
-57	361-0411-00			2		. SPACER,PUSH SW:0.13 W X 0.375 INCH L,PLSTC	71590	J64285-00
-58	260-1572-00			1		. SWITCH,PUSH:	80009	260-1572-00
-59	361-0542-00	B010100	B162406	4		. SPACER,SWITCH:PLASTIC	71590	J-64281
	361-0411-00	B162407		4		. SPACER,PUSH SW:0.13 W X 0.375 INCH L,PLSTC	71590	J64285-00
-60	354-0366-00	B010100	B149999	1		RING,RETAINING:LOUDSPEAKER	80009	354-0366-00
	352-0449-00	B150000		1		HOLDER,SPEAKER:0.66 X 2.07 INCHES (ATTACHING PARTS)	80009	352-0449-00
						-----*		
-61	211-0507-00	B010100	B149999	3		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
	211-0101-00	B150000		2		SCREW,MACHINE:4-40 X 0.25" 100 DEG,FLH STL	83385	OBD
						-----*		
-62	119-0131-00	B010100	B149999	1		LOUDSPEAKER,PM:2.25 OD,VC 100 OHM	74199	22A06Z100
	119-0716-02	B150000		1		LOUDSPEAKER,PM:WITH CABLE	80009	119-0716-02
	175-0825-00			FT		WIRE,ELECTRICAL:2 WIRE RIBBON	08261	OBD
	131-0621-00			2		CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	352-0198-00			1		CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0198-00
-63	334-2149-00			2		LABEL,INFO:CAUTION,CKT BD	80009	344-2149-00
-64	441-1159-00	B010100	B151529	1		CHASSIS,MONITOR:	80009	441-1159-00
	441-1159-02	B151530		1		CHASSIS,MONITOR:W/SHIELD (ATTACHING PARTS)	80009	441-1159-02
	211-0038-00			4		SCREW,MACHINE:4-40 X 0.312"100 DEG,FLH STL	83385	OBD
	210-0586-00	B010100	B151529X	4		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
	210-0457-00	B010100	B151529X	4		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL	83385	OBD
	220-0780-00	XB151530		1		NUT PLATE:4.312 X 0.312 X 0.063	80009	220-0780-00
	220-0781-00	XB151530		1		NUT PLATE:3.125 X 0.312 X 0.063	80009	220-0781-00
						-----*		
-65	131-0988-00	B010100	B110609	1		CONN,PLUG,ELEC:3 COND MALE,15A,125V	71183	5266-N
	131-1703-00	B110610		1		CONN,PLUG,ELEC:3 COND MALE,W/HOSP GND,15A		
-66	200-0860-00	B010100	B110609X	1		CABLE NIPPLE,EL:2 INCH L,MOLDED BLACK VINYL	80009	200-0860-00
-67	343-0439-00			1		RTNR,CA TO CA:	80009	343-0439-00
-68	175-1415-01			1		CABLE,ELEC:3 COND,18AWG,TYPE SJT	80009	175-1415-01
-69	358-0491-00	B010100	B040259	1		BSHG,STRAIN RLF:RIGHT ANGLE	28520	SR-11-2

