

TECHNICAL MANUAL

**OPERATOR, ORGANIZATIONAL,
AND
DS/GS MAINTENANCE MANUAL**

(INCLUDING REPAIR PARTS)

FOR

**TEKTRONIX
1502 TIME DOMAIN
REFLECTOMETER**

(PATRIOT AIR DEFENSE GUIDED MISSILE SYSTEM)

**HEADQUARTERS, DEPARTMENT OF THE ARMY
AUGUST 1986**

WARNING

DANGEROUS VOLTAGE

is used to operate this equipment

DEATH ON CONTACT

may result if safety precautions are not observed.

Never work on electronic equipment unless there is someone nearby who is familiar with the operation and hazards of the equipment and is able to give first aid. When the technician is aided by operators, he must warn them about dangerous areas.

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

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

When possible, keep one hand away from equipment to reduce the hazard of current flowing through the vital organs of the body.

Read FM 21-11, First Aid for Soldiers, and learn how to administer artificial respiration.

WARNING

Do not be misled by the term "low voltage."
Under adverse conditions, potentials as low
as 50 volts may cause death.

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TECHNICAL MANUAL)
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No. 9-1430-601-14-3&P)

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 26 August 1986

Operator, Organizational, and DS/GS Maintenance Manual

(INCLUDING REPAIR PARTS)

FOR

TEKTRONIX 1502 TIME DOMAIN REFLECTOMETER

(PATRIOT AIR DEFENSE GUIDED MISSILE SYSTEM)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes, or if you find a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 direct to: Commander, U.S. Army Missile Command, ATTN: AMSMI-LC-ME-PM, Redstone Arsenal, Alabama 35898-5238. A reply will be furnished to you.

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OPERATORS SAFETY SUMMARY

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

TERMS

In This Manual

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

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


As Marked on Equipment

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


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

SYMBOLS

In This Manual

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

As Marked on Equipment

 DANGER - High voltage.

 Protective ground (earth) terminal.

 ATTENTION - refer to manual.

Power Source

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

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Danger Arising From Loss of Ground

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

Use the Proper Power Cord

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

Use only a power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

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

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

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

Do Not Remove Covers or Panels

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

SERVICE SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

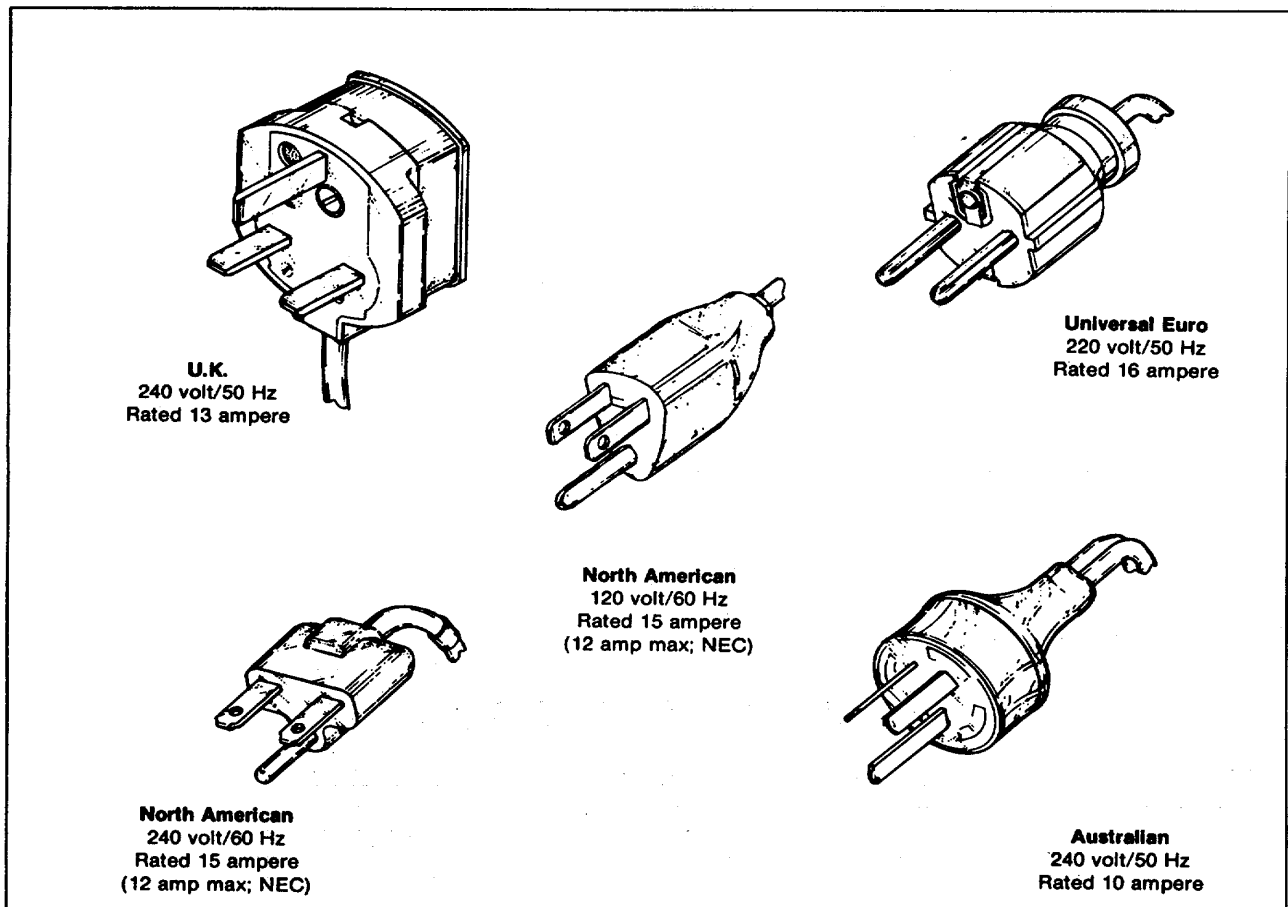
Use Care When Servicing With Power On

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

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

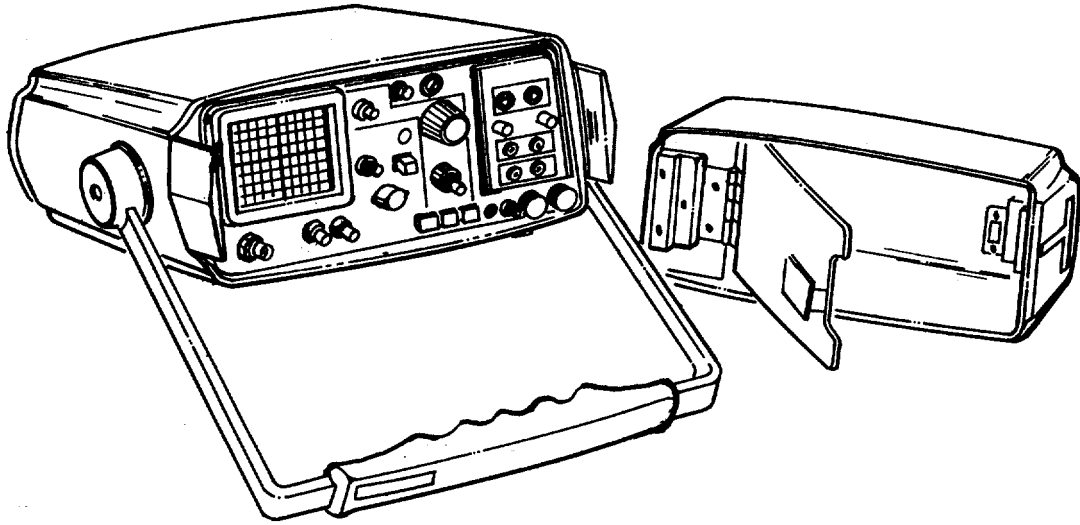
Power Source

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



Power plug options.

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1502 Time Domain Reflectometer.

1792-01

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SECTION 0.

GENERAL

0-1. MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System (TAMMS).

0-2. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your PATRIOT system needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you do not like about your equipment. Let us know why you do not like the design. EIRs will be prepared using SF 368, Quality Deficiency Report (QDR). Mail the QDRs to Commander, U.S. Army Missile Command, ATTN: AMSMI-LC-ME-PMH, Redstone Arsenal, AL 35898-5238. A reply will be furnished to you.

0-3. ADMINISTRATIVE STORAGE

To prepare this unit for placement into and removal from administrative storage, refer to section 3, chapter 4, of AR 750-1, Maintenance Equipment and Supplies. Temporary storage should be accomplished in accordance with TB 750-25-1, section 2, Maintenance of Supplies and Equipment.

0-4. DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE

For procedures for destruction of Army material to prevent enemy use, see section XI of TM 9-4935-393-14-1.

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SPECIFICATION

General Information

The Tektronix 1502 is a portable Time Domain Reflectometer that uses pulses to test cables and provides a visual display of cable faults. The test pulses are transmitted via the CABLE output jack. Reflections are received at the same jack and displayed on the Cathode-Ray Tube (crt).

NOTE

All distances are shown in feet followed by metres in parenthesis. Metric units are not direct conversions from the measurements shown in feet, but represent the calibrated ranges of the metric option 1502.

Calibrated distance controls allow an operator to examine up to 100 feet (25 metres) of cable with segments as small as 1 foot (25 cm) displayed horizontally across the 10-division crt screen. Low-loss cables as long as 2000 feet (500 metres) may be examined at 100 feet (25 metres) per division or 200 feet (50 metres) per division. The horizontal crt scale is calibrated directly in distance units from 0.1 foot (2.5 cm) per division to 200 feet (50 metres) per division in a 1-2-5 sequence (1-2.5-5 sequence).

A 3-digit, direct reading dial indicates the distance to any cable discontinuity when the dial is used to horizontally position the discontinuity's reflection to a crt reference line.

Vertical (Y-axis) deflection of the crt beam is proportional to the amplitude of the reflected signal plus the incident step. The vertical scale is calibrated in units of rho (ρ) of the transmitted pulse amplitude. For a definition of rho, refer to section 2 of this manual. The sensitivity scale can be selected in 7 calibrated steps from 5 m ρ /div to 500 m ρ /div.

The transmitted pulse is a step-signal having an amplitude of approximately 225 mV. The risetime of the pulse generator and the equivalent bandwidth of the deflection circuits provide a system reflected risetime of 140 ps or less.

The 1502 plug-in compartment will accept either the X-Y OUTPUT MODULE or the TEKTRONIX Y-T Chart Recorder. The X-Y OUTPUT MODULE is a standard accessory for the 1502 and provides an interface for an X-Y recorder. The TEKTRONIX Y-T Chart Recorder is an optional accessory. This recorder uses a heated stylus to record on 4 cm wide, heat-sensitive chart paper. The chart recording length represents the entire crt screen and is controlled by the 1502.

The 1502 is a ruggedized portable instrument that can be used in the field as well as in the laboratory. The requirements for a Type III, Class 3, Style A instrument as specified in MIL-T-28800 were used as a guideline for the environmental specifications. The 1502 has a ruggedized case that provides protection when the instrument is stored in exposed areas. When the instrument is not being used, the accessories, including the Operators manual, may be packed in the instrument cover and latched tightly on the front of the instrument. Table 1-1 indicates which accessories may be placed in the cover of the 1502.

The characteristics given in Table 1-2 apply over an ambient temperature range from -15°C to +55°C after the instrument has been calibrated at +25°C, $\pm 5^\circ\text{C}$. Under these conditions, the 1502 will perform to the requirements given in the Performance Check section of this manual.

**Table 1-1.
1502 ACCESSORIES**

| Accessories stored in the 1502 cover | |
|--|--------------------------------|
| Accessory | Tektronix Part Number |
| 1 50 Ω BNC Terminator | 011-0123-00 |
| 1 Precision 50 Ω Cable | 012-0482-00 |
| 1 Viewing Hood | 016-0297-00 |
| 1 Operators Manual | 070-1790-00 |
| 1 BNC Connector, Female-to-Female | 103-0028-00 |
| 2 Replacement Fuses (for front panel) For 115 V ac Operation or For 230 V ac Operation (Option 6) | 159-0113-00 159-0029-00 |
| 1 Power Cord | 161-0066-00 |
| 1 Filter, Mesh (crt) | 378-0055-00 |
| Accessories not stored in the 1502 cover | |
| 1 TDR Slide Rule | 003-0700-00 |
| 1 X-Y Output Module | 016-0606-00 |
| 1 Instruction Manual | 070-1792-01 |

SPECIFICATION

The performance limits in this specification are valid with the following conditions:

The instrument must have been calibrated at an ambient temperature between +20°C and +30°C.

The instrument must have a warm up period of at least 20 minutes.

**Table 1-2.
ELECTRICAL CHARACTERISTICS**

| Characteristics | Performance Requirements | Supplemental Information |
|-------------------------|---|--|
| Excitation Step Pulse | | Cable Dielectric set to AIR |
| Reflected Rise | ≤0.07 feet (≤140 ps) ≤2.1 cm for metric | 10% to 90% |
| Aberrations | ±5% peak during 1st 10 feet (300 cm) after rise | |
| | ±0.5% peak beyond 10 feet (300 cm) | Noise Filter "Out" |
| Jitter | ≤0.02 feet (≤40 ps) ≤0.6 cm | Set at X.1 (Cable Dielectric set to AIR) |
| | ≤0.1 feet (≤200 ps) ≤3 cm | Set at X1 (Cable Dielectric set to AIR) |
| Deflection Factor | 5 mp/div to 500 mp/div | 7 steps, 1-2-5 sequence |
| Accuracy | Within ±3% | |
| Gain | At least 3.5:1 from calibrated point | Screwdriver control |
| Display Noise | ±5 mp or less, NOISE FILTER switch "Out" | Peak |
| Low Noise Operation | ±2 mp or less, NOISE FILTER switch "in" | Peak |
| Distance Controls | | 0 to 2000 feet total |
| Distance Dial | | |
| At X.1 Multiplier Range | 0 to 100 feet 0 to 25 metres for metric | |
| Accuracy | Within ±2% ±0.05 feet Within ±2% ±0.05 metres for metric | from 2nd to 9th graticule lines |
| At X1 Multiplier Range | 0 to 1000 feet 0 to 250 metres for metric | |
| Accuracy | Within ±2% ±0.5 feet Within ±2% ±0.5 metres for metric | from 2nd to 9th graticule lines |

**Table 1-2. (cont)
ELECTRICAL CHARACTERISTICS**

| Characteristics | Performance Requirements | Supplemental Information |
|--|--|---|
| FEET/DIV Control At X.1 Multiplier Range | To 20 feet/div To 5 metres/div for metric | |
| Scales | .1 feet/div to 20 feet/div 0.025 m/div to 5 m/div for metric | 8 steps, 1-2-5 sequence 8 steps, 1-2.5-5 sequence |
| At X1 Multiplier Range | To 200 feet/div To 50 metres/div for metric | DISTANCE dial disabled in 200 (FIND) position |
| Scales | 1 foot/div to 200 feet/div 0.25 m/div to 50 m/div for metric | 8 steps, 1-2-5 sequence 8 steps, 1-2-5 sequence |
| Dielectric Scales | SOLID PTFE, $V_p/V_{air} = 0.70$ SOLID POLY, $V_p/V_{air} = 0.66$ OTHER-VAR, $V_p/V_{air} = 0.55$ to 1 | $r = 2.04$ $r = 2.31$ VAR is calibrated for air when turned to full cw position. All buttons re- leased causes default mode and is cal. for air |
| Accuracy | Within $\pm 2\%$ | |
| External Recorder Inter- face for X-Y Recorders | | |
| Horizontal | 0.1 V/div | Source impedance 10 k Ω |
| Vertical | 0.09 to 0.13 V/div (adjustable) | Source impedance 10 k Ω |
| Pen Lift Mode 1 Source | $V_s = 5$ V Nominal with $R_s = 10$ k Ω | |
| Mode 2 (inverted Mode 1) Source | $V_s = 5$ V Nominal with $R_s = 10$ k Ω | |
| Y-T Plug-in Chart Recorder Interface | | |
| Horizontal | 0.4 V/div | Source impedance 200 Ω (switched) |
| Vertical | 0.2 V/div | Source impedance 200 Ω (switched) The TEKTRONIX Chart Recorder, 016-0506-03 is designed to operate with the 1502. The chart uses a heat sensitive stylus to record on 4 cm chart paper. Chart recording length is con- trolled by the 1502. |

**Table 1-2. (cont)
ELECTRICAL CHARACTERISTICS**

| Characteristics | Performance Requirements | Supplemental Information | | |
|-----------------------------------|---|--|-------------------|-------|
| Line Voltage | 117 Vac \pm 20%, 48 to 410 Hz 234 Vac \pm 20%, 48 to 410 Hz | Fused at 0.5 A Fused at 0.3 A | | |
| Battery Pack | | C size 9 cell | | |
| Operation | At least 5 hours | +20° C to +25° C charge and discharge temperature | | |
| Full Charge Time | | 16 hours | | |
| Typical Charge Capacity | | Discharge Temperature | | |
| Charge Temperature | | -15°C | +20°C to +25°C | +55°C |
| 0° C | | 40% | 60% | 50% |
| +20° C to +25° C | | 65% | 100% | 85% |
| +40° C | | 40% | 65% | 55% |
| Temperature Operating | -15° C to +55° C | At temperatures other than 20°C- 25° C, the battery efficiency becomes restricted | | |
| Non-Operating | -62° C to +85° C | With batteries removed. If stored with batteries storage range changed to -40° C to +55° C | | |
| Humidity | To 100% | | | |
| Altitude Operating | 10,000 feet | | | |
| Non-Operating | 50,000 feet | | | |
| Vibration | 3.0 g, 5 to 55 Hz; Test time 45 minutes | | | |
| Shock, Mechanical Shock, Pulse | 15 g, 1/2 sine shock waveform of 11 ms duration. Total of 18 shocks | | | |
| Bench Handling Operating | 4 drops each face at 4 inches or 45° with opposite edge as pivot | Case on | | |
| Non-Operating | 4 drops each face at 4 inches or 45° with opposite edge as pivot. Satisfactory operation after drops. | Case off | | |
| Transit Drop | 12 inch drop | | | |

**Table 1-2. (cont)
ELECTRICAL CHARACTERISTICS**

| Characteristics | Performance Requirements | Supplemental Information |
|---|--|---------------------------------|
| Water Resistance Operating | Splashproof and drip proof with cover off and instrument operating | |
| Non-Operating | Watertight with three feet of water above top of the case | Cover on |
| Salt Atmosphere Structural Parts | Withstand 48 hours exposure to 20% solution without corroding | |
| Explosive Atmosphere | Operation does not cause ignition of an ambient-explosive-gaseous mixture with air | |
| Sand and Dust | Operates after non-operating, cover removed, exposure to dust test of MIL-STD-810, Method 510, Proc. I | |
| Washability | Capable of being washed | |
| Electromagnetic Compatibility Electromagnetic Interference (EMI) | Meets requirements specified in Table X of MIL-T-28800A | |
| Magnetic Environment DC | Performs satisfactorily when 20 oersted dc applied | |
| AC | Performs satisfactorily when 5 oersted RMS ac applied | |
| Fungus Inert | Materials used are fungus inert | |
| Weight With Panel Cover and Accessories | 18 pounds (8.2 kg) | |
| Without Panel Cover and Accessories | 16.0 pounds (7.3 kg) | |
| Domestic Shipping Weight | 24.4 pounds (11.1 kg) | |
| Export Shipping Weight | Approximately 36.0 pounds (16.4 kg) | |
| Height | 5.0 inches (12.7 cm) | |
| Width With Handle | 12.4 inches (31.5 cm) | |
| Without Handle | 11.8 inches (29.9 cm) | |

Table 1-2. (cont)
ELECTRICAL CHARACTERISTICS

| Characteristics | Performance Requirements | Supplemental Information |
|-----------------------------|--------------------------|--------------------------|
| Depth Including Panel Cover | 16.5 inches (41.9 cm) | |
| Handle Extended | 18.7 inches (47.4 cm) | |

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OPERATING INSTRUCTIONS

This section of the manual contains the basic information required for the operation of the 1502 Time Domain Reflectometer. Included is a brief description of the purpose of each front panel control, general operating information, care of the instrument, and basic applications.

FRONT COVER AND HANDLE

The watertight front cover protects the front panel when the instrument is not in use and the cover is latched in place. Standard accessories stored in the cover are indicated on the storage compartment lid. Special operating instructions and cautions are printed on the lid. These cautions should be followed at all times to avoid damage to the instrument.

The cover is released from the unit by pulling forward on the side latches. To secure the cover over the front panel, place the cover into the grooved portion of the front panel and push the latches backwards toward the instrument. If the unit is accidentally left on, it will be turned off when the cover is secured over the front panel.

The handle is a friction disc design and will rotate 325°. When the handle is turned so that it is beneath the unit, it will serve as a stand (see Fig. 2-1).