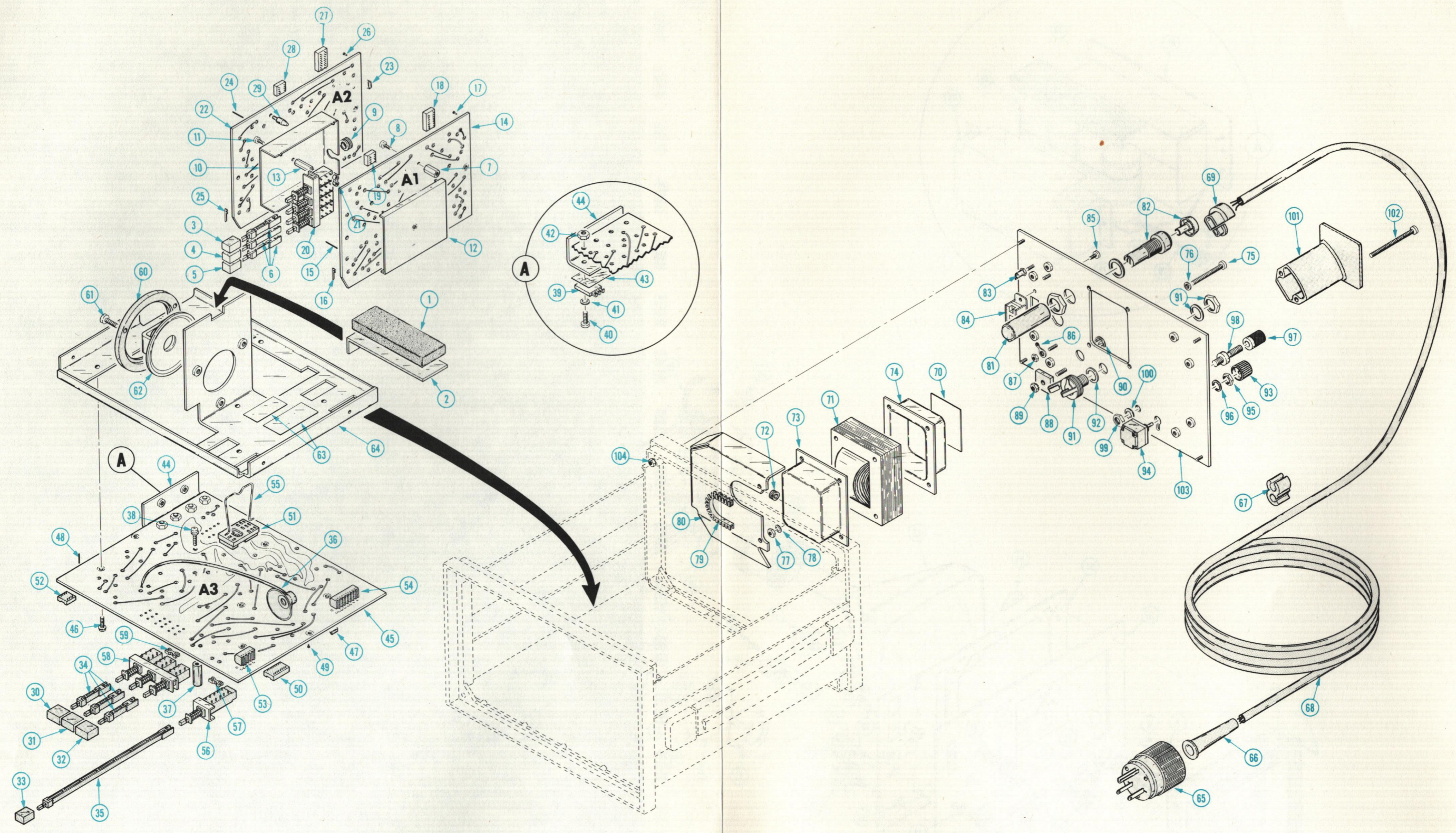
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	343-0440-00	B040260		1		RETAINER,CABLE:STRAIN RELIEF (ATTACHING PARTS)	80009	343-0440-00
	211-0018-00	B040260		2		SCREW,MACHINE:4-40 X 0.875 PNH,STL -----*	83385	OBD
	200-1561-00	B040260		1		CA NIPPLE,ELEC:1.5 INCH LONG,RUBBER	80009	200-1561-00
-70	334-2124-00			1		LABEL,IDENT:SERIAL NUMBER	80009	334-2124-00
-71	120-0866-00	B010100	B079999	1		XFMR,PWR,STPDN:	80009	120-0866-00
	120-0866-01	B080000		1		XFMR,PWR,STPDN: - . TRANSFORMER INCLUDES:	80009	120-0866-01
-72	348-0003-00			2		. GROMMET,RUBBER:0.312 INCH DIAMETER	70485	1411B6040
-73	200-0105-02			1		. COVER,XFMR:WITH TWO 0.312 INCH DIA HOLES	80009	200-0105-02
-74	200-0105-01			1		. COVER,XFMR:	80009	200-0105-01
-75	211-0553-00			4		. SCREW,MACHINE:6-32 X 1.5 INCH,PNH STL	83385	OBD
-76	210-0823-00	B010100	B089999	4		. WASHER,NONMETAL:0.125 ID X 0.25"OD,FIBER	74921	OBD
	210-0006-00	B090000		3		. WASHER,LOCK:INTL,0.146 IDX 0.288 OD,STL	78189	1206-00-00-0541C
	210-0202-00	B090000		1		. TERMINAL,LUG:SE #6	78189	2104-06-00-2520N
-77	210-0407-00			4		. NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
-78	210-0006-00			4		. WASHER,LOCK:INTL,0.146 IDX 0.288 OD,STL	78189	1206-00-00-0541C
-79	255-0334-00			FT		PLASTIC CHANNEL:	11897	122-37-2500
-80	337-1812-00	B010100	B079999	1		SHLD,ELECTRICAL:	80009	337-1812-00
	337-1812-01	B080000		1		SHLD,ELECTRICAL:	80009	337-1812-01
-81	200-0237-01	B010100	B161629	1		INS HOOD,INS:FUSE HOLDER,BLACK PLASTIC	80009	200-0237-01
	200-0237-03	B161630		1		COVER,FUHLR:	80009	200-0237-03
-82	352-0362-00			1		FUSEHOLDER: W/MOUNTING HARDWARE	75915	345001
-83	131-0775-00			2		CONTACT,ELEC:HEX,0.25 INCH W/6-32 1 END	88245	1601-A
-84	260-1300-01			1		SWITCH,SLIDE:DPDT,3A,125V (ATTACHING PARTS)	82389	11A-1354
-85	211-0007-00			2		SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL -----*	83385	OBD
-86	210-0201-00			1		TERMINAL,LUG:SE #4 (ATTACHING PARTS)	78189	2104-04-00-2520N
-87	210-0551-00			1		NUT,PLAIN,HEX.:4-40 X 0.25 INCH,STL -----*	83385	OBD
-88	-----			2		SEMICONV DEVICE:(SEE CR703,CR704 EPL) (ATTACHING PARTS)		
-89	210-0457-00			2		NUT,PLAIN,EXT W:6-32 X 0.312 INCH,STL -----*	83385	OBD
	131-0621-00			4		CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	352-0203-00			1		CONN BODY,PL,EL:7 WIRE BLACK	80009	352-0203-00
-90	134-0026-00			1		BUTTON,PLUG:FOR 0.375" HOLE	80112	1711-M
-91	131-0267-00	B010100	B109999	1		PLUG TELEPHONE:3 CONDUCTOR	72653	33-708
	131-0267-00	B110000		2		PLUG TELEPHONE:3 CONDUCTOR	72653	33-708
-92	210-0012-00	B010100	B109999	1		WASHER,LOCK:INTL,0.375 ID X 0.50" OD STL	78189	1220-02-00-0541C
	210-0012-00	B110000		2		WASHER,LOCK:INTL,0.375 ID X 0.50" OD STL -----*	78189	1220-02-00-0541C
	175-0825-00	XB110000	B151380X	FT		WIRE,ELECTRICAL:2 WIRE RIBBON	08261	OBD
	131-0621-00	XB110000		2		CONTACT,ELEC:0.577"L,22-26 AWG WIRE	22526	75694-006
	352-0199-00	XB110000		1		CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0199-00
	131-0707-00			1		CONNECTOR,TERM.:0.48" L,22-26AWG WIRE	22526	75691-005
	352-0171-00			1		CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
-93	366-1495-00			1		KNOB:GRAY	80009	366-1495-00
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-94	-----			1		RES.,VAR,NONWIR:(SEE R695 EPL) (ATTACHING PARTS)		
-95	210-0583-00			1		NUT,PLAIN,HEX.:0.25-32 X 0.312 INCH,BRS	73743	2X20224-402
-96	210-0940-00			1		WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL -----*	79807	OBD
-97	200-0072-00			1		NUT,PLAIN,KNURL:BINDING POAST CAP	80009	200-0072-00
-98	355-0503-00			1		STUD,SHOULDERED:BINDING POST STEM (ATTACHING PARTS)	80009	355-0503-00
-99	210-0410-00			1		NUT,PLAIN,HEX.:10-32 X 0.312 INCH,BRS	73743	2X20003-402
-100	210-0010-00			1		WASHER,LOCK:INT,0.20 ID X0.376" OD,STL -----*	78189	1210-00-00-0541C

Replaceable Mechanical Parts—408

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont					
2-101	348-0359-00	B010100	B161869	4		FOOT:CORD WRAP	80009	348-0359-00
	348-0359-01	B161870		1		FOOT,CABINET:SILVER GRAY,PLASTIC (ATTACHING PARTS)	80009	348-0359-01
-102	211-0552-00			8		SCREW,MACHINE:6-32 X 2 INCH,PNH STL - - - * - - -	83385	OBD
-103	386-2597-00	B010100	B080384	1		PANEL,REAR:	80009	386-2597-00
	386-2597-01	B080385	B109999	1		PANEL,REAR:	80009	386-2597-01
	386-2597-02	B110000		1		PANEL,REAR: (ATTACHING PARTS)	80009	386-2597-02
-104	210-0586-00			4		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL - - - * - - -	78189	OBD







## ACCESSORIES

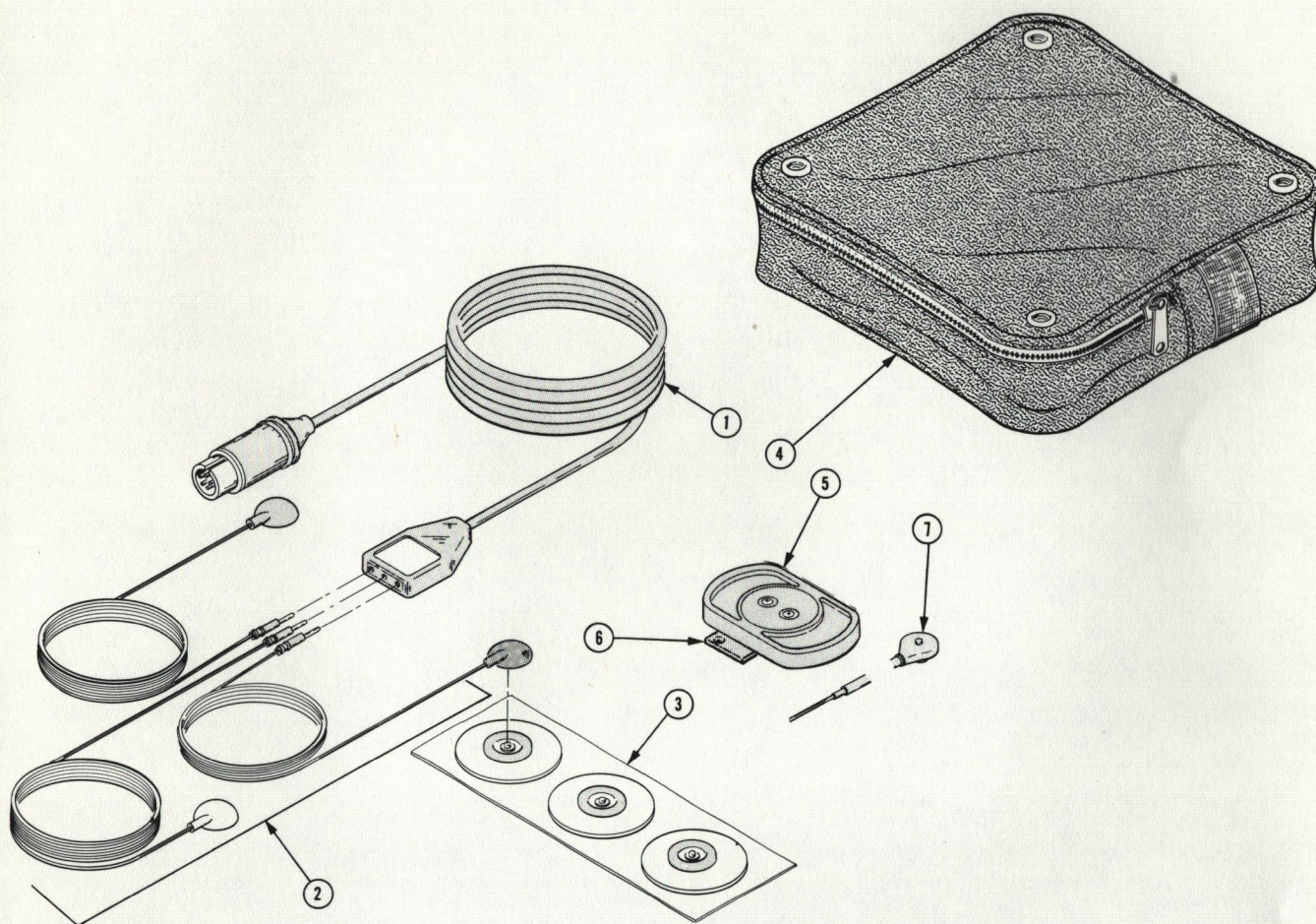


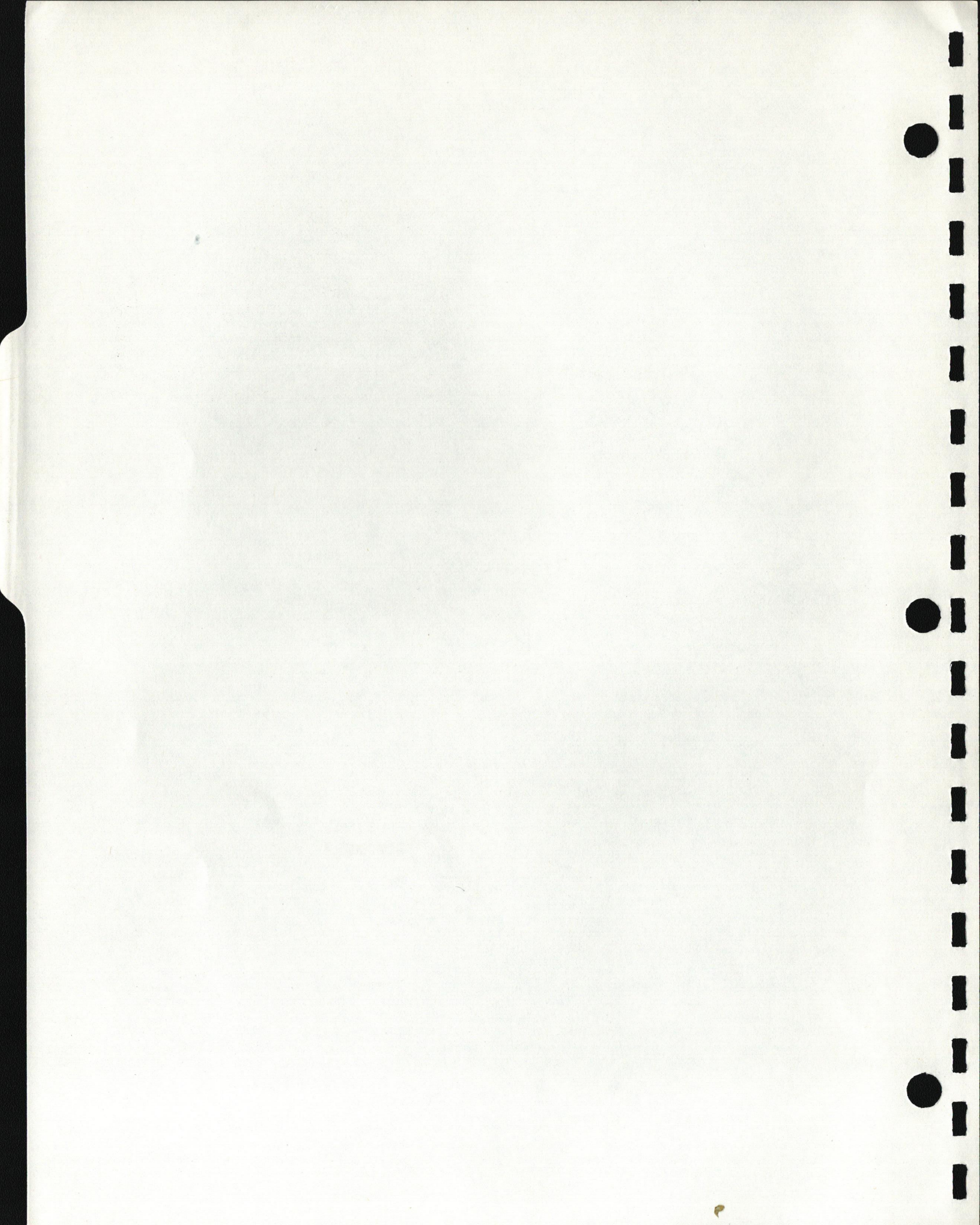
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
-1	012-0445-00			1						CABLE ASSEMBLY: PATIENT	04919	A-2576-B
	012-0459-00			1						CABLE ASSEMBLY: PATIENT	80009	012-0459-00
-2	012-0502-00			2						LEAD, SET ELEC: SET OF THREE	02318	65375-760