POWERING THE 1502

This equipment has a 3-wire power cord with a 3-contact plug for connection to the power source and to protective ground. The plug protective-ground contact connects (through the cord protective-grounding conductor) to the accessible metal parts of the equipment. For electric-shock protection, insert this plug into a socket outlet that has a securely grounded protective-ground contact.

CAUTION

Do not operate or charge the battery in the 1502 from an inverter that produces a square wave output. It can damage the instrument.

For confirmation that the socket-outlet ground contact is securely grounded, refer to qualified service personnel.

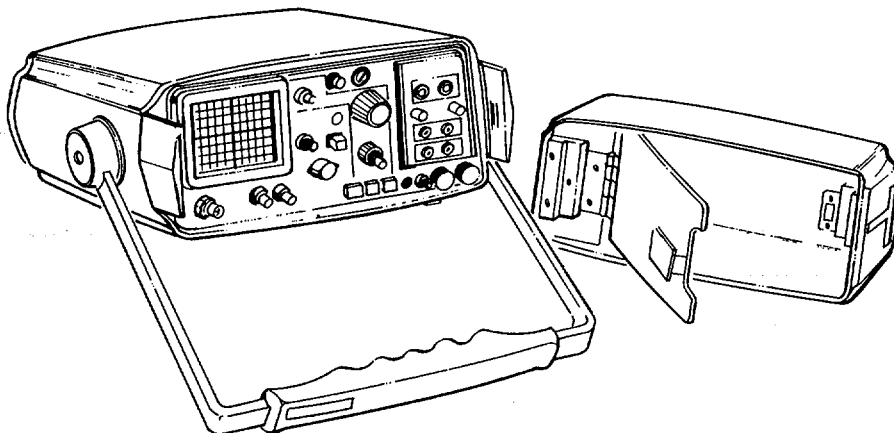


Figure 2-1. 1502 TDR With Cover

The 1502 operates from the battery supply for a minimum of 5 hours (including 20 chart recordings). If a TEKTRONIX Y-T Chart Recorder is used, the 5 hours operating time will decrease by about 3 minutes for each recording made beyond the 20 specified.

Charging the Battery

The battery pack can be charged at any temperature between 0°C and +40°C. It can be operated at any temperature between -20°C and +55°C. For maximum charge capacity, the cells should be charged at +20°C to +25° C.

The battery pack is fully charged in 16 hours when connected to an ac power source and the unit is switched off. The 1502 may be operated while the battery pack is charging, however, the charging time will increase. The batteries will not overcharge if the charger is left on longer than 16 hours. The 1502 can remain connected to an ac source without damaging the batteries. Approximately once a month or every 15 charge-discharge cycles, the batteries should be charged for approximately 24 hours. Approximately 30 minutes of operating time can be expected from a 1 hour partial charge. To avoid reverse charging, the full 16 hour charge should be completed in preference to a partial charge cycle whenever possible.

A battery can be damaged by reverse charging. This can occur if an individual cell becomes completely discharged and the current from the other cells flow in a reverse direction through the discharged cell. Such a case can develop due to cell aging, partial charging, or if a cell is replaced. The battery charger uses SCR protection circuits to prevent accidental reverse charging. The SCR protection circuits automatically shut off the instrument whenever battery voltage falls below about 10 V.

CAUTION

When the Anti-Deep-Discharge circuit is operating, the voltage circuits are turned off, but there is still a small amount of current drawn from the batteries. This will further discharge the batteries (at a slower rate) if the POWER switch is not turned off.

A 12 V dc power supply may be substituted for the 1502 battery pack by removing the pack from the unit and connecting the power supply to the terminals inside the battery pack compartment.

CAUTION

When substituting a dc power supply or external battery for the battery pack, be sure the polarity is correct. See Fig. 2-2.

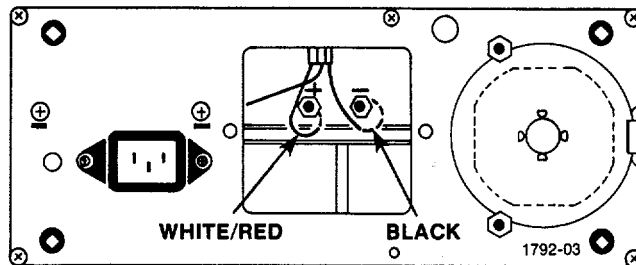


Figure 2-2. Battery Connector Polarity

The power pack can be stored at any temperature between -40° C and +50° C with the battery cells either fully or partially charged. The self-discharge rate of the cells increases with increased temperature. A fully charged battery will lose about 50% of its charge in 3 to 4 months if stored at +20°C to +25°C. Therefore, the battery pack should be completely recharged before using if it has been stored without power supplied to its charging circuit for more than a month.

FRONT PANEL CONTROLS AND CONNECTORS

A brief description of the purpose of each front panel connector, pushbutton, control, and screwdriver adjustment follows. A description of the controls of the plug-in modules is also included. Refer to Fig. 2-3 for their location.

- | | |
|------------------|--|
| 1. CABLE | BNC Connector-delivers pulse to the test cable and receives the reflected return pulse. |
| 2. FOCUS | Adjusts the focus of the crt electron beam. |
| 3. INTENSITY | Controls the brightness of crt display. |
| 4. POSITION/FINE | Vertical position control of the crt display. The outer control is a course adjustment and the inner control is a fine adjustment. |
| 5. mp/DIV | Selects the vertical deflection factor-5 mp/div to 500 mp/div (5-2-1 sequence). |
| 6. POWER | Push-off, pull-on switch -does not affect the battery charging circuit. |

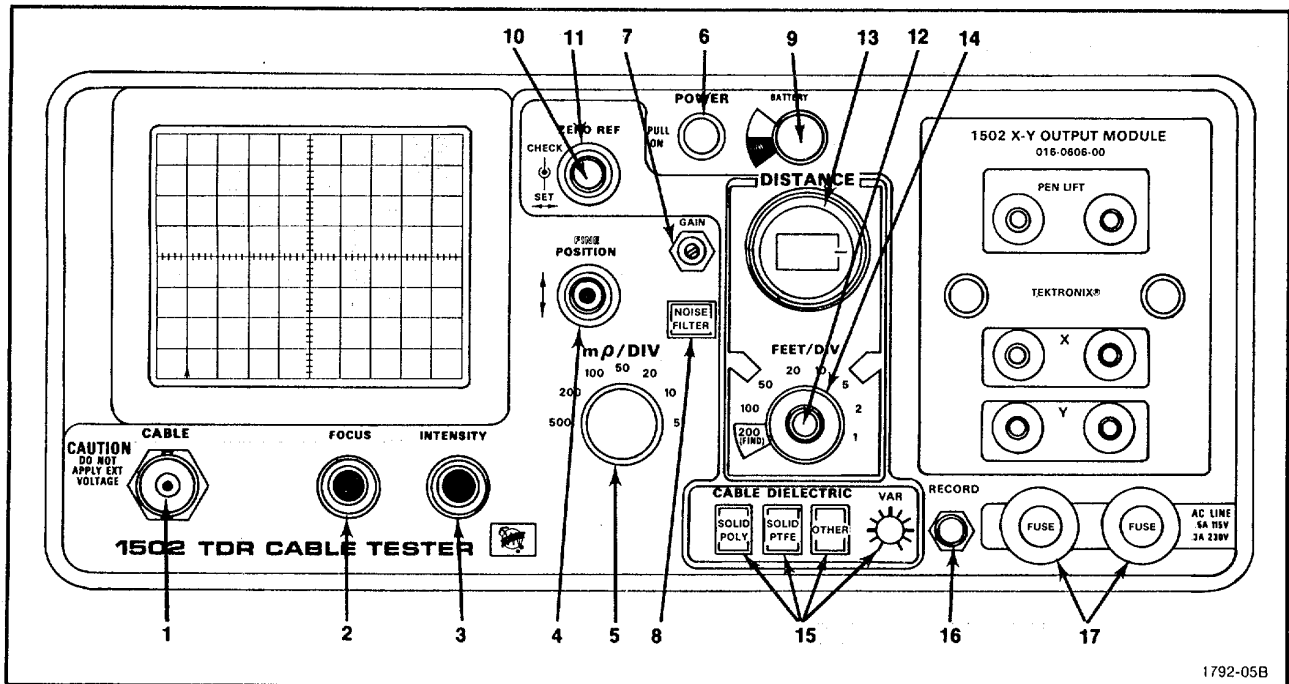


Figure 2-3. 1502 Front Panel Controls.

- | | | | | | |
|-----|----------------|---|-----|---|--|
| 7. | GAIN | Screwdriver adjust to set the gain of the vertical amplifier. | 13. | DISTANCE | Indicates the distance from the 1502 to the point on the cable where the display window begins. Two ranges: 100 feet (25 m) at X.1 or 1000 feet (250 m) at X1. Disabled when the FEET/DIV (METRES/DIV) is at 200 (FIND) (50). |
| 8. | NOISE FILTER | Reduces displayed noise. Display rate is reduced by a factor of 10. | 14. | FEET/DIV (METRES/DIV) | Selects the horizontal deflection factor: X1 = 1 - 200 ft/div (25 cm - 50 m/div). X.1 = 0.1 - 20 ft/div (2.5 cm - 5 m/div). |
| 9. | BATTERY | Meter to indicate the relative charge of the power pack. | 15. | CABLE DIELECTRIC SOLID POLY SOLID PTFE OTHER VAR | Three pushbuttons and a screwdriver adjust. Selects the proper velocity of propagation. VAR from 0.55 to 1.0 when the OTHER pushbutton is pressed. Fully CW is for air dielectric. VAR control has reference marks every 30° to indicate relative propagation constants. |
| 10. | ZERO REF CHECK | Momentary contact pushbutton. When pushed, checks the horizontal location of the incident pulse on the crt when the DISTANCE dial is being used. | | | |
| 11. | ZERO REF SET | Horizontal pulse position control for crt display. Sets the incident pulse edge to a vertical reference line of the crt when the DISTANCE dial is at 000 or the ZERO REF CHECK button is at pushed. | | | |
| 12. | MULTIPLIER | Two-position switch (red control) for X.1 or X1 multiplier. Affects both the DISTANCE dial and the FEET/DIV (METRES/DIV) control. | | | |

- 16. RECORD Two-position lever switch; pushed up and then released, it initiates X-Y recorder or a chart recorder.
- 17. AC LINE FUSES Protection fuses for line power and battery charging circuits (0.5 A fuses for 115 V ac; 0.3 A fuses for 230 V ac).

PLUG-IN Controls and Connectors

- 1. X-Y OUTPUT MODULE The standard plug-in module for the 1502. Used to drive an external X-Y Chart Recorder.

X, Y, and PEN LIFT Six front panel jacks used for driving an external X-Y recorder. X jacks are for horizontal drive. Y jacks are for vertical drive. PEN LIFT jacks are for pen control.
- 2. Y-T CHART RECORDER An optional TEKTRONIX Y-T Chart Recorder which replaces the X-Y OUTPUT MODULE.

OPERATIONAL CHECKOUT

To check the operation of the 1502, follow these step-by-step procedures:

- 1. Preset the front panel controls as follows:

| | |
|------------------|------------|
| FOCUS | Midrange |
| INTENSITY | Midrange |
| ZERO REF | Fully cw |
| POSITION | Midrange |
| mp/DIV | 500 |
| DISTANCE | 000 |
| FEET/DIV | 1 |
| (METRES/DIV) | (.25) |
| X1 - X.1 | X1 |
| CABLE DIELECTRIC | SOLID POLY |

- 2. Adjust the INTENSITY and FOCUS controls for a clear bright trace.
- 3. Adjust the POSITION controls to set the trace 2 divisions below the horizontal centerline.
- 4. Attach the precision 50 Ω cable (012-0482-00) to the CABLE connector.
- 5. Turn the ZERO REF SET button ccw until the incident pulse edge is located on a vertical reference line. The incident pulse edge is the initial rise of the step pulse. The vertical reference line may be any line you choose from the center line to the left side of the crt graticule. We have added an arrow in the second vertical line to indicate a commonly used reference line.

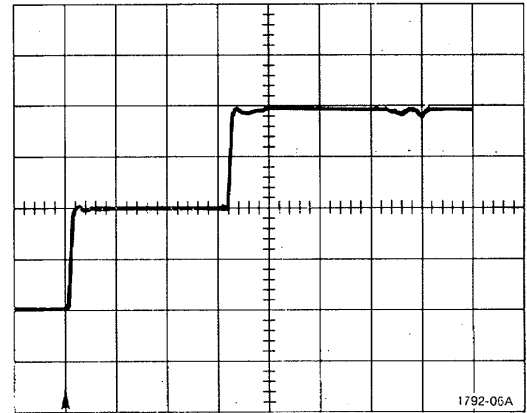


Figure 2-4. Incident and Reflected Pulses.

- The reflected pulse from the open end of the 50 Ω cable should appear 3 horizontal divisions to the right of the reference line in the non-metric version only. The open end of the cable is indicated by the start of a second rise in the trace (see Fig. 2-4).
- 6. Turn the ZERO REF SET control throughout its range to see the incident pulse edge can be set on any vertical graticule line. Set the incident pulse edge on the vertical reference line.
 - 7. Set the DISTANCE dial to 050 and check that the top of the step (open cable reflection) is displayed.
 - 8. Press the ZERO REF CHECK button and check that the incident pulse edge returns to the vertical reference line of the graticule. Reset the DISTANCE dial to 000.

9. Change mp/DIV to 50 and adjust the POSITION controls so the top of the incident pulse is on the horizontal centerline.
10. Press the NOISE FILTER Pushbutton and check for a reduction in the displayed noise as well as a reduction in the scan rate. Reset mp/DIV to 500, and release (by depressing a second time) the NOISE FILTER button.
11. Lift up and hold the RECORD switch. Check that a bright spot appears at the left edge of the crt.
12. Release the RECORD switch. The slow scan of the spot will trace the displayed waveform. When the scan is complete. The 1502 will automatically return to its normal mode of scanning.

CONNECTING A TEST CABLE TO THE 1502

CAUTION

Do not connect live circuit cables to the input of the 1502. Voltages in excess of 5 V can damage the sampling gate or tunnel diode. If both the sampling bridge and tunnel diodes are destroyed at the same time, an improper use is indicated. If such simultaneous damage occurs, repair charges will be assessed to the customer regardless of the equipment warranty period.

Bleeding of cables before connecting them to the 1502 will remove static charge from them. The 50 Ω termination and BNC adapter supplied may be used to bleed any cable charge.

When testing antennas, be sure that you are not close to transmitters that can be keyed at the antennas receiving frequency. Keying of transmitters in close proximity can cause damage to the 1502.

Connect cables to be tested by the 1502 to the BNC connector (CABLE) on the front panel. Table 2-1 lists optional connectors/adapters that can be used with the 1502.

**Table 2-1.
OPTIONAL CONNECTORS/ADAPTERS
FOR THE 1502**

| Type | Tektronix Part Number |
|---|-----------------------|
| Terminator, 75 Ω BNC | 011-0102-00 |
| Adapter, 50 to 125 Ω | 017-0090-00 |
| Adapter, 50 to 75 Ω | 017-0091-00 |
| Adapter, 50 to 93 Ω | 017-0092-00 |
| BNC Connector, Female to Clip Leads | 013-0076-00 |
| BNC Connector, Female to GR | 017-0063-00 |
| BNC Connector, Male to GR | 017-0064-00 |
| BNC Connector, Female to UHF Male | 103-0015-00 |
| BNC Connector, Male to UHF Female | 103-0032-00 |
| BNC Connector, Male to Dual Binding Post | 103-0035-00 |
| BNC Connector, Female to N Male | 103-0045-00 |
| BNC Connector, Male to N Female | 103-0058-00 |
| BNC Connector, Female to Dual Banana Jack | 103-0090-00 |
| BNC Connector, Male to Male | 103-0029-00 |

LOCATING A DISCONTINUITY IN A CABLE

The DISTANCE dial and the FEET/DIV (METRES/DIV) control make it possible to evaluate cables as long as 2000 feet (500 metres). The entire length can be displayed directly on the crt if desired. If a chart recorder is used, only that portion of the trace seen on the crt will be recorded on the graph.

To check cables using only the crt display, the FEET/DIV (METRES/DIV) control and the X1/X.1 control must be set so that the crt display window is longer than the cable. For example, if the cable is 150 feet (46 m) long, set the FEET/DIV (METRES/DIV) to 200 (50) and the multiplier at X.1.

NOTE

Use the X.1 multiplier whenever possible to lessen the effects of jitter.

This setting of the FEET/DIV (METRES/DIV) control ensures that the reflected signal will appear in the display window. Measure the distance between the incident pulse rise and the reflected pulse rise.

NOTE

The distance from the sampling bridge to the CABLE connector (2.5 inches or 6.35 cm) should be taken into account when measuring cables less than 2 feet (50 cm) in length.

To more accurately locate the discontinuity, set the FEET/DIV (METRES/DIV) control to a lower setting. (The reflected pulse does not need to be in the display window). Push the ZERO REF CHECK button and adjust the ZERO REF SET control so that the incident pulse rise is set at a convenient vertical reference graticule line. The ZERO REF SET control may have to be readjusted when changing the FEET/DIV (METRES/DIV) control.

NOTE

Always set the incident and reflected pulse to the 10% points of their amplitude (see Fig. 2-5).

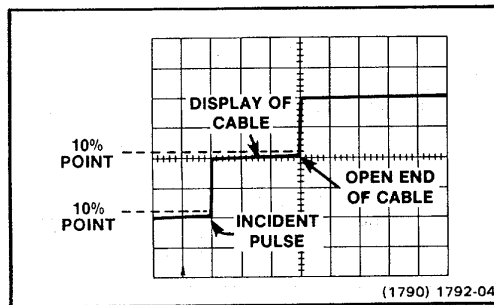


Figure 2-5. CRT Display of Pulse.

Now turn the DISTANCE dial clockwise until the reflected pulse is located on the reference graticule line. The reading on the DISTANCE dial times the multiplier gives the length from the CABLE connector to the end of the cable (or to the discontinuity).

NOTE

When checking cables longer than 1000 feet (250 metres), adjust the DISTANCE dial until the reflected pulse reaches the right-hand edge of the graticule, then add the graticule display distance to that on the DISTANCE dial for the total length. The reading of the DISTANCE dial, plus the number of divisions (from the reference line) across the graticule times the FEET/DIV (METRES/DIV) setting gives the total length of the cable. Remember that in the 200 FEET/DIV (50 METRES/DIV) setting the DISTANCE dial is inoperative.

The CABLE DIELECTRIC pushbuttons allow the 1502 to accurately locate discontinuities in cables of various relative propagation velocity constant (V_p). The SOLID POLY button is calibrated to check solid polyethylene dielectrics, which have a V_p of 0.66. The SOLID PTFE button is calibrated to check solid polytetrafluoroethylene (Teflon), which has a V_p of 0.70. The OTHER button is variable from 0.55 to 1.00 and is controlled by the screwdriver adjustment control VAR. When this screwdriver control is turned to the fully clockwise position, it is calibrated for air dielectrics, which have a V_p of 1.00. If all three of the CABLE DIELECTRIC buttons are released, a default condition leaves the instrument calibrated for air dielectric ($V_p = 1.00$).

EVALUATING A DISCONTINUITY

The mp/DIV control determines the vertical deflection that can be seen on the crt or recorded on a graph if a chart recorder is used. This control is calibrated to measure the ratio of the reflected signal amplitude to the incident signal amplitude in rho (ρ), which is called the voltage reflection coefficient. Rho (ρ) is the measurement of reflected signal amplitude and can be used to determine the impedance of a discontinuity. Note that no reflection is obtained from a cable that has no discontinuities if the cable is terminated with its characteristic impedance. If a cable has an open, i.e., a break (infinite impedance), the reflected step amplitude is $+1 \rho$; and if a cable has a short (zero impedance), the reflected step amplitude is -1ρ .

Fig. 2-6 shows the two parts of a TDR display labeled to identify the incident and reflected voltage signals. When $\rho=0$, the transmission line is terminated by a resistance equal to its characteristic impedance (Z_0) which, in this case, is 50Ω . (When ρ equals $+1$, the transmission line load is an open circuit. When ρ equals -1 , the transmission line load is a short. If the line is terminated by $R_L > 50 \Omega$, ρ is positive and if the line is terminated by $R_L < 50 \Omega$, ρ is negative.

Fig. 2-7 is a chart for converting reflected pulse amplitude to impedance. Rho is dependent on the characteristic impedance, Z_0 , of the cable under test and the load (or the impedance of the discontinuity), R_L , on the cable. Therefore, ρ can also be defined as:

$$\rho = \frac{R_L - Z_0}{R_L + Z_0}$$

This relationship was used to develop the chart shown in Fig. 2-7.