-3	119-0353-00			3						ELECTRODE PAD: PACKAGE OF THREE	02318	65375-030
-4	016-0560-00			1						POUCH, ACCESSORY:	80009	016-0560-00
-5	014-0050-00	B010100	B120948	1						ADAPTER, MTG:	80009	014-0050-00
	014-0054-00		B120949	1						ADAPTER, MT:	80009	014-0054-00
-6	386-2657-00	B010100	B120549	1						PLATE, TRNR MTG:	80009	386-2657-00
	386-3536-00		B120550	1						PLATE, TRNR MTG:	80009	386-3536-00
-7	103-0110-00			3						ADPTR, TEST LEAD:	80009	103-0110-00
	159-0044-00	XB080000		1						FUSE, CARTRIDGE: 0.2A MED	71400	MDL2-10
	070-1522-00			1						MANUAL, TECH: OPERATORS (NOT SHOWN)	80009	070-1522-00
	070-1525-00			1						MANUAL, TECH: SERVIC (NOT SHOWN)	80009	070-1525-00

### OPTIONAL ACCESSORIES

020-0078-00

1 EXTENDER SET: SERVICING (NOT SHOWN)

80009 020-0078-00



# 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 01—BATTERY-PACK AND METER DELETED

A plastic plug (134-0144-00) is added to cover the BATTERY meter hole and nomenclature on the front panel.

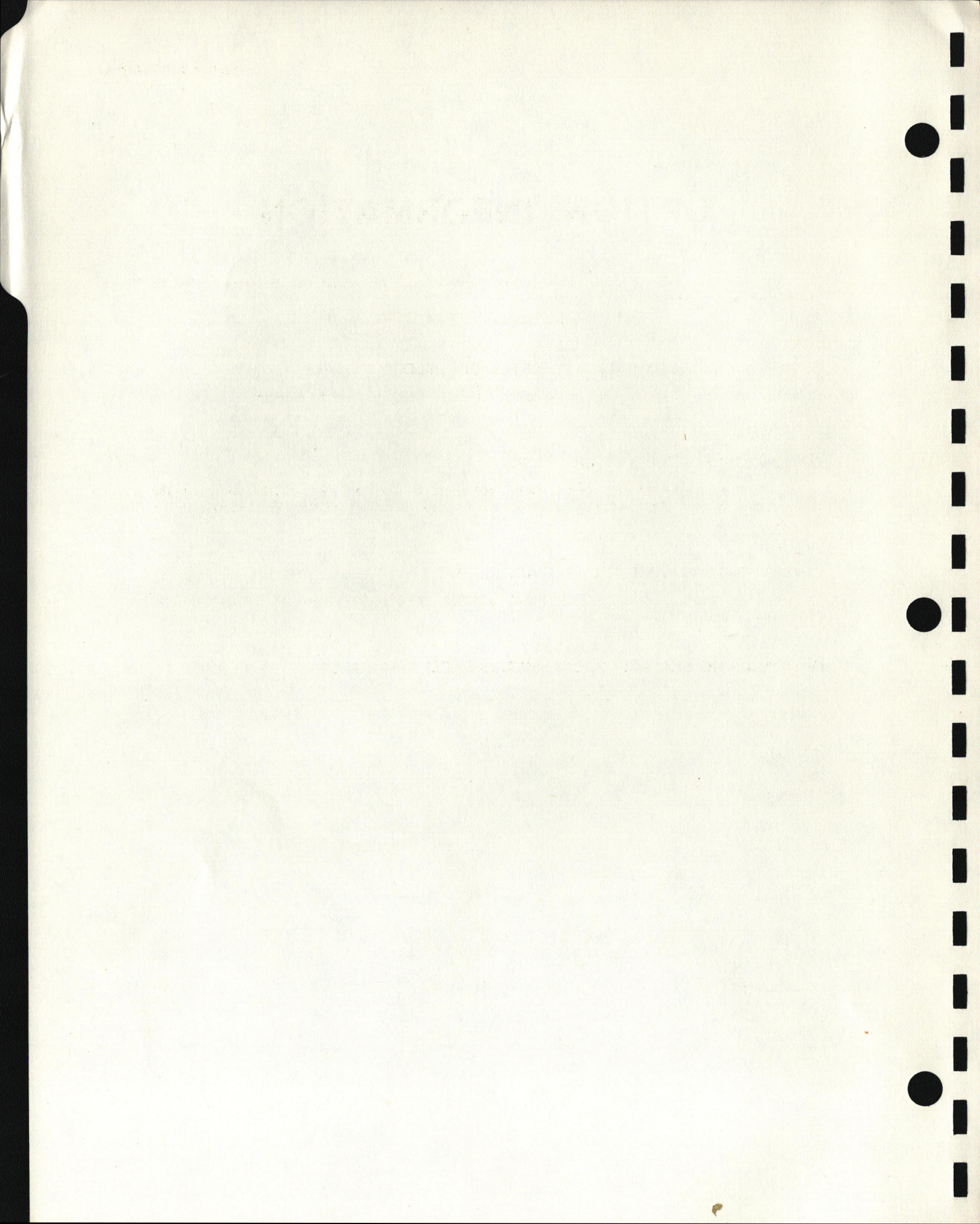
## OPTION 03—"F" CELL BATTERY-PACK

Battery case parts and batteries were changed. R716 was changed from 2.2  $\Omega$  to 1.1  $\Omega$  to increase the charging current from about 400 mA to about 700 mA. See Electrical and Mechanical Parts Lists for replaceable parts.

## OPTION 13—LIMB PATIENT CABLE ACCESSORIES

Standard accessories include 012-0459-00 and (3) 103-0110-00 instead of 012-0445-00, (2) 012-0446-00, (2) 012-0447-00 and (2) 012-0448-00.

## OPTION 15—NO STANDARD ACCESSORIES EXCEPT MANUALS



## **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

Comparison of Main Characteristics		
DM 501 replaces 7D13		
PG 501 replaces 107	PG 501 - Risetime less than 3.5 ns into 50 $\Omega$ .	107 - Risetime less than 3.0 ns into 50 $\Omega$ .
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 - $\pm 5$ V output.	114 - $\pm 10$ V output. Short proof output.
115	PG 501 - Does not have Paired, Burst, Gated, or Delayed pulse mode; $\pm 5$ V dc Offset. Has $\pm 5$ V output.	115 - Paired, Burst, Gated, and Delayed pulse mode; $\pm 10$ 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 - $\pm 5$ V output	114 - $\pm 10$ V output. Short proof output.
115	PG 502 - Does not have Paired, Burst, Gated, Delayed & Undelayed pulse mode; Has $\pm 5$ V output.	115 - Paired, Burst, Gated, Delayed & Undelayed pulse mode; $\pm 10$ V output. Short-proof output.
2101	PG 502 - Does not have Paired or Delayed pulse. Has $\pm 5$ 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, 067-0532-01		
	SG 503 - Amplitude range 5 mV to 5.5 V p-p.	190B - Amplitude range 40 mV to 10 V p-p.
	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		
	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 $\mu$ s. 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.
181	TG 501 - Marker outputs, 5 sec to 1 ns. Sinewave available at 5, 2, and 1 ns.	181 - Marker outputs, 1, 10, 100, 1000, and 10,000 $\mu$ s, plus 10 ns sinewave.
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.	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 $\mu$ 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 $\mu$ s.
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.	2901 - Marker outputs, 5 sec to 0.1 $\mu$ s. Sinewave available to 50, 10, and 5 ns. Separate trigger pulses, from 5 sec to 0.1 $\mu$ s. 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.