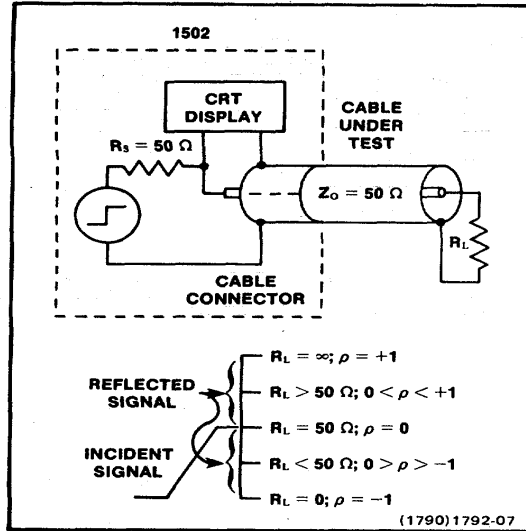


Figure 2-6. TDR Display of R_L vs Z_0 .

TYPICAL CABLE PROBLEMS

A few of the cable problems that can be analyzed with the 1502 include opens, shorts, pin-holes in the cable shield, opens in the shield, kinks in the cable, mismatched connectors, and corroded connectors. Figs. 2-8 through 2-11 show typical examples of these problems.

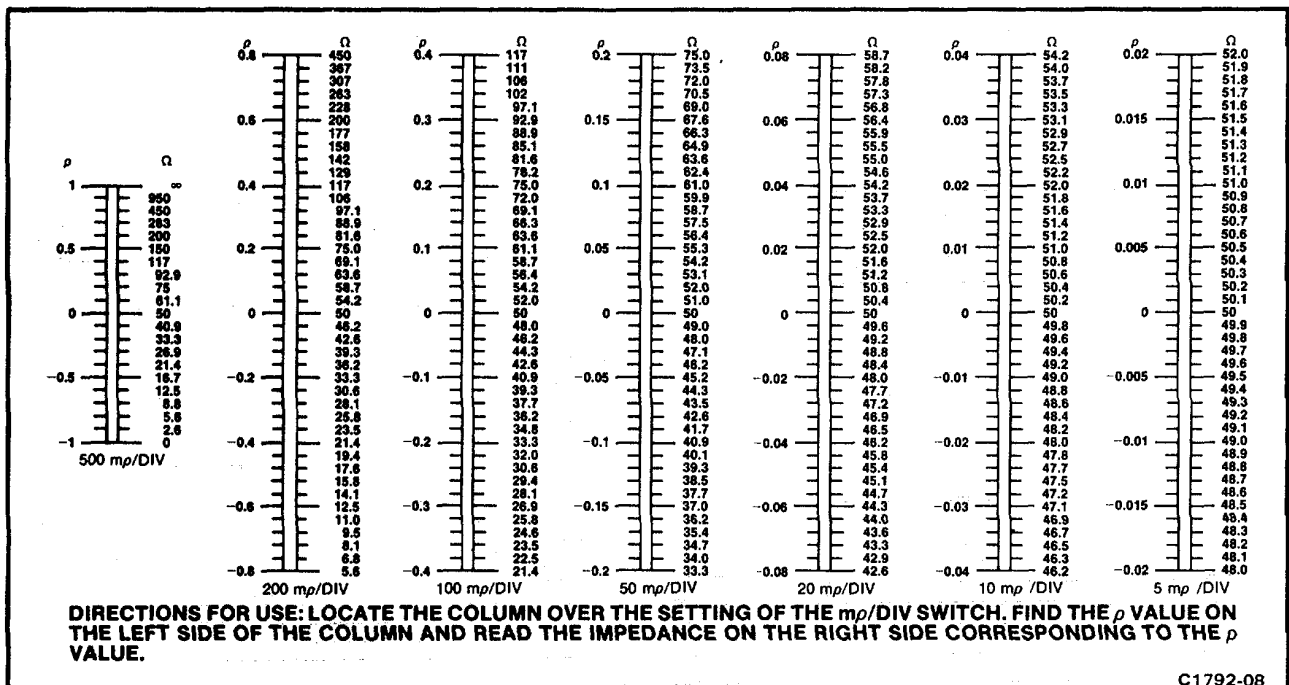


Figure 2-7. Impedance Nomograph.

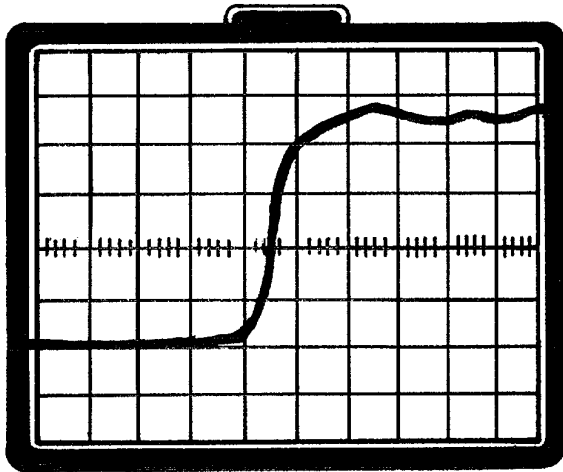


Figure 2-8. Open Cable.

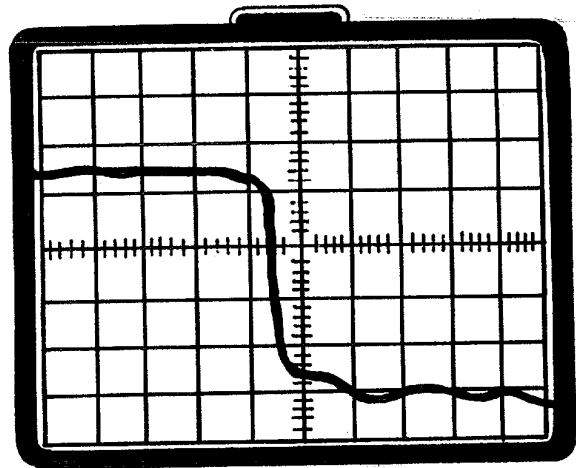
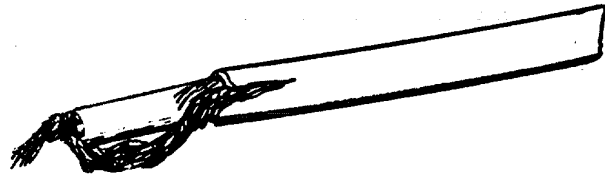
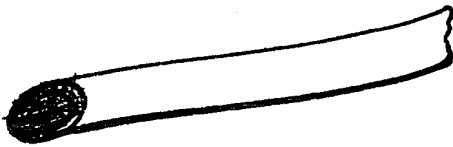


Figure 2-9. Shorted Cable.



CHECKING CABLES WITH IMPEDANCE OTHER THAN 50 W

Cables with a characteristic impedance other than 50 Ω can be evaluated by adjusting the GAIN control (screwdriver adjust) to correct the reflected pulse for $+1p$ at the open end of a cable. When the GAIN is changed, the incident pulse will no longer be $1p$.

To reset the GAIN for an impedance other than 50 Ω , either connect an impedance-matching adapter (50 to 75 Ω , 50 to 93 Ω , 50 to 125 Ω , etc.) to the CABLE connector and connect a short length of cable (with impedance the same as the adapter, i.e., 75 Ω , 93 Ω , 125 Ω , etc.) to the adapter or connect the cable to be tested to the CABLE connector. With the mp/DIV control set at 500, position the trace on the graticule so that the display of the cable appears in the display. Now adjust the GAIN control so that the open end display (reflected pulse) is set 2 divisions above the cable display (horizontal centerline). This sets the reflected pulse to $+1p$ from the characteristic impedance.

NOTE

If an impedance adapter is not used, secondary reflections will re-appear as discontinuities beyond the open end of the cable.

1502 ACCESSORIES

Plug-Ins

The 1502 plug-in compartment will accept the X-Y OUTPUT MODULE (provided as a standard accessory) or the TEKTRONIX Y-T Chart Recorder (part number 016-0506-03).

Using an X-Y Recorder

The X-Y OUTPUT MODULE is wired for either a positive or negative pen lift signal. Before using the X-Y OUTPUT MODULE, be sure that the pen lift circuit on the etched circuit board is properly connected. Fig. 2-12 shows the proper connection for either a positive or negative pen lift signal.

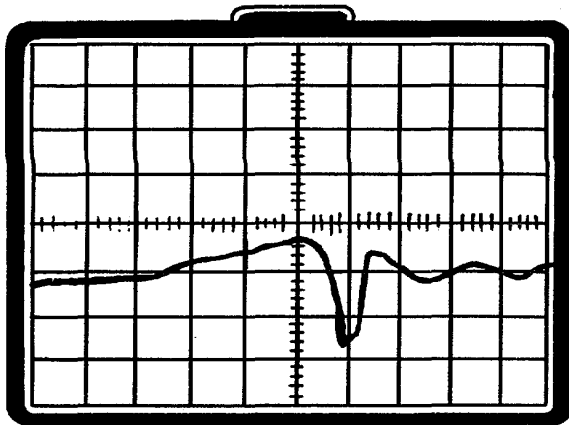


Figure 2-10. Crimped Cable.

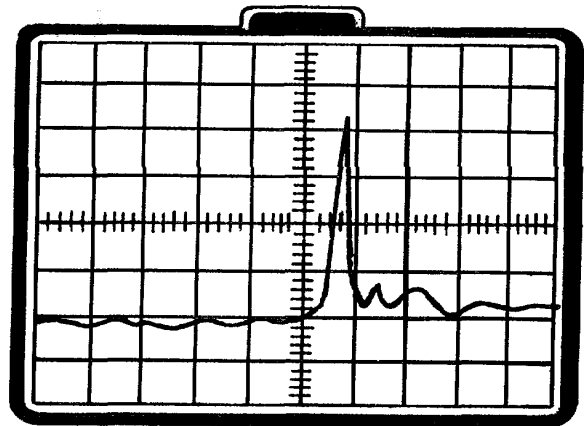
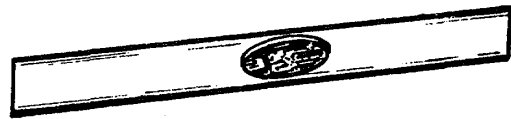
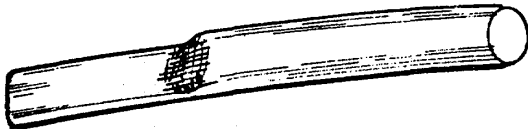


Figure 2-11. Frayed Cable.



An X-Y recorder can be used with the 1502 by connecting it to the X-Y OUTPUT MODULE when this module is plugged into the 1502. Connect the X, Y, and PEN LIFT inputs of the recorder to the corresponding jacks of the X-Y OUTPUT MODULE. See the information or manual provided with the recorder for further information on its use.

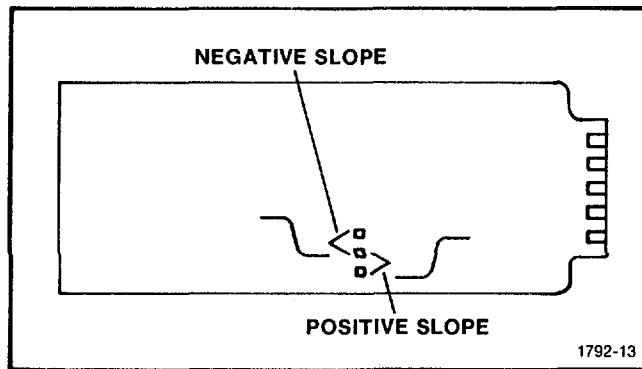


Figure 2-12. X-Y Output Module Strap.

Mesh Filter for the crt

A mesh filter is provided with the 1502, which makes viewing of the crt easier when the unit is being used in the sunlight. This filter is placed over the crt by sliding it onto the slots of the crt bezel.

Viewing Hood

The viewing hood provides shading for the crt and can be installed over the crt by sliding it down over the crt bezel sides. The mesh filter must be removed before the viewing hood will connect it to the crt bezel.

Using a Camera with the 1502

If a Camera Adapter (Tektronix Part Number 016-0327-01) is attached to the crt bezel of the 1502, A C-30B/31B camera can be used to take photographs of the crt display.

Nominal C-30B/31B camera settings are:

| | |
|---------------|----------------------------|
| f/stop | 5.6-11 |
| time | 1 sec |
| magnification | 1.2 (fixed at 0.5 in C31B) |
| focus | as necessary |

INSTRUMENT STORAGE

The 1502 has been made with a ruggedized case that will provide protection when stored in exposed areas. When the instrument is not being used, the accessories (including the Operators manual) should be packed in the instrument cover and the cover latched on the front of the instrument.

The 1502 can be stored in temperatures between -62°C and $+85^{\circ}\text{C}$, but if the temperature is below -40°C or exceeds $+55^{\circ}\text{C}$, the batteries must be removed and stored in a location where the temperature is between -40°C and $+55^{\circ}\text{C}$.

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THEORY OF OPERATION

This section describes the circuits of the 1502 using a combination of block and circuit diagrams on pull-outs from the back of this manual.

Block Diagrams

There are two block diagrams that show the overall functions of the 1502; Fig. 3-1, a simplified version, and the main block diagram located on a pull-out.

Circuit Operation

The 1502 uses pulses to check cable conditions. The Pulser circuits transmit the pulses down the cable under test, and the Sampler circuits sample the reflections and provide the vertical signal for display on the crt.

The Pulser is basically a tunnel diode in a 50 Ω strip line (cavity). It contains all biasing and timing circuits required for operation of tunnel diode, CR1703.

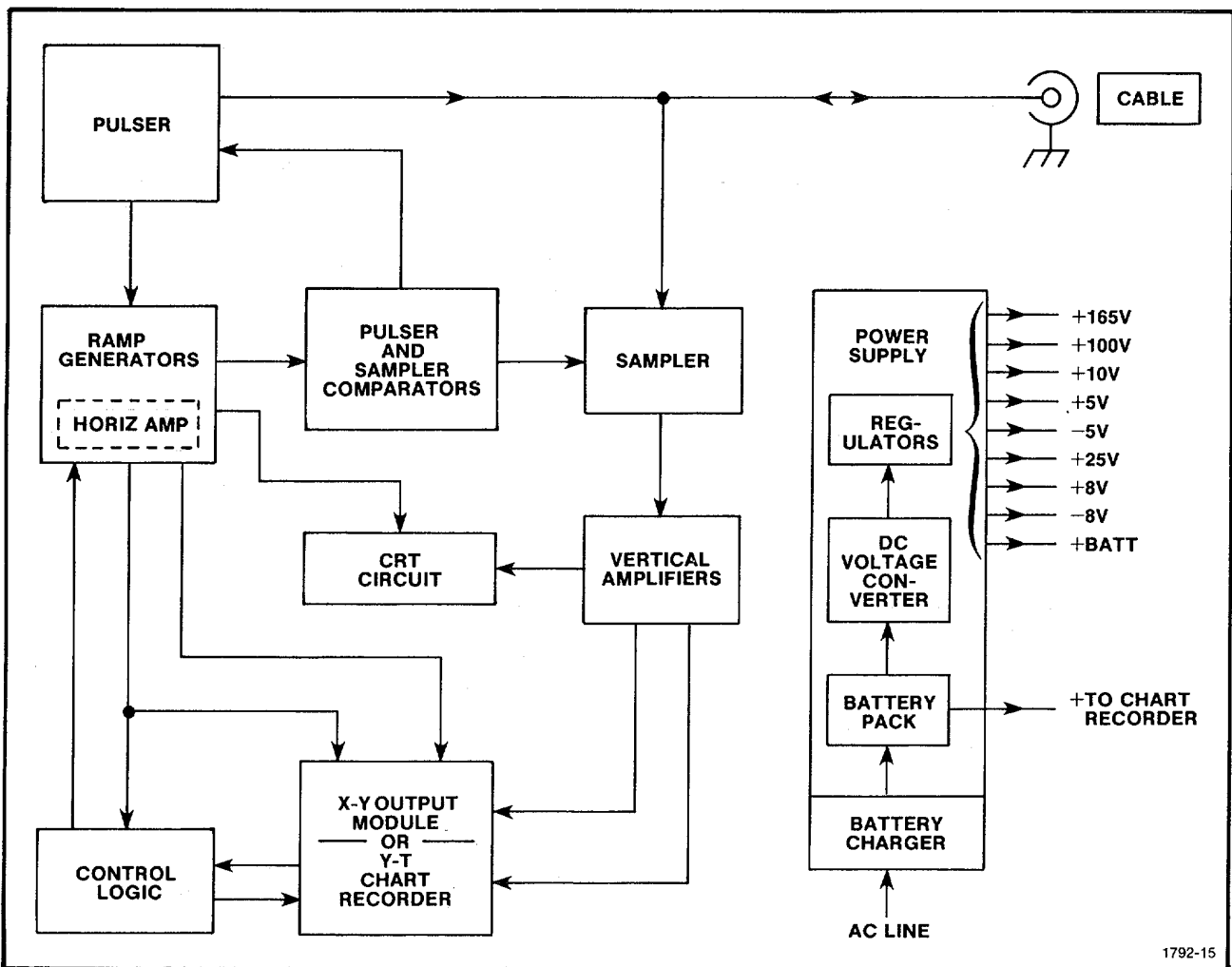


Figure 3-1. Simplified Block Diagram-1502

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Sequential equivalent-time sampling is used to develop a display. Two ramps are generated, a fast ramp and a slow ramp. The fast ramp is compared to the slow ramp or a fixed reference to generate trigger pulses for the Sampler and the Pulser respectively. These comparisons are made by the Pulser and Sampler Comparators.

A short time after the Pulser transmits the step pulse into the cable under test, depending on the amplitude of the slow and fast ramps, a sampling trigger from the Sampler Comparator causes the Sampler to sample-and-hold the voltage level appearing at that time. This voltage is taken at the point where the Sampler is connected to the 50 Ω strip line. This voltage sample is amplified and sent through the vertical amplifiers to the crt.

The Slow Ramp Generator provides the horizontal sweep for the crt and, combined with the vertical sample, provides a display of the sampled value. Sampling triggers, taken later during the next fast ramp time, cause additional samples to be displayed next to the first one, until a line of very short dashes are formed across the crt, appearing as a solid line (Fig. 3-2).

The amplified vertical and ramp signals are also sent to X-Y Interface connectors. These signals, along with a pen lift control signal, provide the information for driving external X-Y recorders.

If the TEKTRONIX Y-T Chart Recorder is used, the amplified vertical signals from the Sampler are applied to the writing stylus drive circuits. The speed of the chart paper is derived by the holes along the edge of the chart paper passing between a phototransistor and a light-emitting diode providing digital information to the Control Logic. The Control Logic uses this information to control the slope of the slow ramp so as to match the speed of the chart paper. Thus, the trace and grid on the chart recording correlates to the trace and graticule displayed on the crt.

When the horizontal scan of the crt has been completed, the vertical input is automatically disconnected and the slow ramp is released to scan at its own speed. The chart paper continues to run until the entire recorded data is outside the chart recorder.

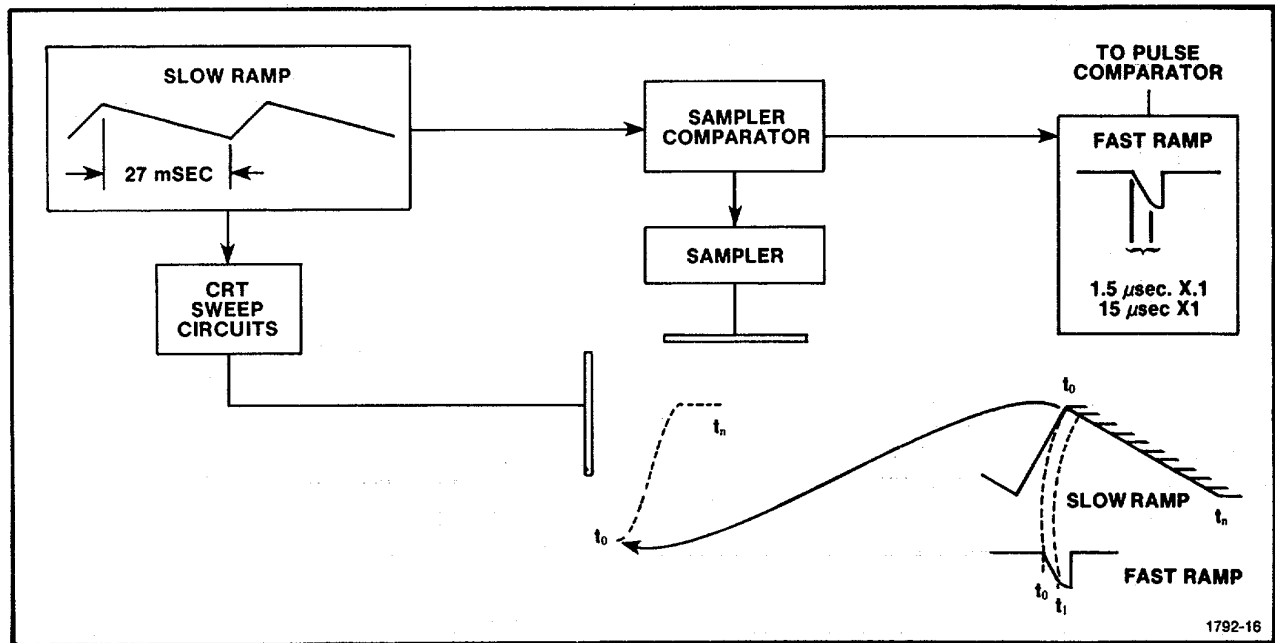


Figure 3-2. Sampling Diagram.