# MANUAL CHANGE INFORMATION

PRODUCT 408 Service  
070-1525-00

CHANGE REFERENCE C4/178  
DATE 1-23-78

CHANGE:	DESCRIPTION
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TEXT CORRECTION

Page 5-8, left column, Step 13 b.

CHANGE:

- b. CHECK - Pulse duration at TP388 is  $150 \pm 25$  ms ( $200 \pm 25$  ms in instruments below serial number B142005); see Fig. 5-8.

CHANGE:

Fig. 5-8 to show  $150 \pm 25$  ms pulse instead of the  $200 \pm 25$  ms pulse.

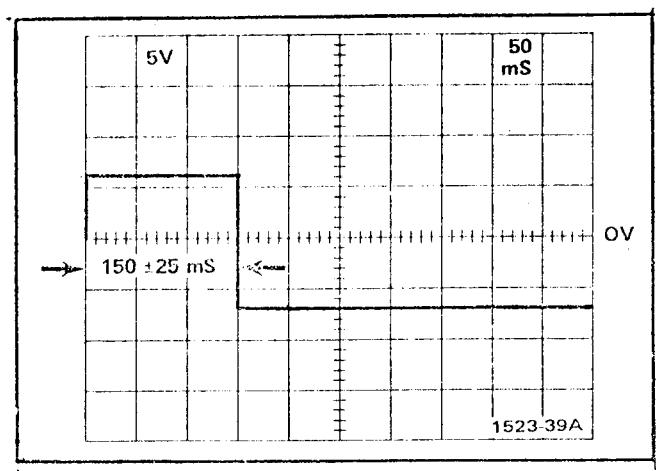


Fig. 5-8 QRS Width.



המנהל הכללי של המבחן



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## MANUAL CHANGE INFORMATION

PRODUCT 400, 401, 408, 412  
413 & 414 SERVICE MANUALS

CHANGE REFERENCE C8/378

DATE 3-15-78

CHANGE:

DESCRIPTION

### BATTERY USE AND CARE

THIS INFORMATION SUPERSEDES ALL SIMILAR INFORMATION  
CONTAINED ELSEWHERE IN THIS MANUAL

#### CONTENTS OF THIS SECTION:

1. BATTERY CHARGING INSTRUCTIONS AND RELATED INFORMATION,
2. INSTRUCTIONS FOR A PERIODIC BATTERY-OPERATING-TIME TEST WHICH THE USER SHOULD PERFORM,
3. A CHART WHICH SHOWS THE BATTERY CHARGING AND OPERATING TIMES APPROPRIATE FOR VARIOUS MONITORS, AND
4. A MAINTENANCE PLAN FOR QUALIFIED SERVICE PERSONNEL.

#### 1. BATTERY CHARGING INSTRUCTIONS

- A. 16 HOURS MINIMUM ARE REQUIRED TO RECHARGE A DEPLETED BATTERY. CONNECT THE LINE CORD PLUG TO A "HOSPITAL GRADE" AC OUTLET.

LONGER CHARGING TIME IS REQUIRED UNDER CERTAIN CIRCUMSTANCES. SEE THE TIME CHART ON A LATER PAGE OF THIS SECTION.

- B. CHARGE IN A COOL PLACE; PREFERABLY NO WARMER THAN  $+22^{\circ}\text{C}$  ( $\approx +72^{\circ}\text{F}$ ).

HIGHER TEMPERATURES PREVENT THE BATTERY FROM ACCEPTING MAXIMUM CHARGE. LONGER CHARGING TIME WILL ONLY PARTIALLY COMPENSATE FOR A HIGH TEMPERATURE. NO CHARGING WILL OCCUR WHEN THE TEMPERATURE EXCEEDS  $+40^{\circ}\text{C}$  ( $+104^{\circ}\text{F}$ ).

MAXIMUM BATTERY OPERATING TIME IS OBTAINED WHEN CHARGING IS DONE WITH THE MONITOR TURNED

CHANGE:	DESCRIPTION
	<p>OFF AND IN A COOL PLACE. WITH THE MONITOR OFF, THE INTERNAL TEMPERATURE WILL BE LOWER.</p> <p>C. AVOID EXCESSIVE CHARGING.</p> <p>IF THE MONITOR IS NOT BEING USED, TURN IT OFF. UNPLUG IT FROM THE AC OUTLET WHEN THE BATTERY IS FULLY CHARGED.</p> <p>THE BATTERY WILL GRADUALLY DISCHARGE ITSELF OVER A TWO TO SIX MONTH PERIOD AND WILL, THEREFORE, REQUIRE RECHARGING WHEN IT IS AGAIN PLACED INTO USE.</p> <p>APPLICATIONS, SUCH AS USE IN INTENSIVE CARE, MAY REQUIRE CONTINUOUS USE AND, THEREFORE, WILL REQUIRE THE MONITOR TO BE CONTINUOUSLY CONNECTED TO AN AC OUTLET. WEEKS OR MONTHS OF EXCESSIVE CHARGING RESULT. WHEN NEXT USED ON BATTERY, THE OPERATING TIME MAY BE SIGNIFICANTLY LESS THAN THE LISTED, TYPICAL AMOUNT.</p> <p>2. BATTERY OPERATING TIME TEST</p> <p>OCCASIONALLY CHECK OPERATING TIME AS FOLLOWS:</p> <p>A. CHARGE FULLY. SEE THE TIME CHART ON A LATER PAGE OF THIS SECTION.</p> <p>B. OPERATE MONITOR ON BATTERY UNTIL AUTOMATIC SHUTDOWN OCCURS.</p> <p>C. NOTE THE OPERATING TIME.</p> <p>IF THE OPERATING TIME IS SIGNIFICANTLY LESS THAN LISTED ON THE CHART AND BECOMES, THEREFORE, UNSUITABLE FOR YOUR APPLICATION, REFER THE MONITOR FOR SERVICE.</p>

TEKTRONIX MEDICAL MONITORS  
BATTERY CHARGING AND OPERATING TIMES

MONITOR TYPE	CHARGING HOURS @ 20-25°C AMBIENT			OPERATING HOURS <sup>①②</sup>		
	D-CELL BATTERY	F-CELL BATTERY		D-CELL BATTERY	F-CELL BATTERY	
	EITHER OPERATING OR NOT	NOT OPERATING	FULLY OPERATING	TYPICAL	TYPICAL	
408 MONITOR	16	16	18	3.5	5.6	
w/400 RECORDER	③	16	20④			5.3④
w/400 RECORDER	③	16	26⑤			4.6⑤
412 MONITOR	16	16	18	2.5	4.0	
w/400 RECORDER	③	16	20④			3.8④
w/400 RECORDER	③	16	26⑤			3.3⑤
413 MONITOR	16	16	18	1.6	2.6	
w/400 RECORDER	③	16	20④			2.5④
w/400 RECORDER	③	16	26⑤			2.3⑤
w/401 DRM	③	16	50			1.9
w/BOTH 400 & 401	③	16	⑦			1.8④
414 MONITOR	16	16	18	1.7	2.7	
w/400 RECORDER	③	16	20④			2.6④
w/400 RECORDER	③	16	26⑤			2.4⑤
w/400 RECORDER	③	16	22⑥			2.5⑥
w/401 DRM	③	16	50			2.1
w/BOTH 400 & 401	③	16	⑦			2.0④

Footnotes:

1. Operating times listed are for new battery packs which have been charged while the monitor is turned off. For battery packs charged while the monitor was operating, reduce the listed time by about one-third.
2. Operating times listed assume that all monitor capabilities are being used and with typical trace positions and sizes.
3. Combination not recommended.
4. With Recorder producing four 14-second strips per hour.
5. With Recorder producing twenty 14-second strips per hour.
6. With Option 3 Recorder producing four 28-second strips per hour.
7. Monitor can be operating, but either or both the Recorder or DRM must be turned off for charging to take place.

CHANGE:	DESCRIPTION
	<p data-bbox="170 262 462 304">4. MAINTENANCE</p> <p data-bbox="243 325 1347 420">THE FOLLOWING PROCEDURES ARE TO BE PERFORMED BY QUALIFIED SERVICE PERSONNEL ONLY.</p> <p data-bbox="243 441 1347 535">WHEN A BATTERY PROVIDES SIGNIFICANTLY LESS THAN THE RATED OPERATING TIME, THERE ARE THREE ALTERNATIVES:</p> <ul data-bbox="324 556 1104 693" style="list-style-type: none"><li>A. REPLACE IT WITH A NEW BATTERY, OR</li><li>B. ATTEMPT TO REJUVENATE THE BATTERY, OR</li><li>C. CONTINUE TO USE THE BATTERY, AS IS.</li></ul> <p data-bbox="243 745 1445 934">ATTEMPTED REJUVENATION CARRIES THE RISK THAT ONE OR MORE CELLS MAY BECOME SHORT CIRCUITED INTERNALLY AND MUST THEN BE REPLACED. THIS RISK IS OF LITTLE CONSEQUENCE IF IT HAS ALREADY BEEN DECIDED THAT THE BATTERY CAN NO LONGER BE USED.</p> <p data-bbox="243 997 730 1039">REJUVENATION CONSISTS OF:</p> <ul data-bbox="324 1060 682 1249" style="list-style-type: none"><li>A. DEEP DISCHARGE</li><li>B. RECHARGE</li><li>C. DEEP DISCHARGE</li><li>D. RECHARGE</li></ul> <p data-bbox="243 1302 1445 1491">THIS PROCEDURE SHOULD CORRECT ANY ACCUMULATED CHARGE IMBALANCE AND REFORM THE CRYSTALLINE STRUCTURE OF THE CELL PLATES. IF ADEQUATE OPERATING TIME IS NOT RESTORED, THE BATTERY SHOULD BE REPLACED.</p> <p data-bbox="243 1543 1445 1827">DEEP DISCHARGE IS ACCOMPLISHED BY CONNECTING A RESISTOR ACROSS THE BATTERY. RESISTOR VALUE SHOULD BE ABOUT TEN OHMS AND THE POWER RATING SHOULD BE AT LEAST FIVE WATTS (TEK PART No. 308-0399-00). THE RESISTOR WILL GET HOT, SO TAKE APPROPRIATE PRECAUTIONS. THE RESISTOR SHOULD REMAIN CONNECTED UNTIL THE BATTERY VOLTAGE DROPS BELOW ONE VOLT.</p>