DETAILED CIRCUIT DESCRIPTION

Pulser

The Pulser consists of three circuits: a Clock Generator, a Logic Programmer, and a Pulse Generator. These circuits provide a signal for the fast ramp generator called the FAST RAMP START, and provide timing for firing the tunnel diode, CR1703. A complete programming cycle consists of six equally divided time slots derived from the 60 kHz Clock Generator output. The Logic Programmer develops the timing pulses from the Clock Generator output to control bias level timing on the tunnel diode and the duration of the Fast Ramp Generator.

The Pulser uses a two step process to generate a test pulse. Two steps are used to automatically bias the tunnel diode. The first step checks the peak current point of the tunnel diode then stores the firing voltage level on Memory Capacitor C1596. The second step uses the voltage stored on C1596 and an additional pulse (TD TRIGGER) to fire the tunnel diode and transmit the test pulse to the CABLE connector. This peak current check is performed for each Programming cycle. Thus, the automatic bias corrects for tunnel diode aging, thermal effects, and loading variations. Biasing action on the tunnel diode during each time slot is as shown in Fig. 3-3 and described as follows:

Time Slot 1. All current is removed from the tunnel diode to reset it to its low state. The low state is on the low voltage side of the peak current point on the voltage-current curve of the tunnel diode (Fig. 3-4).

Time Slot 2. Bias current is applied to the tunnel diode so that the current is raised to just below the minimum peak current point (depending on the tolerance of the tunnel diode characteristics).

Time Slot 3. A current ramp is added to the bias current until the tunnel diode fires. After firing, the tunnel diode current is reduced to a predetermined amount where it remains for the rest of time slot 3.

Time Slot 4. All current is removed to reset the tunnel diode to the low state. This completes the first pulse and the firing level of the tunnel diode is now just above the voltage stored in capacitor C1596.

Time Slot 5. This is a waiting period where currents are allowed to stabilize.

Time Slot 6. The tunnel diode is fired by TD TRIGGER from the Pulse Comparator. The fast ramp makes its sweep and the Sampler takes its sample during this time.

Clock Generator. The Clock Generator consists of two inverters, U1575A and U1575B, which act as an astable multivibrator. The output signal is a square wave about 60 kHz, as determined by C1572 and R1574. R1577 protects the input to U1575B. The square wave is applied to a divide-by-six counter in the Logic Programmer.

Logic Programmer. The Logic Programmer provides the needed logic sequence to allow automatic tunnel diode biasing and sampler synchronization. It consists of a divide-by-six counter, U1569, and gates U1575C, U1575D, and U1671. A cycle is completed after every six clock inputs (Fig. 3-3). $\overline{Q1}$ starts going high at the start of the clock pulse train and remains high for three clock pulses, then goes low for the next three clock pulses.

The outputs ($\overline{Q1}$ through $\overline{Q5}$) of the counter go to gates U1575C, U1575D, and U1671. The output of U1575C is called FAST RAMP START and controls the duration of the fast ramp generator. It is in the low state for the first five clock cycles and in the high state for the sixth clock cycle (see Fig. 3-3b).

The output of U1575D, MEMORY RESET, is used to reset the biasing level of tunnel diode CR1703. By turning Q1597 on, the charging current to C1596 is shunted to ground, and any voltage on this capacitor is removed. This occurs during the first 2 time slots (see Fig. 3-3c).

The output of gate U1671D resets the tunnel diode during time slots 1 and 4, accomplished by diverting the current for the tunnel diode to ground through Q1602. This causes the tunnel diode to turn off. The reset action occurs each time after the tunnel diode is fired (shown in Fig. 3-3d).

The output of U1671C is used to enable a comparator, Q1688 and Q1695, which senses when tunnel diode CR1703 goes into the high state during time slot 3 (see Fig. 3-3e).

Pulse Generator. The Pulse Generator consists of the high speed, 20 milliamp tunnel diode, CR1703, and the tunnel diode bias control circuits. It generates the test output pulses to the CABLE connector.

The voltage pulse across CR1703 is 400 mV with a risetime of about 50 ps. The low impedance of CR1703, combined with R1701, form a source impedance of 50 Ω . This circuit provides a 200 mV step pulse to the CABLE connector.

Bias current for tunnel diode CR1703 is provided by R1601 and R1693. Transistors Q1602 and Q1603 serve as a switch to direct the current through the tunnel diode via Q1603 or to divert the current to ground via Q1602. TUNNEL DIODE RESET (U1671D output), which is high during time slots 1 and 4, is used to switch between Q1602 and Q1603. When the base of Q1583 goes high, its output to Q1589 goes low. The emitter of Q1589 goes low, turning Q1595 on, which turns Q1602 on (through Q1502) and Q1603 off (through Q1504). CR1703 is then off.

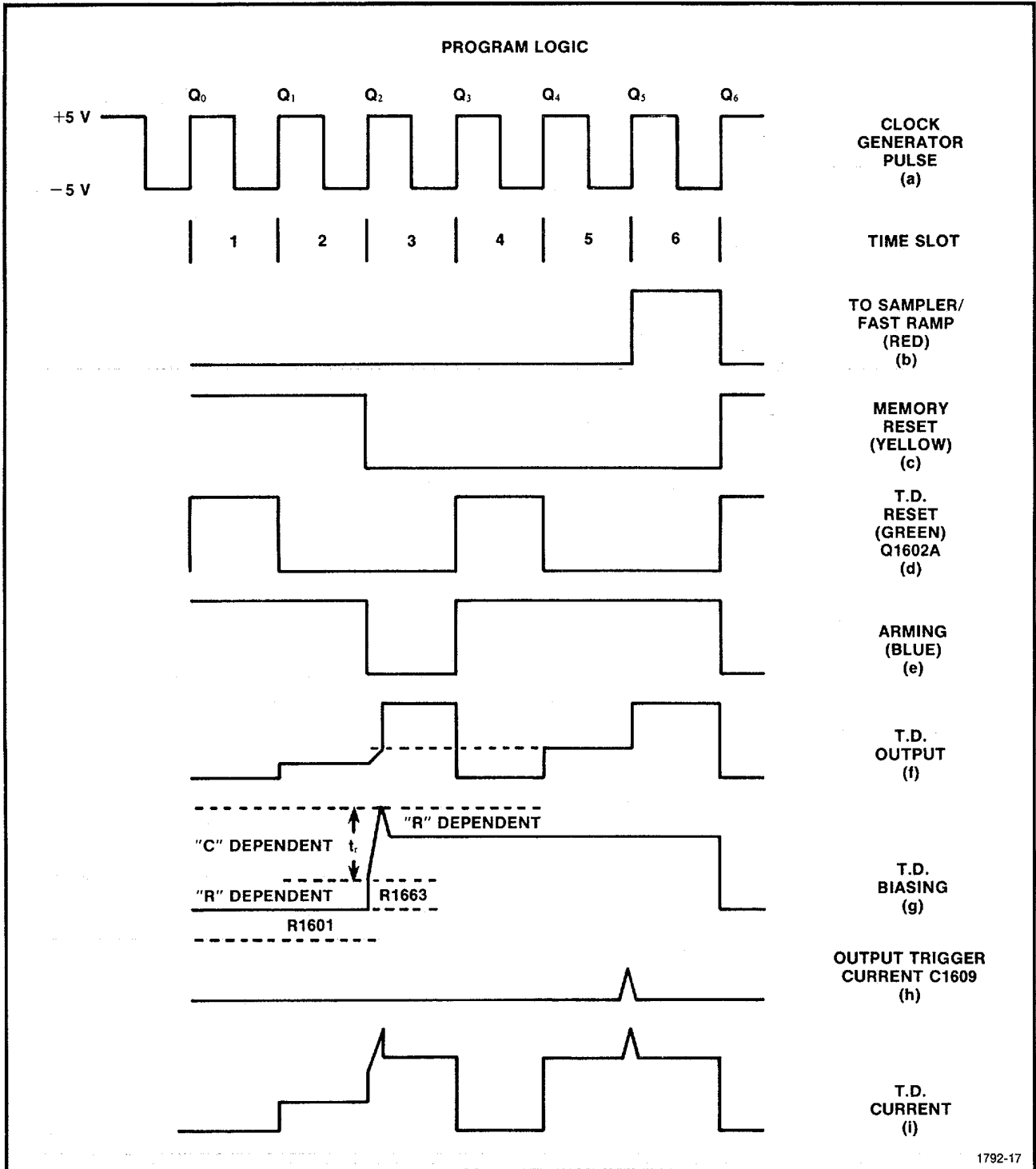


Figure 3-3. Program Logic Cycle.

During time slots 1 and 2, Q1597 is saturated, discharging memory capacitor C1596. At the start of time slot 3, Q1597 is cut off, allowing the current through CR1691 and R1691 to charge C1596 via R1692 and R1594. (C1596, R1692, and R1594 compose the memory circuit). This causes the gate voltage of Q1693 to be stepped up to a value determined by voltage divider R1691, R1692, and R1594 and then increase with a time constant rate determined by R1691, R1692, R1594, and C1596 (see Fig. 3-3g).

A current with a waveform similar to the voltage waveform at the gate of Q1693 will flow through R1693 and is added to the idle current from R1601. This current flows through Q1603 to output tunnel diode CR1703, and continues to increase until the tunnel diode goes into the high voltage state. At this point, comparator Q1695 and Q1688 cause Q1683 to remove the memory charge current. Thus, current stops flowing into C1596, causing the voltage ramp at the gate of Q1693 to stop and step-down. Similarly, the current ramp into the tunnel diode will stop and step-down.

The comparator consists of Q1695 and Q1688. Its reference is set at a negative level, except during time slot 3 when it is set at a positive 300 mV. The reference input voltage (the voltage at the base of Q1695) equals the tunnel diode voltage (which is always above ground level). These conditions cause Q1683 to saturate and remove the memory charging current. At the beginning of time slot 3, when the tunnel diode is still at its low voltage state, the comparison voltage is set at 300 mV. At this level Q1683 is not conducting, therefore, the memory charge current flows to the memory capacitor. When the tunnel diode fires, the comparator input voltage goes above the 300 mV comparison level. Q1683 becomes saturated again and the memory charge current is removed. The comparison reference levels are set by R1682, R1683, R1681, and Q1675. Factory selectable resistors R1702 and R1707, along with capacitors C1701 and C1706, are used to compensate for tunnel diode thermal time constants.

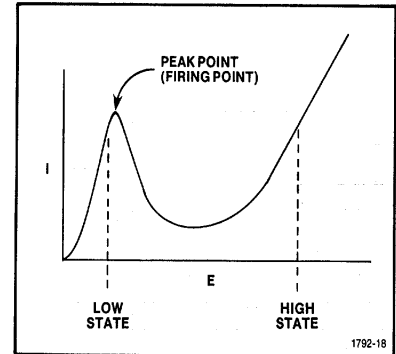


Figure 3-4. Tunnel Diode Voltage-Current Curve.

A tunnel diode, CR1609, is used to reduce jitter on the output step pulse. Q1608 conducts when TD TRIGGER is received from the pulser comparator during time slot 6. The current through Q1608 causes tunnel diode CR1609 to go to the high voltage state, producing a fast spike pulse through C1609 and R1701 to tunnel diode CR1703. This fires CR1703, sending the test pulse to the CABLE connector. Dc balance network, R1753, R1659, and C1655 provides an output of "zero" level when no test pulse is being generated, and if the CABLE terminations are not too extreme.

Sampler

The Sampler circuitry provides positive and negative strobes to strobe the sampling diodes, so that during a short time period (100 ps), a sample of the incident pulse or reflected signals can be taken. The sampling preamplifier amplifies these signals for display on the crt. The sampler consists of a Sampling Gate, Sampling Preamplifier, Strobe Generator, and Blowby Compensation.

Sampling Gate. Dual-diode Sampling Gate, CR1732, allows signals from the output terminal to appear at the preamplifier input for a short period of time. The bandwidth (or risetime) of the sampler is proportional to the conduction time of the diodes, which are controlled by the strobe width of the strobe generator.

Sampling Preamplifier. The Sampling Preamplifier consists of Q1648, Q1556, and Q1643. While strobing is occurring, a signal sample is taken from the transmission line and stored in capacitors C1635, C1636, C1637, C1638, C1646, and C1647. The preamplifier amplifies the charge stored in the capacitors. A positive feedback is provided by C1646 and C1647 to bring the sampling efficiency to unity. The sampling efficiency is adjustable by R1543.

The preamplifier has a gain of approximately 2 times, which is controlled by R1549 and R1651. R1639 and R1630 are needed to bleed off some of the reverse self-charge of C1637 and C1638. This allows the sampling gate to conduct during the peak amplitude of the strobes and thus determines the sampling aperture.

Strobe Generator. The Strobe Generator consists of preamplifier Q1553; signal-shaping amplifier Q1544 and Q1535; avalanche circuit Q1537; snap-off diode circuitry and strobe shaper, CR1632; and shorted strip lines.

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A negative-going signal from the sampler comparator is amplified by Q1553 and the collector output is fed to a fast-rise one-shot multivibrator. A positive-going signal to Q1544 produces a negative-going signal on the base of Q1535, which results in a more positive-going signal on the base of Q1544. This action continues until both transistors are completely saturated, at which point TP1534 (violet test point) is at ground level. It will stay in this state as long as a charge remains on C1543. When this charge is depleted, the circuit resets and TP1534 returns to -5 volts. The fast positive edge at TP1534 is fed through C1534 into transformer T1538, which drives the avalanche circuit. Avalanche transistor Q1537 goes into its avalanche mode and the voltage across the transistor collapses very rapidly (300 ps). The collector voltage drops and the emitter voltage rises. These opposite signals are fed to the SNAP-OFF circuit by way of C1631 and C1632. The SNAP-OFF diode CR1632 is normally forward biased by a current from R1625 and R1633. This current is established by the emitter voltage of Q1539. The emitter voltage is controlled by R1538 (SNAP-OFF CURRENT). The negative-going signal of the avalanche circuit is applied to the anode of the SNAP-OFF diode and the positive-going signal is applied to the cathode to reverse bias this diode. After a small delay, the SNAP-OFF diode will become reverse biased. The reverse biasing occurs in less than 50 nanoseconds. The fast rising step from CR1632 is applied to the shorted strip lines. The width of the strobes is determined by the physical length of the shorted strip lines. The generated strobe is differentiated by capacitors C1635 and C1636 and then strobes the sampling diodes.

The avalanche voltage amplitude is controlled by R1525 with Q1529 acting as an emitter follower.

Blowby Compensation. The Blowby compensation network, Q1656, R1657, R1752, and R1656, cancels any signal component passing the gate due to diode shunt capacitance. This is accomplished by inverting the transmission line signal and adding it to the input of the preamplifier through C1648. The amount of compensation is set by R1657 and R1659 (LO FREQ COMP).

Comparators

There are two comparators; the Pulser Comparator and the Sampling Comparator. The Pulser Comparator provides the TD trigger signal to the Pulse Generator and the Sampler Comparator provides the Sampling Trigger signal to the Strobe Generator. Each comparator consists of a differential amplifier; Q1336 and Q1325 in the Sampler Comparator; and Q1347, Q1348 in the Pulser Comparator. The two comparators operate the same, therefore only the Sampler Comparator component numbers will be used in this description (see circuit diagram 1B).

The two inputs for the Sampler Comparator are the bases of Q1336 and Q1325. Depending on which input is higher, the voltage at TP1324 (green test point) will be +5 V or negative. If the base of Q1336 is high, Q1336 conducts and Q1325 is turned off. The current for Q1336 comes from Q1329 which turns Q1328 on. This puts the voltage at TP1324 high (+5 V). When the base of Q1336 is below that of Q1325, Q1336, Q1329 and Q1328 are turned off. Q1325 is conducting. The output voltage drops to the level of a conducting diode junction.

Q1425 and Q1431 form a temperature-compensated current source for the differential amplifier. The collector current of Q1431 is determined by the value of R1431 and R1422. It is approximately equal to the current of Q1425.

The second input of the Sampler Comparator is connected to the attenuated and inverted slow ramp signal. (The second input for the Pulser Comparator is a dc voltage that is controlled by the ZERO REF SET, R0151. The X.1 POSITION CAL control, R1132, compensates for unequal delays in the comparator when the speed of the Fast Ramp is changed (X1 to X.1).)

Ramp Generators

There are two ramp generators, the Fast Ramp Generator and the Slow Ramp Generator. The Fast Ramp is used for setting the X1 and X.1 distance timing. The Slow Ramp is used for the crt sweep and, when combined with the Fast Ramp, to create slewed strobes for the sampler.

Fast Ramp. The Fast Ramp Generator consists of amplifier Q1357 and Q1358; fast ramp clamp Q1338; current source Q1337 and Q1339; and timing capacitors C1325, C1237, and C1332.

Q1337 provides a constant current source for the timing capacitors to develop a linear voltage ramp across them. The magnitude of current can be precisely set with the FEET/DIV CAL, R1435. Q1339 is needed for thermal tracking. The timing capacitors are reset, at the end of time slot 6, by high speed ramp clamp Q1338. The ramp clamp is controlled by the pulse generator programmer through Q1338 and Q1357. C1332 is a timing adjustment for the X.1 ramp. The Fast Ramp signal is supplied to the Sampler and Pulser Comparator.

Slow Ramp (Schematic 3). The Slow Ramp Generator consists of an integrator, a bi-level comparator, a positive current source, a negative current source, a retrace switch, and a retrace signal amplifier. A functional block diagram of the Slow Ramp Generator is shown in Fig. 3-5.

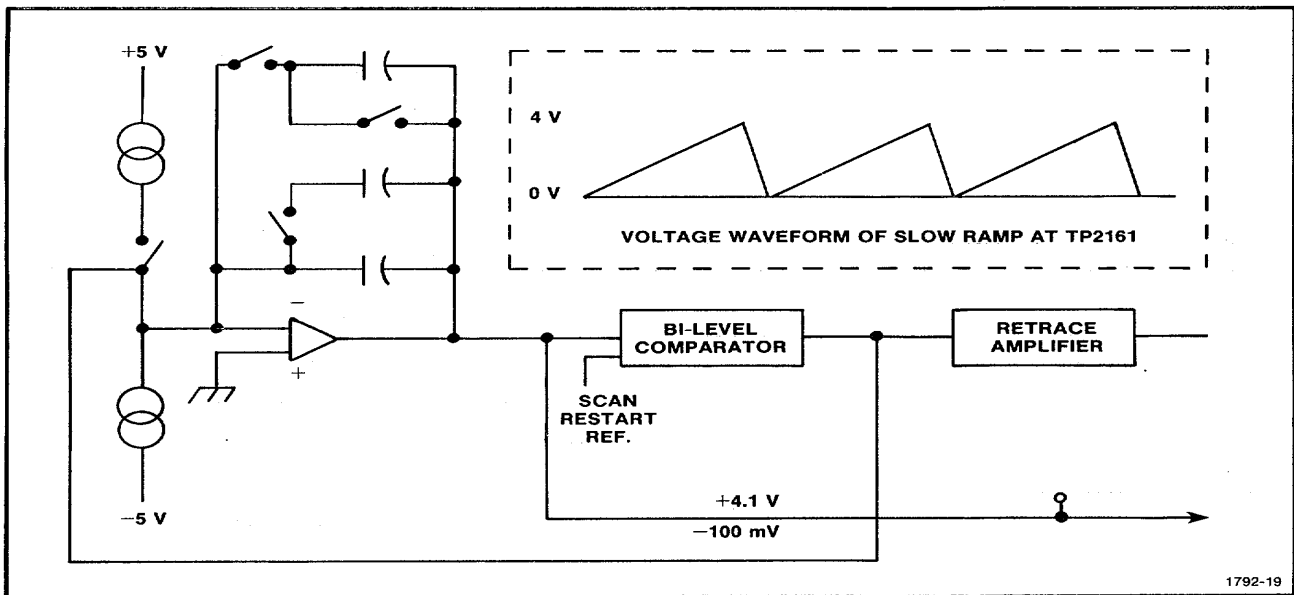


Figure 3-5. Functional Block Diagram of Slow Ramp Generator.

Integrator. An inverting amplifier circuit with an FET input is used as an integrator. Integrator capacitor C2356 is connected between the collector of Q2345 and the inverting input (gate of Q2246A). A minus current applied to the inverting input through R2353 results in a linear rising voltage on the output (see the waveform shown in Fig. 3-5). This output voltage will continue to rise until it reaches the internal comparison level of 4.1 volts. The bi-level comparator output then switches to a higher output level to close FET switch Q2257. It also changes its comparison level to -0.1 V. This allows a positive current to be applied to the input of the integrator. The positive current is several times larger than the negative current and causes the output voltage of the integrator to decrease linearly. After a short period of time, the integrator output voltage approaches this comparison voltage of -0.1 V and causes the positive current into the integrator to be turned off. At this time the comparator level is switched back to the 4.1 V level and the cycle starts over.

The rise and fall time of the slow ramp can be varied by changing the integrating capacitance values. In the normal 40 Hz scan frequency, a value of $0.0013 \mu\text{F}$ is used. When NOISE FILTER switch S2254 is activated, the scan frequency is reduced by approximately 7 times by paralleling a capacitance value of $0.01 \mu\text{F}$ to the original $0.0013 \mu\text{F}$. For recording (X-Y or chart) purposes, a value of $1 \mu\text{F}$ is used. (Q2248 acts as a FET switch and is controlled by the Record Logic.)

Bi-Level Comparator. During the positive going sequence of the Slow Ramp Generator, Q2261 is saturated and Q2262 is off. The emitter voltage of Q2261 and Q2262 is 4.1 volts. This voltage is controlled by a resistor divider, R2267 and R2158. The collector (output of the comparator) of Q2262 is at a -5 V level because the transistor is not conducting. The anode of CR2161 has to rise to 4.1 volts in order to turn off Q2261.

When Q2261 turns off, its collector level will decrease, which causes Q2262 to be turned on and saturated. The emitter voltage output switches to -0.1 volt. Q2261 remains off until the anode voltage of CR2161 goes to -0.1 volt, which restarts the cycle.

The comparator can be forced into the scan cycle when the Recorder Logic turns on CR2262.

Retrace Signal Amplifier. The retrace signal amplifier uses an input FET (Q2258) to drive amplifier Q2259. The output voltage is $+5$ V during retrace and -5 V during the scan cycle. The output is used for Chart Recorder Logic and Record Logic.

Current Sources. The positive and negative currents for the retrace sweep are generated by applying $+5$ V and -5 V to the high value resistors R2251 and R2353 respectively.

Sweep Inverter with Horizontal Attenuator (Schematic 2)

The Sweep Inverter consists of an operational amplifier U1344; selectable input resistors, R1216, R1217, R1218, R1219, R1226, R1227, R1323, R1324 (which are selected by the FEET/DIV switch, S1222F) and selectable feedback resistors, R1148, R1146, R1152, which are selectable by the CABLE DIELECTRIC switch S1251.

Operational amplifier U1344 is connected in the circuit as an inverter. Its input voltage amplitude is determined by the position of FEET/DIV switch S1222F, whose input signal is the 4 volt, slow-ramp generator signal. The FEET/DIV control is selectable from 1 to 200 feet per division in a 1-2-5 sequence. The output of the FEET/DIV control is fed to the Sampler Comparator by way of voltage offset circuitry R1342 and R1239.

Feedback resistor R0472 is a variable range adjustment for the "OTHER" cable types; OTHER being any cable with a dielectric material other than solid polyethylene or solid polytetrafluoroethylene.

Distance Offset

The distance offset consists of a compensated current source Q1413, Q1317; a DISTANCE dial, R0271; and a ZERO REF CHECK switch, S0151.

The constant current of Q1413 is fed into the wiper of the variable DISTANCE resistor, R0271. The variable calibrated current of R0271 is fed into the summing junction of the Inverters operational amplifier, U1344. This occurs in all FEET/DIV settings except the 200 feet/div setting. When depressed, ZERO REF CHECK switch S0151 disables the offset current so that reference checks can be made. DISTANCE CAL resistor R1315 provides an adjustment for the calibrated current of Q1317.

Horizontal Output Amplifier (Schematic 4)

The Horizontal Output Amplifier consists of Q3221, Q3118, Q3113, and Q3114. This amplifier amplifies the 0-4 volt, slow ramp signal into a differential voltage of approximately 150 volts as well as shifting the output level to an average voltage of 85 V. This amplifier gain of approximately 37 times is achieved with a differential transistor amplifier, Q3221 and Q3118. The gain is controlled by the ratio of resistance R3122 or R3121, the parallel values of resistors R3217 and R3116, and resistors R3216 and R3212. R3217 is variable to adjust for crt deflection factor tolerances. The differential amplifier uses 0Q3113 and 0Q3114 as a current mirror current source. The thermally stable current is set by R3112, R3114, and R3115. R3213 is used for horizontal positioning.

X-Y Recorder Logic (Schematic 3)

The X-Y Recorder Logic consists of bi-stable multivibrator U2332B and U2332D; gates U2332A and U2332C and multiplex switches U3223A and U3223B. (U3223A and U3223B are on Schematics 3 and 4.)

During the normal mode of 1502 operation, the output of the multivibrator (PENLIFT: TP2157, yellow) is low and Q2248 is not conducting. Pin 10 of gate U2332C is low and Q2249 is not conducting. By pressing RECORD switch S0481B, the RECORD line goes high, the multivibrator changes level, and TP2157 becomes positive (+5 V). The output of U2332A (pin 3) goes low and the output of U2332C (pin 10) goes high. This turns Q2249 on. Q2249 keeps C2356 discharged and the output of the Slow Ramp remains at 0 V. By releasing the RECORD switch, the output of U2332C goes low, which turns Q2249 off. At the same time, Q2248 is on. This starts the Slow Ramp Generator scanning at a much slower rate due to C2252 being added to the circuit. When the scan cycle ends, the output of retrace amplifier Q2259 goes high, causing multivibrator U2332D and B to be reset. This sets the Recorder Logic back to the normal mode of operation.

Components CR2324, R2324, and C2325 are used to ensure that the Recorder Logic is in the normal mode of operation when the power supply switch is turned on.

Vertical Amplifier

The Vertical Amplifier circuit contains selectable gain amplifier U2136 with positioning control, variable gain amplifier U2143 to calibrate the instrument for different cable impedances, retrace logic with a fogging oscillator, and a vertical output amplifier.

Vertical Amplifier. This circuit consists of operational amplifier U2136, and a bank of resistors for gain selection. The required resistors are selected by switch S2126 (m μ /DIV).

The operational amplifier is connected as a voltage follower. The non-inverting input receives its signal from the preamplifier through R2138 and the positioning signal from amplifier U2131 through R2137. High-frequency noise is filtered by 0.001 μ F capacitor C2137. Additional noise filtering can be obtained by activating the NOISE FILTER switch, S2254, which adds 0.1 μ F capacitor C2241 to the circuit.

Positioning. Vertical trace positioning is accomplished by offsetting the dc level of the vertical signal. Operational amplifier U2131 provides the dc offset voltage. U2131 is controlled by R0251A (POSITION) and R0251B (FINE).

Gain Amplifier. The Gain Amplifier consists of U2143 with variable gain provided by R0263. The incoming voltage is attenuated approximately 20% by R2228 and R2144. The output voltage is approximately 200 mV per division. The variable gain control has a range of approximately 5 times and is set by the values of R0263 and R2142. The output goes through the Retrace Logic to the Vertical Output Amplifier.

Retrace Logic (Schematic 4). The Retrace Logic consists of gate U3123C, inverter Q3137, oscillator U3123A and U3123D, and analog switches U3223C and U3223D.

The only time the vertical signal is applied to the vertical output amplifier is during the forward scanning cycle. During the retrace cycle, an offset voltage is applied to the vertical output amplifier.

During the slow ramp forward scan cycle, the retrace signal is negative, as is pin 2 of U3123A. This causes the output of U3123D to be low. Pin 6 of U3223C is also high and the vertical signal is passed through the analog gate to the output amplifier.

During the retrace cycle, the output of U3123D is high, but pin 6 of U3223C is low and pin 12 of U3223D is high. This allows the output of U3123D to be passed to the vertical output amplifier, which causes the beam to be deflected below the crt viewing area.

Vertical Output Amplifier. The Vertical Output amplifier consists of Q3236, Q3232, Q3139, and Q3235. The mode of operation is identical to that of the Horizontal Output Amplifier. In the Vertical Output Amplifier, the amplifier gain is approximately 80. Capacitor C3233 is added to increase high frequency response.

CRT Display Circuits (Schematic 4)

The crt display circuit High Voltage Supply provides the voltage for the FOCUS control, INTENSITY control, and the cathode of the crt and the crt biasing network. The crt provides a display of the conditions of the cable being checked and is also shown in the circuit.

High Voltage. The high voltage circuit consists of: an oscillator, formed by transistors Q4149 and Q4145; transformer T4141; a high voltage multiplier circuit consisting of CR4323, CR4313, CR4311, and CR4211, and a resistor divider string consisting of R4114, R4126, R4222, R4129, and R4221, INTENSITY control R0442, and FOCUS control R0432.

The self-starting oscillator is formed by R4146, R4141, and transformer T4241. The transformer has a separate feedback winding (pins 9, 10, 11), which ac couples the voltage to the bases of the transistors (Q4149 and Q4145). R4146 and R4141, along with the 0.001 μ F capacitors (C4135 or C4134), establish a time-constant that prevents saturation and controls the oscillator frequency.

Winding 7-8 of the transformer provides a 0.6 volt rms signal for the crt filament. This winding is high voltage insulated. Winding 4-6 provides a 500 volt square wave that is used to generate the high voltage. The high voltage multiplier circuit converts the 500 volts to 2000 volts. A resistor divider string is connected between the 2000 volt and the 1000 volt taps of the multiplier circuit. This provides the voltages for correct biasing of the crt. The FOCUS and INTENSITY controls are included in this divider string. A 150 volt zener diode, VR4117, is used to stabilize the cathode voltage.

Cathode-Ray Tube. In order to optimize the crt display, internal controls for Astigmatism, Geometry, and Trace Rotation are provided. These controls, which are located on the output board, are: R3148, R3149, R3242 (ASTIGMATISM); R3249, R3248 (GEOMETRY); and R3142, R3143 (TRACE ROTATION).

Power Supply (Schematic 6)

The Power Supply consists of a line selector, transformer T0389, a battery charger network, battery pack BT0369, and the dc voltage converters. The battery charger network contains SCR switch Q6155, SCR triggering circuit Q6143, Q6244, and Q6241, operational amplifier U6138, and the current reference resistor R6131.

In the dc voltage converters, there is an Anti-Deep Discharge circuit, Q6548, Q6549, and Q6547; a primary regulator, Q6552, Q6557, and VR6459; a controllable oscillator, Q6458, Q6445, C6551, R6545; a fly-back switch, Q6435 and Q6349; and fly-back transformer T6535. The secondary output windings of T6535 provide the +165 V, +100 V, +25 V, +10 V, +8 V, -8 V, +5 V, and -5 V supplies. The +10 V, +5 V, and -5 V circuits have secondary regulation circuitry. See Fig. 3-6 for a simplified block diagram of the power supply.

Line Selector. The line selector is composed of the input transformer's terminals and can be wired for either 110 volts or 220 volts. It is factory wired for 110 volts. If 220 volt operation is required, remove the wire straps from lugs 1-2 and 3-4 of T0389; then connect a strap from lug 2 to lug 3.

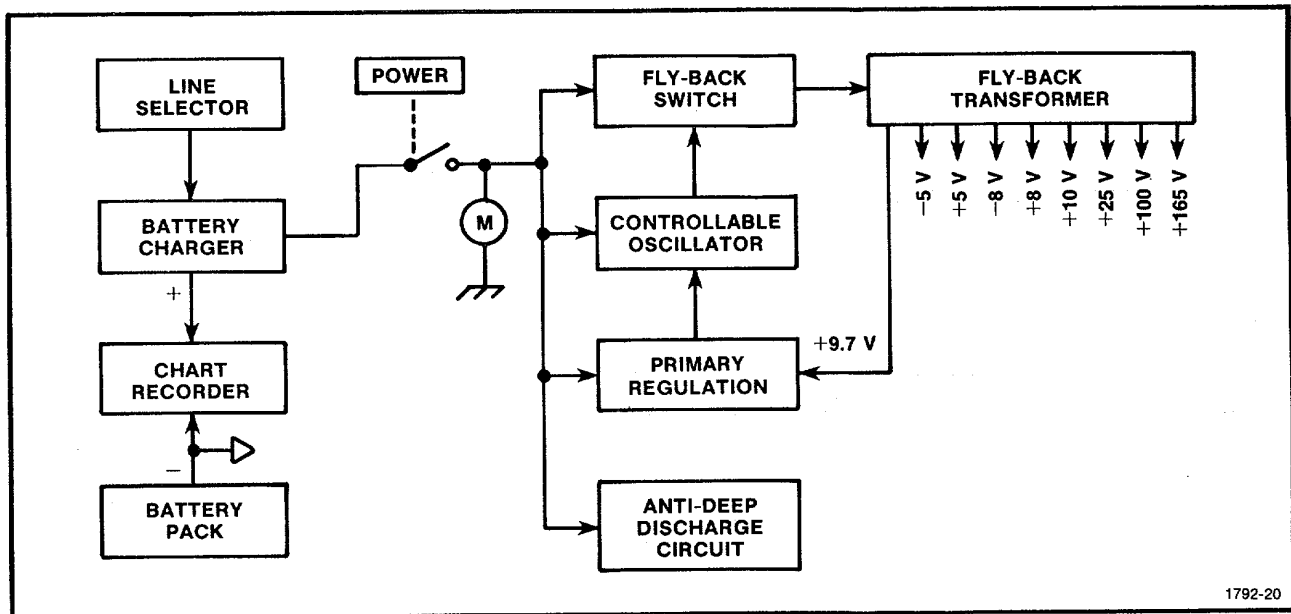


Figure 3-6. Block Diagram of 1502 Power Supply.

CAUTION

If the instrument is wired for 220 V operation, be sure that the two front panel fuses are changed. See the electrical parts list for proper fuse size.

Battery Charger. Line transformer T0389 provides battery charge current. The battery charge current is regulated for an average current of 150 mA (independent of battery load).

A reference voltage of approximately 50 mV is created across reference resistor R6132. This voltage is created by R6135 and VR6134. The battery load and charge current are always fed through R6131 and the charger will try to maintain an average current of 150 mA into the battery. This is done by comparing the voltages across two reference resistors (R6132 and R6131) using operational amplifier U6138. Depending upon the battery charge current, the output of the operational amplifier will provide more or less current into the current source input Q6244. With every new cycle, a current (of the same magnitude as the input current) will be released by Q6241 to charge capacitor C6147. Full wave rectification is provided by CR6157. The voltage across C6147 builds up every cycle until it reaches the firing threshold level of the programmable unijunction transistor (PUT) Q6143. At this moment, a triggered pulse occurs at the cathode of the PUT, which in turn fires SCR Q6155. When this occurs, a portion of the full-wave rectifier output provides a charge current for the battery during the remainder of the cycle. During this same period, C6147 gets discharged through the anode of the PUT. The point at which the triggering occurs is determined by how fast C6147 becomes charged to the reference voltage of about 4.5 V and the charging speed is determined by the average current to the battery.

Because the charge current and load currents are in the form of pulses, averaging (integration) is performed at the output of operational amplifier U6138 by a 15 μ F capacitor C6233. Zener diode VR6134 provides protection in case the battery pack is removed and the line cord is plugged into a line-voltage source. Battery pack BT0369 consists of nine nickel-cadmium C cells.

NOTE

For proper operation, the battery pack must be in place at all times during operation of the instrument.

DC Voltage Converter. The controllable oscillator is an astable multivibrator (Q6458 and Q6445). Its output voltage is high for 8 μ s and low during the remainder of the period. The 8 μ s period is set by C6551 and R6545 in parallel with R6449 and R6457. The low voltage duration at the output is controlled by the primary regulation voltage of Q6552, R6454, and R6451. Diode CR6452, R6451, and R6453 protect against base-emitter reverse breakdown voltage.

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The output of the astable multivibrator is connected to the fly-back switching circuitry consisting of Q6349 (an emitter follower) and Q6435 (a high current switch). Q6435 conducts when the output of the multivibrator is high, so a magnetic field builds up in fly-back transformer T6535 by way of windings 5-6 during the 8 μ s period. When Q6435 turns off, the field collapses and the stored energy is transferred to the secondary windings. Diodes CR6347, CR6441 and CR6442 prevent Q6435 from saturating, causing the switch-off time to be faster. To reduce the base drive energy, a voltage source that is lower than the battery pack is used. This is supplied from terminal 3 of T6535.

The +25 V (pre-regulated) supply is used to control the primary regulation. (It is also used for the high voltage circuitry.) A voltage tap is provided by way of R6358 and Q6357 to create 9.7 V as a reference voltage for the primary regulator network. This voltage is compared against the combined voltage of 9.1 V zener diode VR6459 and the base-emitter junction of Q6557. Depending on the voltage level of the 25 volt supply, Q6557 increases or decreases conduction. The amplified collector voltage is fed to astable multivibrator Q6458 and Q6445 by way of emitter-follower Q6552. This controls the low voltage output duration of the astable multivibrator.

Anti-Deep-Discharge Circuit. The Anti-Deep Discharge circuit prevents the battery pack from going into deep discharge, which could permanently damage the batteries. Q6549 and Q6547 are connected as an SCR network. When fired, both transistors fully conduct, which forces the collector of Q6557 to ground. This removes all the input voltage to the input of the astable multivibrator, which turns it off and disables the dc voltage converter.

The SCR network can be triggered when Q6548 conducts. This happens when the battery voltage drops below 10 volts. The +25 V and +10 V power supplies are used as reference voltages by way of R6549, CR6546, and R6539. To reset this SCR network, the battery voltage must be removed by turning off the front panel POWER switch. The batteries must be charged or replaced (unless ac power is to be used) before further operation of the instrument.

Voltage Regulators. The +165 V, +100 V, +8 V, and -8 V supplies are not individually adjustable. R6358 is used to adjust the +25 V supply to the correct output voltage. The +10 V regulator provides a 10 volt reference for the +5 V and -5 V regulators.

The 5.1 V zener diode, VR7417, is used in a bridge configuration to provide a reference voltage for the +10 V supply. R6518, R6513, R6413, and R6514 are part of this bridge network. The bridge outputs are fed into operational amplifier U6515, which drives series regulator Q6427. Zener diode VR6419 is used as a start-up circuit. Capacitor C6416 provides additional power supply filtering. In order to reduce the energy or power losses, Q6427 has only a 2 volt collector-to-emitter drop.

Q6331 is the series regulator for the +5 V power supply. The +5 V is referenced against the +10 V with operational amplifier U6236. The output of U6236 drives the series regulator in an emitter-follower mode.

The -5 V power supply uses Q6227 as a series regulator. U6222 is used as a controlled current source and the minus voltage connection (VEE) is connected to the base of the series regulator. The standing amplifier current is shunted by R6222 and only the load fluctuations are used to control Q6227. R6223 is a current limiter.

Control Logic (Schematic 5)

The Logic board is only used with the TEKTRONIX Y-T Chart Recorder. This board can be removed without affecting the operation of the 1502. However, if this board is removed, the RECORD switch would have to be connected to the Vertical board by connecting the cable from the RECORD switch to P28 on the Vertical board.

The Logic board consists of pulse shaper, U5166A, U5166B, U5166C, and U5166D; binary counter U5147; a horizontal correction network; Chart Recorder Logic for controlling the paper drive motor; stylus heat; a Chart Recorder power switch; and an anti-bounce record circuit. See Fig. 3-7 on Chart Recorder Logic.

Pulse Shaper. The Pulse Shaper is made up of U5166A, U5166B, U5166C and U5166D. When the paper is moving, a square wave signal (CHART SPEED SENS) is generated by the holes in the paper passing between a light-emitting diode and a photo-sensitive transistor. The resultant pulses are shaped to a clean square wave by a Schmitt trigger circuit, U5166B and U5166C. The output signal is capacitor-coupled by C5167 to one-shot multivibrator U5166A and U5166D. This one-shot produces an output signal at TP5145 (violet test point) which is a positive going pulse approximately 10 ms wide. This (clock) pulse is connected to binary counter U5147; and to the end of the paper-sensitizer network, R5148.

Counter. The 7-stage binary counter is integrated circuit U5147. The binary outputs are connected to a resistor ladder network, which forms a digital-to-analog converter. Outputs Q1 and Q7 are connected to AND gate U5252B so that it recognizes the count number 65. Q2 clocks multivibrator U5127B at count 2. (The signal from U5127B starts the slow ramp.)