CHANGE:	DESCRIPTION						
	<p>BATTERY RECHARGING CAN, OF COURSE, BE ACCOMPLISHED THROUGH IT'S MONITOR, BUT YOUR MONITORS NEED NOT BE KEPT IN THE MAINTENANCE AREA WHILE THIS REJUVENATION IS PERFORMED. THE MONITOR CAN BE USED ON AC LINE WITHOUT A BATTERY INSTALLED (UNLESS THE MONITOR IS EQUIPPED WITH A 400 RECORDER AND/OR A 401 DIGITAL READOUT MODULE). HOWEVER, THIS MAY BE INCOMPATIBLE WITH THE USER'S NEEDS.</p> <p>RECHARGING SHOULD BE DONE WITH A RELATIVELY CONSTANT CURRENT SOURCE, NOT A VOLTAGE SOURCE AS WITH LEAD-ACID BATTERIES. THIS CAN BE ACCOMPLISHED BY PUTTING A SUITABLE RESISTOR IN SERIES WITH A POWER SUPPLY. THE PACK VOLTAGE WILL RANGE FROM AS LOW AS 4.6 VOLTS DURING THE LATTER PHASE OF DISCHARGING TO AS HIGH AS 6 VOLTS DURING THE LATTER PHASE OF CHARGING.</p> <p>THE RECOMMENDED CHARGING CURRENTS FOR THIS PURPOSE ARE:</p> <table data-bbox="292 1081 1291 1270"><tr><td>D - CELLS</td><td>250 TO 350 mA</td><td>(BATTERY PACK - TEK PART No.: 119-0441-01)</td></tr><tr><td>F - CELLS</td><td>400 TO 600 mA</td><td>(BATTERY PACK - TEK PART No.: 119-0443-01)</td></tr></table> <p>THE FOLLOWING IS RECOMMENDED. BUY EXTRA BATTERY PACKS, PERHAPS ONE EXTRA FOR EACH FIVE MONITORS IN USE. IF YOU USE BOTH "D" AND "F" CELL BATTERIES, THEY MUST BE CONSIDERED SEPARATELY. PUT A NEW BATTERY IN THE MONITOR AND RETURN IT FOR USE WHILE THE REJUVENATION PROCEDURE IS PERFORMED. (NOTE: MONITORS EQUIPPED WITH D-CELL PACKS CAN BE CONVERTED TO F-CELL PACKS BY INSTALLING AN F-CELL MOD KIT - TEK PART No.: 040-0710-00).</p> <p>IT IS SUGGESTED THAT EACH BATTERY PACK BE MARKED WITH AN IDENTIFYING NUMBER AND THAT BATTERY SERVICE RECORDS BE KEPT.</p>	D - CELLS	250 TO 350 mA	(BATTERY PACK - TEK PART No.: 119-0441-01)	F - CELLS	400 TO 600 mA	(BATTERY PACK - TEK PART No.: 119-0443-01)
D - CELLS	250 TO 350 mA	(BATTERY PACK - TEK PART No.: 119-0441-01)					
F - CELLS	400 TO 600 mA	(BATTERY PACK - TEK PART No.: 119-0443-01)					

CHANGE:	DESCRIPTION
	<p>BATTERY PACKS WHICH FAIL TO REJUVENATE MAY BE REPAIRABLE BY REPLACING THE DEFECTIVE CELL(S). THERE ARE SEVERAL THINGS TO KEEP IN MIND WHEN REPLACING CELLS:</p> <ol style="list-style-type: none"><li>1. REPLACE CELLS WHICH FAIL TO DELIVER AT LEAST 75% OF THEIR LISTED, TYPICAL OPERATING TIME.</li><li>2. WHEN A BATTERY PACK HAS BEEN IN SERVICE MORE THAN ONE YEAR, IT IS PROBABLY WISE TO REPLACE ALL OF THE CELLS WHEN THE FIRST BAD CELL IS DETECTED.</li><li>3. REPLACEMENT CELLS SHOULD BE OBTAINED FROM TEKTRONIX BECAUSE THESE SPECIAL CELLS ARE DIFFICULT TO OBTAIN OTHERWISE. LOCALLY AVAILABLE CELLS TYPICALLY HAVE LOWER CAPACITY, NARROWER TEMPERATURE RANGE AND CANNOT TOLERATE THE MAGNITUDE OF CHARGING CURRENT PROVIDED BY THE MONITOR.</li><li>4. MINIMIZE THE AMOUNT OF HEAT TRANSFERRED FROM SOLDERING IRON TO CELL BODY. BEND THE SOLDER TAB OUTWARD, AWAY FROM THE CELL BODY AND PLACE A HEAT-SINK CLIP BETWEEN THE CELL BODY AND THE SOLDER AREA. NEVER SOLDER DIRECTLY TO THE CELL BODY.</li></ol>



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# MANUAL CHANGE INFORMATION

PRODUCT 408 SERVICE

CHANGE REFERENCE M33489

070-1525-00

DATE 3-6-78

CHANGE:	DESCRIPTION
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EFF SN B170000

MECHANICAL PARTS LIST CHANGE

Page 8-4

CHANGE TO:

136-0551-01      1 SOCKET, PLUG-IN: CRT







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# MANUAL CHANGE INFORMATION

PRODUCT 408

CHANGE REFERENCE M30,133

EFF SN B151430-up

DATE 8-26-76

**CHANGE:**

**DESCRIPTION**

070-1525-00

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

U120	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U174	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U182	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U204	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U216	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U324	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U336	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U504	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U518	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U522	156-0158-01	MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER
U524	156-0349-02	MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE
U538	156-0349-02	MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE
U542	156-0350-01	MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE
U592	156-0067-01	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER
U628	156-0349-02	MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE
U664	156-0349-02	MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE
U668	156-0349-02	MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE
U764	156-0349-02	MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE





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# MANUAL CHANGE INFORMATION

PRODUCT 408  
070-1525-00

CHANGE REFERENCE M33362  
DATE 4-17-78

CHANGE:

DESCRIPTION

EFF SN B172620

## ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

ADD:

CR841      152-0066-00      SEMICOND DEVICE:SILICON,RECTIFIER,400V,1N3194

CR841 is located on the MAIN circuit board assembly and is added across from C843 with cathode to ground shown on diagram 5 POWER SUPPLY.

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