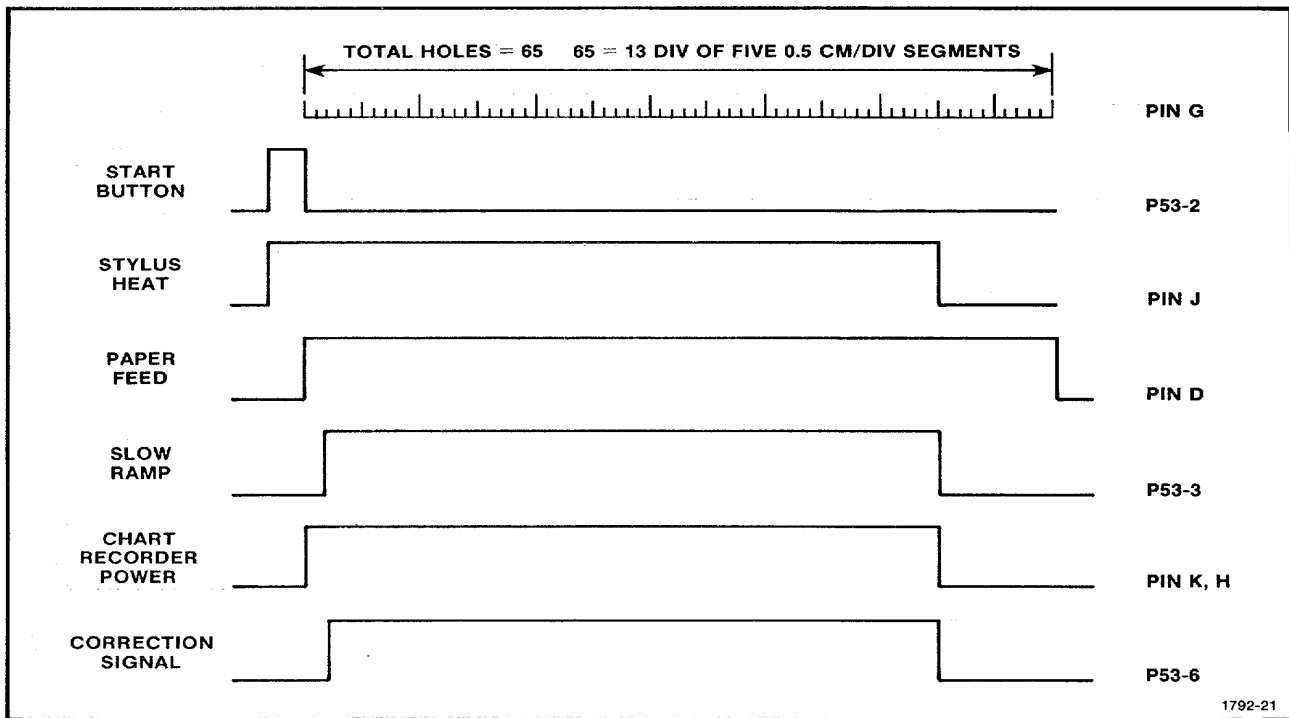


Figure 3-7. Chart Recorder Logic.

Horizontal Correction Network. The Horizontal Correction network compares the output of the digital-to-analog converter U5147 with the inverted slow ramp signal. U5227 inverts the slow ramp signal. The digital-to-analog output and inverted slow ramp signal are connected to inverting amplifier U5117, which performs summation and amplification simultaneously. This signal is fed to the Slow Ramp Generator by way of R5118 and will speed up or slow down the Slow Ramp Generator to synchronize it with the paper speed of the Strip Chart Recorder.

Chart Recorder Logic. The logic control signal that is received through pin 2 of P53 is shaped into a narrow impulse (negative going) by U5156B and U5156C. This impulse occurs at the trailing edge of the logic control signal and latches bi-stable multivibrator U5252A and U5252C. Pin 9 of U5252A goes positive and turns on Q5266, which pulls the motor control line to ground, causing the paper drive motor to start rotating. The paper drive motor turns off at count 65 by U5252B. A second signal is capable of turning the motor off. This occurs when the end of the paper is reached and the output from the pulse shaper is stopped. This causes C5249 to discharge and unlatch the multivibrator.

The multivibrator is initially latched when the inverted control signal from pin 4 of U5156B charges C5249. The impulse from pulse shaper U5166A and U5166D keeps C5249 charged. The multivibrator latch (output of pin 10) disables the reset of the counter and turns Q5144 on. This locks out the logic control input line.

Stylus heat control comes from Q5239, which is turned on by flip-flop U5127A. This flip-flop is energized by PEN LIFT signal from the Vertical board. The RETRACE signal turns the stylus heat off. This signal brings the flip-flop back to its original state (where pin 1 is low). The "Q" output also controls the chart pen motor power switch as well as providing the "J" input to flip-flop U5127B.

U5127 controls the start of the Slow Ramp Generator and controls the horizontal correction signal disable network (Q5112). The Slow Ramp Generator starts when Q2 of the Counter goes high. The output "Q" of U5127A resets U5127B to allow the Slow Ramp Generator to return to its original mode. The horizontal correction disable network Q5112 is controlled by the signal from pin 14 of U5127B, through Q5114.

Q5226 will conduct only when the Strip Chart Recorder is plugged in. Q5237 and Q5229 act as a dc level shift amplifier between flip-flop U5127B and the Slow Ramp Generator, which is on the Vertical board.

Chart Recorder Power Switch. The plus or minus 8 volts to drive the stylus movement is applied to the Strip Chart Recorder through two electronic switches, Q5273 and Q5277. Q5179 parallels Q5273 to provide more current in the +8 V line. These switches are driven by the same signal that is used to control stylus heat switch Q5239. This signal is passed through Q5173 and Q5279 to the switches.

Anti-Bounce Record. This circuit, consisting of U5156A and Q5156D, removes switching transients from the RECORD switch. The output of this circuit goes to the Vertical board to control the X-Y Record Logic. The Record Logic in turn provides the logic control signal that is received through pin 2 of P53 on the Logic board. If the Logic board is removed from the TDR unit, the harmonica connector from the RECORD switch should be connected to P28 on the Vertical board.

X-Y Output Module (Schematic 7)

The X-Y Output Module provides an electrical interface between the 1502 and an external X-Y Chart Recorder. Three signals, PEN LIFT, X Output, and Y Output are provided for use by the external Chart Recorder. The switching mechanisms for the outputs are solid state devices, therefore care should be taken when connecting loads to them. See the specification listed in the Specification section of this manual.

Pen Lift. The Pen Lift signal level changes when the RECORD switch is activated. The normal level is either 0.0 V \pm 0.5 V or 5 V +0 or -1 V, depending on how the terminal link of the X-Y Output Module board is connected (positive or negative slope, see Fig. 3-8). When the RECORD switch is activated, the level will change from 0 V to 5 V or from 5 V to 0 V. The driving capability of this signal source is given in the Specification section of this manual.

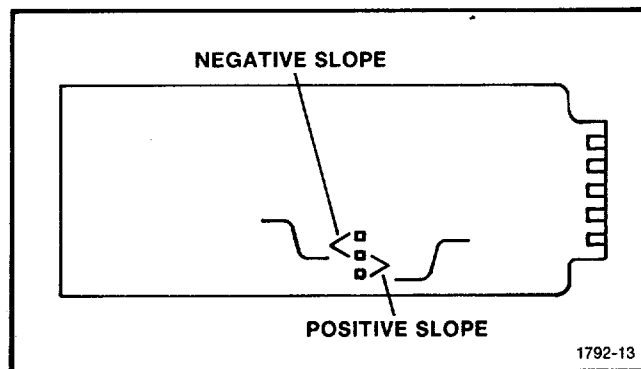


Figure 3-8. X-Y Output Module Strap.

Diode CR7247 is used to clamp the negative voltage swing to -0.6 V. Q7242 provides the capabilities for the operation of units with a positive pen lift or a ground return path.

X Output. The X output is directly proportional to the horizontal position of the crt beam along the crt face. This signal is a ramp of approximately 20 seconds duration and raises at a rate of 0.1 V for each division of horizontal travel across the crt. This 0.1 V per division scale factor is set by a voltage divider network comprised of R7138, R7129 and R7122. C7132 is used to reduce noise. Source impedance is less than 13 K (9.4 K minimum).

Y Output. The Y output is directly proportional to the vertical deflection on the crt. The scale factor (volts output per division of crt deflection) is adjustable, from 0.09 V per division to 0.13 V per division (factory set for 0.1 V/div), by variable resistor R7225. The source impedance of this signal is less than 11 k Ω (8 k Ω minimum) and is determined by R7234, R7224 and R7225. C7232 is used to reduce noise.

CALIBRATION PROCEDURE

The first part of this procedure checks the electrical characteristics of the 1502 that appear in the Specification section of this manual. This procedure can also be used by an incoming inspection facility to determine acceptability of performance. The second part of this section contains a detailed adjustment procedure.

It is recommended that these elementary checks be performed before those in the DETAILED CHECKS AND ADJUSTMENTS section; these checks will identify most conditions calling for troubleshooting and repair. To aid in troubleshooting, the probable problem area(s) are given after each applicable step. Refer to the Block Diagram and Schematics in Section 8 as an aid in locating components, test points and circuits.

**Table 4-1.
TEST EQUIPMENT REQUIRED**

| Performance Description | Requirement | Application | Example |
|----------------------------------|---|-------------------------------|-----------------------------------|
| Precision 50 Ω Cable (2) | Known length and impedance | Timing | Tektronix part number 012-0482-00 |
| Precision 50 Ω Terminator | Known impedance | Gain and impedance checks | Tektronix part number 011-0123-00 |
| BNC female-to-female adapter | | Calibration | Tektronix part number 103-0028-00 |
| BNC male-to-probe adapter | | Calibration | Tektronix part number 013-0130-00 |
| BNC-to-GR adapter | Known impedance | Calibration/Performance Check | Tektronix part number 017-0064-00 |
| GR short | Low inductance | Calibration/Performance Check | Tektronix part number 017-0087-00 |
| Power Module | | Calibration | TEKTRONIX TM 503 Power Module |
| Digital Multimeter | 0-200 V dc | Calibration | TEKTRONIX DM 501 |
| Time Mark Generator | 5 μ s to 10 μ s markers | Calibration | TEKTRONIX TG 501 |
| Pulse Generator | 50 μ s period 2.5 μ s pulse Var dc level 5 V pulse | Calibration | TEKTRONIX PG 502 |
| 1 X Probe | | Calibration | TEKTRONIX P6101 |

Performance Check

1. Make sure the battery pack is in place and connect the unit to the proper AC power source.
2. Pull the POWER switch to turn the unit on. The BATTERY meter will indicate the relative level of charge on the battery pack. If the battery pack is fully charged (charged for 16 hours), the BATTERY meter needle will be approximately at the top mark on the meter.

Performance Checks-Standard Version (See Step 31 for Option 5, Metric Version)

3. Set the front panel controls as follows:

| | |
|------------------|----------|
| INTENSITY | Fully cw |
| ZERO REF | Fully cw |
| POSITION | Midrange |
| mp/DIV | 500 |
| DISTANCE | 000 |
| NOISE FILTER | Out |
| FEET/DIV | 200 |
| MULTIPLIER | X1 |
| CABLE DIELECTRIC | |
| SOLID POLY | In |
| SOLID PTFE | Out |
| Other | Out |
| VAR | Fully cw |

4. Connect the probe adapter to the CABLE connector if the connector is the grounding type (grounded CABLE connector used SN B040616 and up). Preset the POSITION and GAIN controls so the trace is on screen and the amplitude is approximately 4 divisions. Adjust the FOCUS AND INTENSITY controls for a clear, bright trace.
5. Adjust the GAIN control so that the total amplitude of the display is exactly 4 divisions. (If unable to adjust the GAIN control properly, check the Gain Amplifier or Vertical Amplifier Circuits.)
6. Change the FEET/DIV control to 2 and the MULTIPLIER to X.1.
7. Turn the ZERO REF SET control counterclockwise to locate the pulse at center screen. Check for correct waveform as shown in Fig. 4-1a. (If the display is not correct, check the sampling circuitry, avalanche and Snap-off adjustments.) See adjustment procedure for case removal instructions.
8. Remove the probe adapter and connect the precision 50 Ω terminator (Tektronix Part No. 011-0123-00) to the CABLE connector. Turn the GAIN control fully counterclockwise and note the amplitude of the pulse. Turn the GAIN control fully clockwise. The amplitude should be 3.5 times greater than the amplitude with the GAIN control fully counterclockwise. (Adjust the POSITION control as necessary.)
9. Set the mp/DIV control to 200, the FEET/DIV control to 20 and the MULTIPLIER control to X1.
10. Adjust the ZERO REF SET control so that the pulse is at the center of the screen. Adjust the GAIN control for exactly 5 divisions of amplitude.

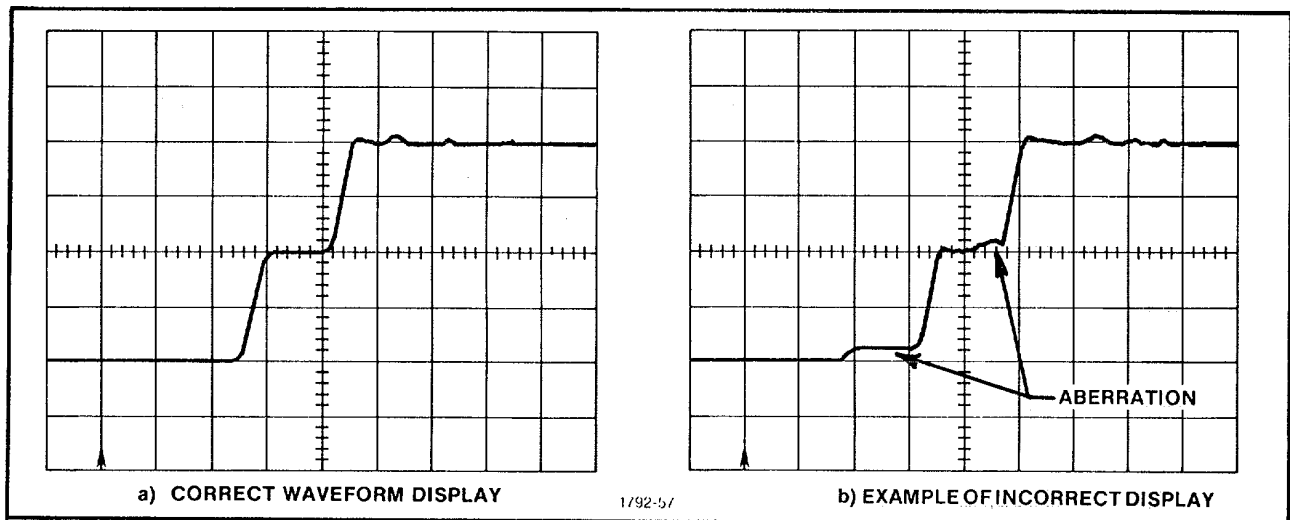


Figure 4-1. Pulse Display.

11. Remove the 50 Ω terminator and connect the probe adapter to the CABLE connector (SN B040616 and up). Change the mp/DIV control to 500. The amplitude of the pulse must be 4 divisions \pm 0.12 division. If not, the Vertical Amplifier circuit or Sampling circuit should be checked.

12. Set the FEET/DIV control to 1 and adjust the ZERO REF SET control so the leading edge of the incident pulse is set on the vertical centerline.

13. Change the MULTIPLIER control to X.1. The leading edge of the incident pulse must be within 1 division of the vertical centerline. (If not, check the X.1 Position calibration (R1132), the Sampler Comparator, or the Pulser Comparator.)

14. Attach the precision 50 Ω cable (Tektronix Part No. 012-0482-00) to the CABLE connector and change the FEET/DIV control to 5. Adjust the ZERO REF SET control to locate the incident pulse on the graticule reference line (as indicated by the arrow on the graticule line). The reflected pulse should be 6.3 divisions to the right of the incident pulse (\pm 1 minor division).

15. Adjust the DISTANCE dial until the reflected pulse is located on the graticule reference line. The DISTANCE dial should read 031.5 \pm 1 digit.

NOTE

When using the more sensitive ranges of the FEET/DIV control, the 0.3 foot between the CABLE connector and the Sampler must be taken into consideration or measurements will appear to be 0.3 feet too long.

Push the ZERO REF CHECK button; the incident pulse should return to the graticule reference line. If the incident pulse does not return to the graticule reference line, adjust the ZERO REF SET control so that the incident pulse is located on the graticule reference line. Release the ZERO, REF CHECK control and check that the reflected pulse is located on the graticule reference line. Adjust the DISTANCE dial if necessary; it must remain at 031.5 \pm 1 digit. (If the DISTANCE dial reading is incorrect or the ZERO REF CHECK control does not work properly, check the Distance Offset, Fast Ramp, and Pulse Comparator circuitry.) Return the DISTANCE dial to 000.

NOTE

To more accurately check the DISTANCE dial, a known length of Solid Polyethylene ($V_p = 0.66$) cable (1000 to 1600 feet) should be used.

16. Change the FEET/DIV control to 20, the MULTIPLIER control to X1, and the mp/DIV control to 200. Adjust the ZERO REF SET control so that the reflected pulse is located exactly on the 8th graticule line from the left-hand edge of the graticule.

17. Adjust the DISTANCE dial to locate the reflected pulse on each graticule line. The DISTANCE dial should read as follows: (If not, check the Distance Offset, Fast Ramp circuitry, and Sweep Inverter.)

| Graticule Line | Distance Dial Reading |
|----------------|-----------------------|
| 8 | 000 |
| 7 | 020 \pm 0.9 |
| 6 | 040 \pm 1.3 |
| 5 | 060 \pm 1.7 |
| 4 | 080 \pm 2.1 |
| 3 | 100 \pm 2.5 |
| 2 | 120 \pm 2.9 |
| 1 | 140 \pm 3.3 |
| 0 | 160 \pm 3.7 |

18. Return the DISTANCE dial to 000, change the MULTIPLIER control to X.1 and repeat the above step.

19. Push the SOLID PTFE button in, do not readjust the ZERO REF SET control and adjust the DISTANCE dial so that the reflected pulse is located on the 0 graticule line. The DISTANCE dial should read between 164.1 and 171.9. Push in the OTHER button (VAR control must be fully cw) and locate the reflected pulse on the 0 graticule line with the DISTANCE dial. The DISTANCE dial should read between 234.7 and 245.3. (If not, check the Sweep Inverter circuit.) Return the DISTANCE dial - to 000 when this step is completed.

20. Change the FEET/DIV control to 1, the MULTIPLIER control to X1, disconnect the precision 50 Ω cable from the CABLE connector, and connect the precision 50 Ω terminator to the CABLE connector. Adjust the ZERO REF SET control to locate the pulse on the graticule center. Adjust the POSITION control to center the pulse on the graticule.

21. Check that the jitter is not greater than 0.1 division (200 ps). See Fig. 4-2.

22. Change the MULTIPLIER control to X.1 and adjust the ZERO REF SET control to locate the pulse on the graticule center. Check that the jitter is not greater than 0.2 division (40 ps). (If jitter is not correct, the tunnel diode, CR1703, or Pulse Generator circuitry may be faulty, or the problem could be due to noise from the Sweep Inverter or the Fast Ramp.)

23. Change the *mp*/DIV control to 50, and turn the POSITION control counterclockwise to display the top of the trace on the graticule, then with the DISTANCE control set to 000 adjust the ZERO REF SET control to locate the pulse on the reference graticule line.

24. Set the DISTANCE control to 500 and adjust the POSITION controls to center the trace on the graticule, then return the DISTANCE dial to 000.

25. While viewing the trace, adjust the DISTANCE dial from 000 to 100. The trace aberrations must remain within ± 1 division of the centerline ($\pm 5\%$ peak aberrations for the first 10 feet). See Fig. 4-3.

26. Change the *mp*/DIV control to 5, set the DISTANCE dial to 500, recenter the trace, then return the DISTANCE dial to 100.

27. While viewing the trace, adjust the DISTANCE dial from 100 to 999. The trace aberrations must remain within ± 1 division of the centerline ($\pm 0.5\%$ peak beyond 10 feet).

28. Return the DISTANCE dial to 100 and push the NOISE FILTER button in. While viewing the trace, adjust the DISTANCE dial from 100 to 999. The trace aberrations will typically be less than was observed in the previous step. If there is a problem with aberrations or noise, Sampling Gate diode CR1732, tunnel diode CR1703, or Lo Freq Comp R1657 are likely causes.

29. Release the NOISE FILTER button, return the DISTANCE dial to 000, and set the *mp*/DIV control to 200.

30. Remove the 50 Ω terminator from the CABLE connector. Install the GR to bnc adapter and the GR short. Check that the reflected rise time of the pulse (fall time) is < 0.7 divisions. (140 ps.)

The bnc shorted input is inductive and is not adequate for the reflected rise time (fall time) measurement.

Performance Checks-Option 5, Metric Version (Continue with Stop 59 for Standard Version)

31. Set the front panel controls as follows:

| | |
|------------------|----------|
| INTENSITY | Fully cw |
| ZERO REF | Fully cw |
| POSITION | Midrange |
| <i>mp</i> /DIV | 500 |
| DISTANCE | 000 |
| NOISE FILTER | Out |
| METRES/DIV | 50 |
| X1/X.1 | X1 |
| CABLE DIELECTRIC | |
| SOLID POLY | In |
| SOLID PTFE | Out |
| Other | Out |
| VAR | Fully cw |

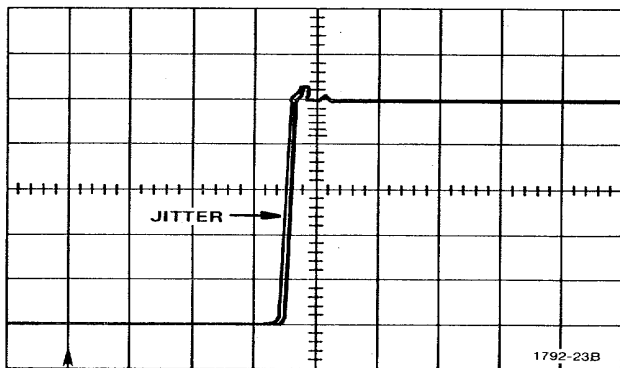


Figure 4-2. Jitter Check.

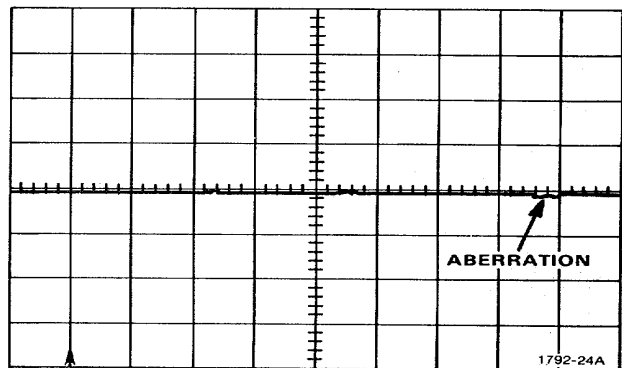


Figure 4-3. Aberration Check.

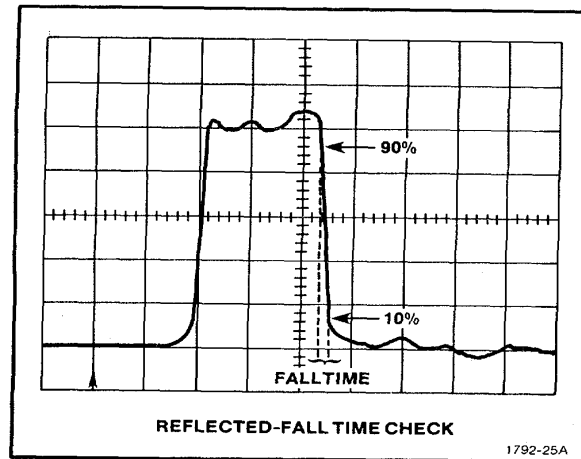


Figure 4-4. Falltime.

32. Connect the probe adapter to the CABLE connector if the connector is the grounding type (grounded CABLE connector used SN B040616 and up). Preset the POSITION and GAIN controls so the trace is on screen and the amplitude is approximately 4 divisions. Adjust the FOCUS and INTENSITY controls for a clear bright trace.

33. Adjust the GAIN control so that the total amplitude of the display is exactly 4 divisions. (If unable to adjust the GAIN control properly, check the Gain Amplifier or Vertical Amplifier circuits.)

34. Change the METRES/DIV control to .5 and the MULTIPLIER control to X.1.

35. Turn the ZERO REF SET control counterclockwise to locate the pulse at center screen. Check for correct waveform as shown in Fig. 4-1c. (If display is not correct, check the sampling circuitry, avalanche and Snap-off adjustments.)

36. Remove the probe adapter and connect the precision 50 Ω terminator (Tektronix Part No. 011-0123-00) to the CABLE connector. Turn the GAIN control fully counterclockwise and note the amplitude of the pulse. Turn the GAIN control fully clockwise; the amplitude should be 3.5 times greater than the amplitude with the GAIN control counterclockwise. (Adjust the POSITION control as necessary.)

37. Set the mp/DIV control to 200, the METRES/DIV control to 5, and the MULTIPLIER control to X.1.

38. Adjust the ZERO REF SET control so that the pulse is at the center of the screen. Adjust the GAIN control for exactly 5 divisions of amplitude.

39. Remove the 50 Ω terminator and connect the probe adapter to the CABLE connector (SN B040616 and up). Change the mp/DIV control to 500. The amplitude of the pulse must be 4 divisions ± 0.12 divisions (± 0.6 minor division). If not, the Vertical Amplifier circuit or Sampling circuit should be checked.

40. Set the METRES/DIV control to .25 and adjust the ZERO REF SET control so the leading edge of the incident pulse is set on the vertical centerline.

41. Change the MULTIPLIER control to X.1. The leading edge of the incident pulse must be within 1 division of the vertical centerline. (If not, check the X.1 Position calibration (R1 132), the Sampler Comparator, or the Pulser Comparator.)

42. Attach the precision 50 Ω cable (Tektronix Part No. 012-0482-00) to the CABLE connector and change the MULTIPLIER control to X1. Adjust the ZERO REF SET control to locate the incident pulse on the graticule reference line. The reflected pulse should be 3.66 divisions to the right of the incident pulse (± 1 minor division).

43. Change the MULTIPLIER control to X.1 and adjust the DISTANCE dial until the reflected pulse is located on the graticule reference line. The DISTANCE dial should read 009.2 ± 1.0 digit. Press the ZERO REF CHECK button; the incident pulse should return to the graticule reference line. If the incident pulse does not return to the graticule reference line, adjust the ZERO REF SET control so that the incident pulse is located on the graticule reference line. Release the ZERO REF CHECK button and check that the reflected pulse is located on the graticule reference line (adjust the DISTANCE dial if necessary; it must remain at 009.2 ± 1.0 digit). If the DISTANCE dial reading is incorrect or the ZERO REF CHECK control does not work properly, check Distance Offset, Fast Ramp, and Pulser Comparator circuitry. Return the DISTANCE dial to 000.

NOTE

To more accurately check the DISTANCE dial, a known length of Solid Polyethylene ($V_P = 0.66$) cable (up to 1500 feet) should be used.

44. Change the METRES/DIV control to 5, the MULTIPLIER control to X1 and the mp/DIV control to 200. Adjust the ZERO REF SET control so that the reflected pulse is located exactly on the 8th graticule line from the left-hand edge of the graticule.

45. Adjust the DISTANCE dial to locate the reflected pulse on each graticule line. The DISTANCE dial should read as follows: (If not, check the Distance Offset, Fast Ramp circuitry, and Sweep Inverter.)

| Graticule Line | Distance Dial Reading |
|----------------|-----------------------|
| 8 | 000 |
| 7 | 005 ± 0.6 |
| 6 | 010 ± 0.7 |
| 5 | 015 ± 0.8 |
| 4 | 020 ± 0.9 |
| 3 | 025 ± 1.0 |
| 2 | 030 ± 1.1 |
| 1 | 035 ± 1.2 |
| 0 | 040 ± 1.3 |

46. Return the DISTANCE dial to 000, change the MULTIPLIER control to X.1 and repeat the above step.

47. Push the SOLID PTFE button in and adjust the DISTANCE dial so that the reflected pulse is located on the 0 graticule line. The DISTANCE should read between 40.7 and 43.3. Push in the OTHER button (VAR control must be fully cw) and locate the reflected pulse on the 0 graticule line with the DISTANCE dial. The dial should read between 58.3 and 61.7. (If not, check the Sweep Inverter circuit.) Return the DISTANCE dial to 000 when this step is completed.

48. Change the METRES/DIV control to .25, the MUTLIPLIER control to X1, disconnect the precision 50 Ω cable from the CABLE connector, and connect the precision 50 Ω terminator to the CABLE connector. Adjust the ZERO REF SET control to locate the pulse at the graticule center. Adjust the POSITION control to center the pulse on the graticule.

49. Check that the jitter is not greater than 0.1 division (200 ps). See Fig. 4-2.

50. Change the MULTIPLIER control to X.1 and adjust the ZERO REF SET control to locate the pulse at the graticule center. Check that the jitter is not greater than 0.2 division (40 ps). (If jitter is not correct, the tunnel diode, CR1703, or Pulse Generator circuitry may be faulty or the problem could be due to noise from the Sweep Inverter or the Fast Ramp.)

51. Change the mp/DIV control to 50 and turn the POSITION control counterclockwise to bring the top of the trace on the graticule, then adjust the ZERO REF SET control to locate the pulse on the reference graticule line.

52. Set the DISTANCE control to 250 and adjust the POSITION controls to center the trace on the graticule; then return the DISTANCE dial to 000.

53. While viewing the trace, adjust the DISTANCE dial from 000 to 050. The trace aberrations must remain within ±1 division of the centerline (± 5% peak aberrations for first 3 metres.) See Fig. 4-3.

54. Change the mp/DIV control to 5, set the DISTANCE dial to 250, and recenter the trace; then return the DISTANCE dial to 050.

55. While viewing the trace, adjust the DISTANCE dial from 050 to 250. The trace aberrations must remain within ±1 division of the centerline (±0.5% peak beyond 10 feet).

56. Return the DISTANCE dial to 050 and push the NOISE FILTER button in. While viewing the trace, adjust the DISTANCE dial from 050 to 250. The trace aberrations will typically be less than was observed in the previous step. If there is a problem with aberrations or noise, Sampling Gate diode CR1732, tunnel diode CR1703, or Lo Freq Comp R1657 are likely causes.

57. Release the NOISE FILTER button, return the DISTANCE dial to 000, and set the mp/DIV control to 200.

58. Remove the 50 Ω terminator from the CABLE connector. Install the GR to bnc adapter and the GR short. Check that the reflected rise time of the pulse (fall time) is 40.875 divisions. See Fig. 4-4.

DETAILED CHECKS AND ADJUSTMENTS

This section gives the procedure for adjusting a 1502. Instructions are included for making each internal electrical adjustment. Adjustment instructions should be ignored when the procedure is being used only to determine whether there is a need for repair or adjustment. The Tektronix X-Y OUTPUT MODULE is covered in this procedure.

Preliminary Procedure

1. Remove the battery pack from the rear of the 1502 case. Remove the front cover of the 1502.
2. Loosen the 4 screws at the rear of the case and set the unit face up. Push down on the handle to break the seal; then place the instrument face down on a flat surface. Take hold of the sides of the case and pull free.

3. Remove the EMI shields from the top and bottom of the unit. Place the battery pack in the rear of the 1502, taking care that the polarity is correct. Connect the ac power cord to the ac outlet, at the rear of the unit, and to a 115 Vac (230 Vac for Option 6) power source.

4. Pull the POWER switch to turn the unit on and allow 20 minutes warm-up before proceeding with the calibration.

5. Preset the front panel controls as follows:

| | |
|-----------------------|--------------------------|
| INTENSITY | Fully cw |
| ZERO REF SET | Fully cw |
| POSITION | Midrange |
| mp/DIV | 500 |
| NOISE FILTER | Out |
| GAIN | Fully ccw |
| DISTANCE Dial | 000 |
| FEET/DIV (METRES/DIV) | 200 (50) (FIND) |
| MULTIPLIER | X1 |
| FOCUS | Adjust for a sharp trace |
| CABLE DIELECTRIC | |
| SOLID POLY | In |
| SOLID PTFE | Out |
| Other | Out |
| VAR | Fully cw |

6. Place the DM 501 Digital Multimeter in the TM 503 Power Module. Plug in the TM 503 to an ac power source and pull the PWR switch on.

7. Set the DM 501 RANGE/FUNCTION control to 200 DC VOLTS. Connect the test leads to the HI and LO INPUT terminals.

Power Supply Checks

The power supply voltages of the 1502 should be checked before any internal adjustments are made. Power supply checks are not to be considered performance checks. The location of the test points and adjustments are shown in Fig. 4-5. Measure the supply voltages with the DM 501.

Voltage Measurements

8. Connect the lead from the DM 501 LO terminal to TP6332 (GND, black test point) on the 1502 Power Supply board.

9. Connect the lead from the DM 501 HI terminal to TP6256 (red test point).

10. Adjust R6358 (HV ADJ) so the voltmeter reads $+25\text{ V} \pm 0.25\text{ V}$.

11. Move the test lead from TP6256 to TP6411 (violet test point).

12. Change the DM 501 RANGE/FUNCTION switch to 20 Vdc.

13. Adjust R6514 (+10 ADJ) so the voltmeter reads $+10\text{ V}, \pm 0.1\text{ V}$.

14. Move the test lead from TP6411 to TP6227 (green test point) and check that the voltmeter reads $+5\text{ V} \pm 0.25\text{ V}$.

15. Move the test lead from TP6227 to TP6218 (orange test point) and check that the voltmeter reads $-5\text{ V} \pm 0.25\text{ V}$.

16. Change the DM 501 RANGE/FUNCTION switch to 200 Vdc.

17. Move the test lead to connector P65 Pin 6 (see Fig. 4-6) and check that the voltmeter reads $+100\text{ V}$ ($+20\text{ V}, -5\text{ V}$).

18. Move the test lead to P65 Pin 7 and check that the voltmeter reads $+165\text{ V}$ ($+25\text{ V}, -5\text{ V}$).

CRT Adjustments

19. Turn the 1502 upside down on the bench.

20. Attach the precision $50\ \Omega$ cable to the CABLE output.

21. Check for a step pulse on the crt.

22. Adjust TD BIAS (R1692) control fully counterclockwise and adjust AVAL VOLT (R1525), LOOP GAIN (R1543), and SNAP-OFF (R1538) until a pulse appears. This is a rough setting of these controls. Finer adjustments will be done later.

Trace Focus and Astigmatism

23. Set the FEET/DIV (METRES/DIV) to 2 (.5) with the MULTIPLIER control to X.1.

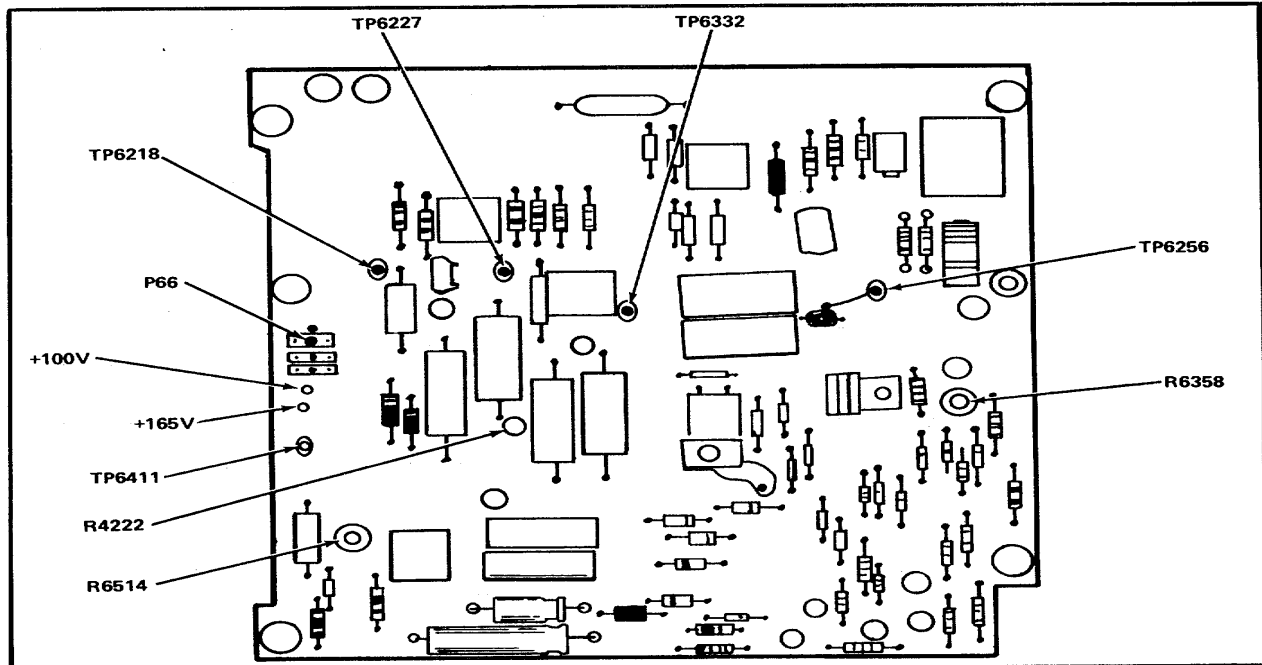


Figure 4-5. Power Supply Test Points And Adjustments.

24. (a). Locate the pulse with the ZERO REF control at the center of the graticule.
(b). Adjust-INTENSITY LIMIT (R4222) for 100 mVdc reading at test point TP4243 to gnd (option 1: 60 mV). The adjustment is made through the hole near Q6427 on the power supply board (see Fig. 4-6).
25. Set the front panel FOCUS control for the clearest possible trace.
26. Adjust-R3242 (AST) located on the OUTPUT AMPS board, and the front panel FOCUS control until the clearest possible trace, both vertically and horizontally, is obtained.
27. Remove the precision 50 Ω cable.

Trace Rotation

28. Set the mp/DIV control to 200.
29. Turn the ZERO REF SET fully clockwise and adjust the POSITION controls so that the trace is located on the horizontal centerline.
30. Check-that the trace aligns with the horizontal centerline.
31. Adjust-R3143 (ROT) located on the OUTPUT AMPS board, so that the trace aligns with the horizontal centerline.

Trace Geometry

32. Move the trace with the POSITION control so that it is located 3 divisions below the horizontal centerline.
33. Check-that the trace aligns with the graticule line within 0.1 division.
34. Move the trace with the POSITION controls so that it is located 3 divisions above the horizontal centerline.

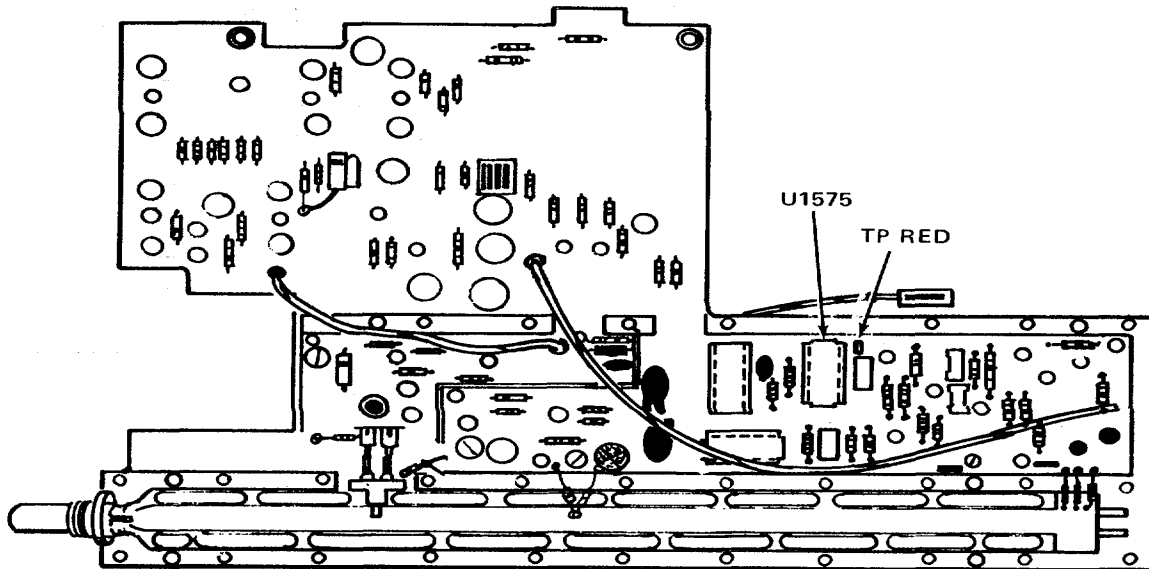


Figure 4-6. Main Board Test Points.

35. Check that the trace aligns with the graticule line within 0.1 division.
36. Adjust-R3248 (GEO) located on the OUTPUT AMPS board, for the least bow in the two positions; 3 divisions above and 3 divisions below the horizontal centerline.
37. Recheck the trace rotation and focus.

HORIZONTAL CHECKS AND ADJUSTMENTS-STANDARD VERSION (See Step 62 for Option 5, Metric Version)

Horizontal Gain Presets

NOTE

If the unit is only being checked and not calibrated, or if the unit is to be used with the optional chart recorder, do not perform the following Horizontal Gain Presets procedure. Instead, turn to the standard version Timing procedure beginning with step 43.

38. Set the mp/DIV control to 500.
39. Use the POSITION controls to center the trace on the graticule.
40. Set R3217 HORIZ GAIN (located on the OUTPUT AMPS board) to the counterclockwise stop.
41. Adjust-R3213 H POS (located on the OUTPUT AMPS board) to center the trace on the graticule.
42. Adjust-R3217 HORIZ GAIN so that the retrace at the start of the sweep is just off the graticule area and the trace covers all 10 divisions of the graticule.

NOTE

Once the horizontal gain has been set, do not change it (Timing, standard version; for metric version Timing, proceed to step 62).

Timing

43. Connect the Marker Out of the TG 501 through a coaxial cable and a 10X attenuator to the CABLE connector of the 1502; also, connect a coaxial cable from the TG 501 + Trigger Out to the PG 502 Trig/Duration Input.

Turn the instrument POWER off. Turn the instrument upside down and remove the shield that covers the pulser/sampler circuitry (remove 12 screws). Remove U1575 from its socket. In the following steps, instructions are given on how to provide an external trigger to the 1502 (see Fig. 4-6).

44. Set the 1502 controls as follows:

| | |
|------------|-----------------------|
| mp/DIV | 200 |
| FEET/DIV | 100 @ X1 |
| DIELECTRIC | AIR (all buttons out) |
| DISTANCE | 000 |

45. Set the PG 502 Pulse Generator controls as follows for a generator output pulse as shown in Fig. 4-7.

| | |
|-------------------|-------------|
| Duration | 50, μ s |
| Variable Duration | Fully ccw |
| Period | Ext Trig |
| Low Level | -1.5 |
| High Level | 2.0 |
| Back Term | Pull Out |
| All pushbuttons | Out |

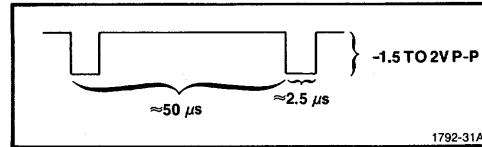


Figure 4-7. Pulse Generator Output.

46. Set the TG 501 Time Mark Generator for 0.2 μ s time marks. Connect a 1X probe from the PG 502 Output to the Red test point located near U1575. Turn the instrument POWER on.

NOTE

The time marks must not exceed 0.85 V to keep the tunnel diode in the low state.

47 (a). Obtain a waveform on the 1502 crt similar to the one shown in Fig. 4-8. Use the variable pulse amplitude control of the PG 502 and the DISTANCE control of the 1502 to align the second time mark with the second graticule line.

NOTE

If the instrument is to be used with the optional chart recorder, continue with the remainder of this step. If the instrument is not to be used with a chart recorder, proceed with step 48.

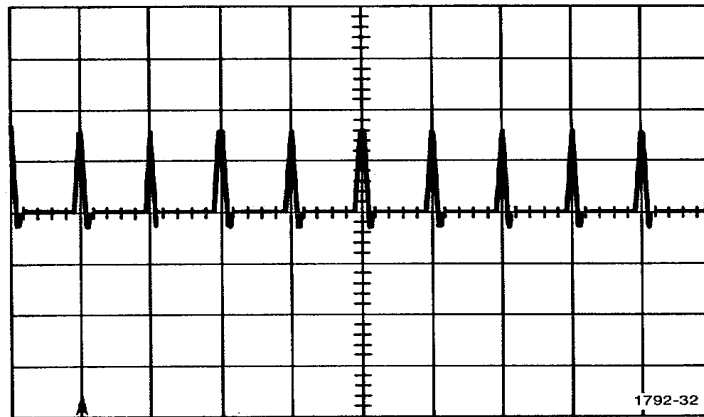


Figure 4-8. Time Marks Aligned (Standard).

(b). Check that the chart paper in the recorder has a bold line next to the hole in the paper that shows a red line through the hole. If the red line is not aligned with a bold line on the chart paper, pull enough chart paper through the recorder to line them up.

(c). Press the RECORD switch to obtain a recording of the time marks. The recording should show the same timing as seen on the crt between the second and tenth graticule lines $\pm 2\%$.

(d). Adjust-R3213 (H POS) and R3217 (HORIZ GAIN), located on the OUTPUT AMPS board, to match the timing and position of the time marks on the crt to the chart recording.

48 (a). Adjust-R1435 (FT/DIV CAL) so the eleventh time mark is 0.2 division to the left of the eleventh graticule line. Keep the first time mark aligned with the first graticule line with the DISTANCE control.

(b). Set the FEET/DIV control to 50, set the TG 501 to .1 ps and check that when the first time mark is aligned with the first graticule line, the eleventh time mark is 0 to 0.4 division to the left of the eleventh graticule line.

(c). Set the FEET/DIV to 20, set the TG 501 to 50 ns and check that when the first time mark is aligned with the first graticule line, the ninth time mark is 0 to 0.4 division to the left of the eleventh graticule line.

(d). Set the FEET/DIV to 10, set the TG 501 to 20 ns and check that when the first time mark is aligned with the first graticule line, the eleventh time mark is 0 to 0.4 division to the left of the eleventh graticule line.

(e). Set the FEET/DIV to 5, set the TG 501 to 10 ns and check that when the first time mark is aligned with the first graticule line, the eleventh time mark is 0 to 0.4 division to the left of the eleventh graticule line.

(f). Set the FEET/DIV to 2 and check that when the first time mark is aligned with the first graticule line, the fifth time mark is 0 to 0.4 division to the left of the eleventh graticule line.

NOTE

*The timing gets difficult to read because of noise at these sensitivities.
Try pressing the NOISE FILTER button to aid resolution.*

(g). Set the FEET/DIV to 1 and check that when the first time mark is aligned with the first graticule line, the third time mark is 0 to 0.4 division to the left of the eleventh graticule line.

(h). Release the NOISE FILTER button if it is pushed in.

(i). Set the FEET/DIV to 100, set the FEET/DIV multiplier to X.1, and set the TG 501 to 20 ns. Check that when the first time mark is aligned with the first graticule line, the eleventh time mark is 0 to 0.4 division to the left of the eleventh graticule line.

49. Adjust-C1332 (X.1 CAL) located on the MAIN board, so the eleventh time mark is 0.2 division to the left of the eleventh graticule line when the first time mark is aligned with the first graticule line.

50. (a). Set the FEET/DIV to 200, set the TG 501 to 50 ns and check that when the first time mark is aligned with the first graticule line, the ninth time mark is 0 to 0.4 division to the left of the eleventh graticule line. Move the time marks by slight adjustment of the PG 502 Output (Volts).

(b). Set the FEET/DIV to 100 and set the TG 501 to .1 μ s. Turn the DISTANCE dial fully counterclockwise. Use the PG 502 Output (Volts) knob to set a time mark directly on a graticule line. Turn the DISTANCE dial clockwise until the second time mark lines up with the same graticule line.

(c). Check that the DISTANCE dial reads between 48.0 to 50.0 (480 to 500 X 0.1 ft). Alternately push and release the ZERO REF CHECK button to make sure that the time marks are lined up on each other.

51. (a). Set the DISTANCE dial to 49.0 (490 X 0.1 ft).

(b). Adjust-R1315 (DISTANCE CAL) located on the MAIN board, for no movement of one time mark while alternately pressing and releasing the ZERO REF CHECK button.

52. (a). Set the FEET/DIV multiplier to X1, set the TG 501 to 2 μ s and set CABLE DIELECTRIC to SOLID POLY.

(b). Check for 6.33 to 6.61 divisions between markers (turn the DISTANCE dial as necessary to see two markers).

(c). Set CABLE DIELECTRIC to SOLID PTFE.

(d). Check for 6.72 to 7.0 divisions between markers (turn the DISTANCE dial as necessary to see two markers).

53. Set CABLE DIELECTRIC to OTHER and turn CABLE DIELECTRIC VAR fully clockwise.

54. (a). Check for 9.7 to 10 divisions between markers (turn the DISTANCE dial as necessary to see two markers).

(b). Turn CABLE DIELECTRIC VAR fully counterclockwise.

(c). Check for <5.5 divisions between markers.

(d). Return the CABLE DIELECTRIC VAR to fully clockwise position.

55. Turn off the 1502, remove all test equipment and reinstall U1575. Install the shield over the pulser/sampler circuitry (install 12 screws). Return the instrument to normal viewing position.

56. Turn on the 1502 and set mp /DIV to 200, set the FEET/DIV to 1, set CABLE DIELECTRIC to AIR (all buttons out), and adjust the DISTANCE dial to 000.

X.1 Positioning

57. Connect the precision 50 Ω terminator to the CABLE connector.

58. Set the FEET/DIV multiplier to X1.
59. Set the incident pulse to a graticule reference line with the ZERO REF control, then set the FEET/DIV multiplier to X.1.
60. Check that the leading edge of the incident pulse is located within 1 division of the selected graticule reference line.
61. Adjust-R1132 (X.1 POS CAL) located on the MAIN board, so that the leading edge of the incident pulse is located on the selected graticule reference line. Repeat steps 58 through 60.

HORIZONTAL CHECKS AND ADJUSTMENTS-OPTION 5, METRIC VERSION
(See Step 38 for Standard Version)

Horizontal Gain Presets

NOTE

If the unit is only being checked and not calibrated, or if the unit is to be used with the optional chart recorder, do not perform the following Horizontal Gain Presets procedure. Instead, turn to the metric version Timing procedure beginning with step 67.

62. Set the mp/DIV to 500.
63. Use the POSITION controls to center the trace on the graticule.
64. Set R3217 (HORIZ) located on the OUTPUT AMPS board, to the counterclockwise stop.
65. Adjust-R3213 (H POS) located on the OUTPUT AMPS board, to center the trace on the graticule.
66. Adjust-R3217 (HORIZ) so that the retrace at the start of the sweep is just off the graticule area and the trace covers all 10 divisions of the graticule.

NOTE

Once the horizontal gain has been set, do not change it.

Timing

67. Connect the Marker Out of the TG 501 through a coaxial cable and a 10X attenuator to the CABLE connector of the 1502; also connect the TG 501 Trigger Out to the Trig/Duration Input of the PG 502.

Turn the instrument POWER off. Turn the instrument upside down and remove the shield that covers the pulser/sampler circuitry (remove 12 screws). Remove U1575 from its socket. In the following steps, instructions are given on how to provide an external trigger to the 1502 (see Fig. 4-6).

68. Set the 1502 controls as follows:

| | |
|------------|-----------------------|
| mp/DIV | 200 |
| METRES/DIV | 25 @ X1 |
| DIELECTRIC | AIR (all buttons out) |
| DISTANCE | 000 |

69. Set the controls of the PG 502 Pulse Generator as follows:

| | |
|-------------------|------------|
| Duration | 50 μ s |
| Variable Duration | Fully ccw |
| Period | Ext Trig |
| Low Level | -1.5 |
| High Level | 2.5 |
| Back Term | Pull Out |
| All pushbuttons | Out |

70. Set the TG 501 Time Mark Generator for 0.5 us time marks. Connect a coaxial cable from the TG 501 + Trigger Out to PG 502 Trig/Duration Input. Connect a 1X probe from the PG 502 Output to the Red test point located near U1575. Connect a coaxial cable and a 10X attenuator from the TG 501 Marker Out to the CABLE connector. Turn the instrument POWER on.

NOTE

The time marks must not exceed 0.85 V to keep the tunnel diode in the low state.

71. (a). Obtain the waveform on the 1502 crt as shown in Fig. 4-9. Use the variable pulse amplitude control of the PG 502 and the DISTANCE control of the 1502 to align the time marks with the crt graticule lines.

NOTE

If the instrument is to be used with the optional chart recorder, continue with the remainder of this step. If the instrument is not to be used with a chart recorder, proceed with step 72, part a.

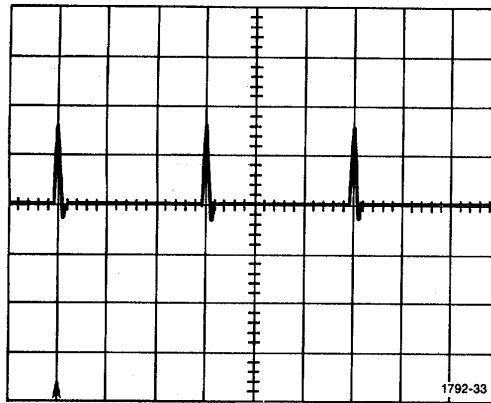


Figure 4-9. Time Marks Aligned (Metric).

(b). Check that the chart paper in the recorder has a bold line next to the hole in the paper that shows a red line through the hole. If the red line is not aligned with a bold line on the chart paper, pull enough chart paper through the recorder to line them up.

(c). Press the RECORD switch to obtain a recording of the time marks. The recording should show the same timing as shown on the crt between the first and fourth time marks, $\pm 2\%$.

(d). Adjust-R3213 (H POS) and R3217 (HORIZ GAIN), located on the OUTPUT AMPS board, to match the timing and position of the time marks on the crt to the chart recording.

72. (a). Adjust-R1435 (FT/DIV CAL) to align the time marks with every third graticule line (see Fig. 4-9).

(b). Set the METRES/DIV control to 50 and set the TG 501 to 1 μ s. Check for 1 time mark every 3 divisions $\pm 2\%$.

(c). Set the METRES/DIV to 10 and set the TG 501 to .1 μ s. Check for 2 time marks every 3 divisions $\pm 2\%$.

(d). Set the METRES/DIV to 5 and check for 1 time mark every 3 divisions $\pm 2\%$.

(e). Set the METRES/DIV to 2.5 and set the TG 501 to 50 ns.

If the timing is difficult to read due to noise, try pressing the NOISE FILTER button or try a slight adjustment of the PG 502 Output (Volts).

(f). Set the METRES/DIV to 1 and set the TG 501 to 10 ns. Check for 2 time marks every 3 divisions $\pm 2\%$.

(g). Set the METRES/DIV to .5 and check for 1 time mark every 3 divisions $\pm 2\%$.

(h). Set the METRES/DIV to .25 and check for 6 divisions between time marks $\pm 2\%$.

(i). Set the METRES/DIV to 50, the METRES/DIV multiplier to X.1, and the TG 501 to 0.1 μ s. Check for 1 time mark every 3 divisions $\pm 1\%$. Locate the time marks by slight adjustment of the PG 502 Output (Volts).

73. Adjust-C1332 (X.1 CAL) for 1 time mark every 3 divisions $\pm 1\%$.

DISTANCE Dial

74. (a). Set the METRES/DIV to 25, the METRES/DIV multiplier to X1, the TG 501 to .5 μ s, and the DISTANCE dial to 000. Locate a time mark on a graticule line by slight adjustment of the PG 502 Output (Volts). Turn the DISTANCE dial clockwise until the second following time mark is aligned on the same graticule line.

(b). Check that the DISTANCE dial reads between 147 and 153.

(c). Check the DISTANCE dial setting for no shift of the time mark with the ZERO REF CHECK button is pressed.

75. (a). Set the DISTANCE dial to 150.

(b). Adjust-R1315 (DISTANCE CAL) located on the MAIN board, for no shift of the time mark while alternately pressing and releasing the ZERO REF CHECK button.

76. (a). Set the TG 501 to 2 μ s.

(b). Set CABLE DIELECTRIC to SOLID POLY. Locate two time marks on the graticule with the DISTANCE dial.

(c). Check-for 7.75 to 8.1 divisions between time marks.

77. (a). Set CABLE DIELECTRIC to SOLID PTFE. Locate two time marks on the graticule with the DISTANCE dial.

(b). Check-for 8.25 to 8.55 divisions between time marks.

78. (a). Set METRES/DIV to 50, set CABLE DIELECTRIC to OTHER, and turn CABLE DIELECTRIC VAR fully clockwise.

(b). Turn the DISTANCE dial as necessary to see two markers and note the timing between the markers.

(c). Turn CABLE DIELECTRIC VAR fully counterclockwise.

(d). Check-that the timing is reduced to $50\% \pm 2\%$ (3.4 to 3.6 divisions) of the timing noted in part b.

(e). Return the CABLE DIELECTRIC VAR to fully clockwise position.

79. Turn off the 1502, remove all test equipment and reinstall U1575. Install the shield over the pulser/sampler circuitry (install 12 screws). Return the instrument to normal viewing position.

80. Turn on the 1502 and set mp/DIV to 500, set the METRES/DIV to 5, set CABLE DIELECTRIC to OTHER and adjust the DISTANCE dial to 000.

X.1 Positioning

81. Connect the precision 50Ω terminator to the CABLE connector.

82. Set the METRES/DIV multiplier to X1.

83. Set the incident pulse to a graticule reference line with the ZERO REF control, then set the METRES/DIV multiplier to X.1.

84. Check-that the leading edge of the incident pulse is located within 2 divisions of the selected graticule reference line.

85. Adjust-R1132 (X.1 POS CAL) located on the MAIN board, so that the leading edge of the incident pulse is located on the selected graticule reference line. Repeat steps 82 through 84.

VERTICAL CHECKS AND ADJUSTMENTS

Pulse Strobe and Risetime

86. Set the mp/DIV control to 500. Connect the probe adapter to the CABLE connector if the connector is the grounding type (grounded CABLE connector used SN B040616 and up).

87. Use the ZERO REF SET and POSITION controls to locate the pulse at the graticule center.

88. Check-that the incident and reflected pulse both have equal amplitudes (see Fig. 4-10 for photos of the correct display).

89. (a). Adjust-R1525 (AVAL VOLT), R1538 (SNAP-OFF), and R1692 (TD BIAS) located on the MAIN board, for a correctly triggered display as shown in Fig. 4-10.

(b). Disconnect the probe adapter.

Loop Gain

90. Set the FEET/DIV (METRES/DIV) to 20 (5), MULTIPLIER to X1, and mp/DIV to 200.

91. Connect the precision 50Ω terminator (Tektronix Part No. 011-0123-00) to the CABLE connector.

92. Use the ZERO REF SET control to locate the pulse on the graticule. Use the POSITION controls as necessary to locate the entire pulse step on the graticule.

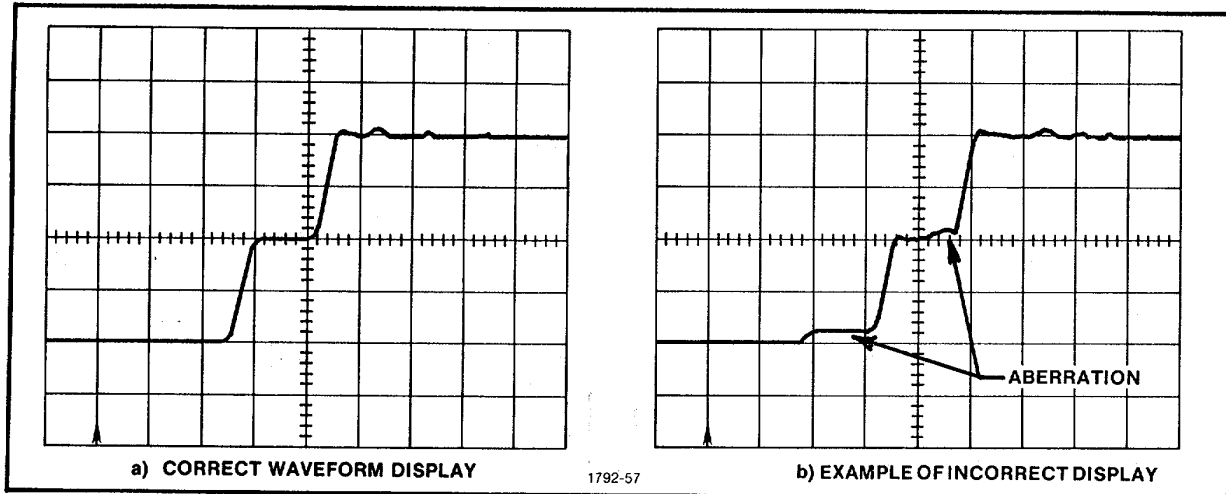


Figure 4-10. Pulse Display.

93. Adjust the front-panel GAIN screwdriver control for a pulse amplitude of 5 divisions. (Adjust the POSITION controls as necessary.)

94. (a). Set the FEET/DIV (METRES/DIV) to 200 (50).

(b). Check that the rise of the pulse occurs within 0.1 division horizontally and there is a spike of approximately 0.2 division at the top corner of the pulse. See Fig. 4-11 for correct and incorrect displays.

95. (a). Adjust-R1543 (LOOP GAIN) located on the MAIN board so that the pulse is as described in the previous step. See Fig. 4-11 for photos of correct and incorrect displays.

(b). Set the FEET/DIV (METRES/DIV) to 1 (.25), set the MULTIPLIER to .1, and set the CABLE DI ELECTRIC to OTHER (VAR-fully cw). Use the ZERO REF and POSITION controls as necessary to locate the pulse at graticule center.

(c). Remove the 50 Ω terminator from the CABLE connector. Install the GR to bnc adapter and the GR short. Check that the reflected risetime of the pulse (fall time) is ≤ 0.7 division (≤ 0.875 division). See Fig. 4-12.

Noise

96. Set the mp/DIV to 5, turn the ZERO REF fully counterclockwise and adjust the POSITION controls so the top of the trace is located on the horizontal centerline.

97. Check that the peak-to-peak noise is not greater than 10 mp (2 divisions).

98. Push the NOISE FILTER button in and check that the peak-to-peak noise is less than 4 mp (0.8 division).

99. Change the FEET/DIV (METRES/DIV) control to 20 (5). Turn ZERO REF fully clockwise.

100. Use the POSITION controls to set the bottom of the pulse at the horizontal centerline.

101. Check that the peak-to-peak noise is less than 4 mp.

102. Release the NOISE FILTER button and check that the peak-to-peak noise is less than 10 mp.

103. Adjust--R1657 (LF COMP) located on the MAIN board, for the lowest possible peak-to-peak noise, then repeat steps 96 through 102 above.

DC Balance

104. Set the mp/DIV to 100.

105. Connect the precision cable from the CABLE connector, to the female adapter, to the 50 Ω terminator. Use the POSITION controls to locate the base of the pulse at the horizontal centerline.

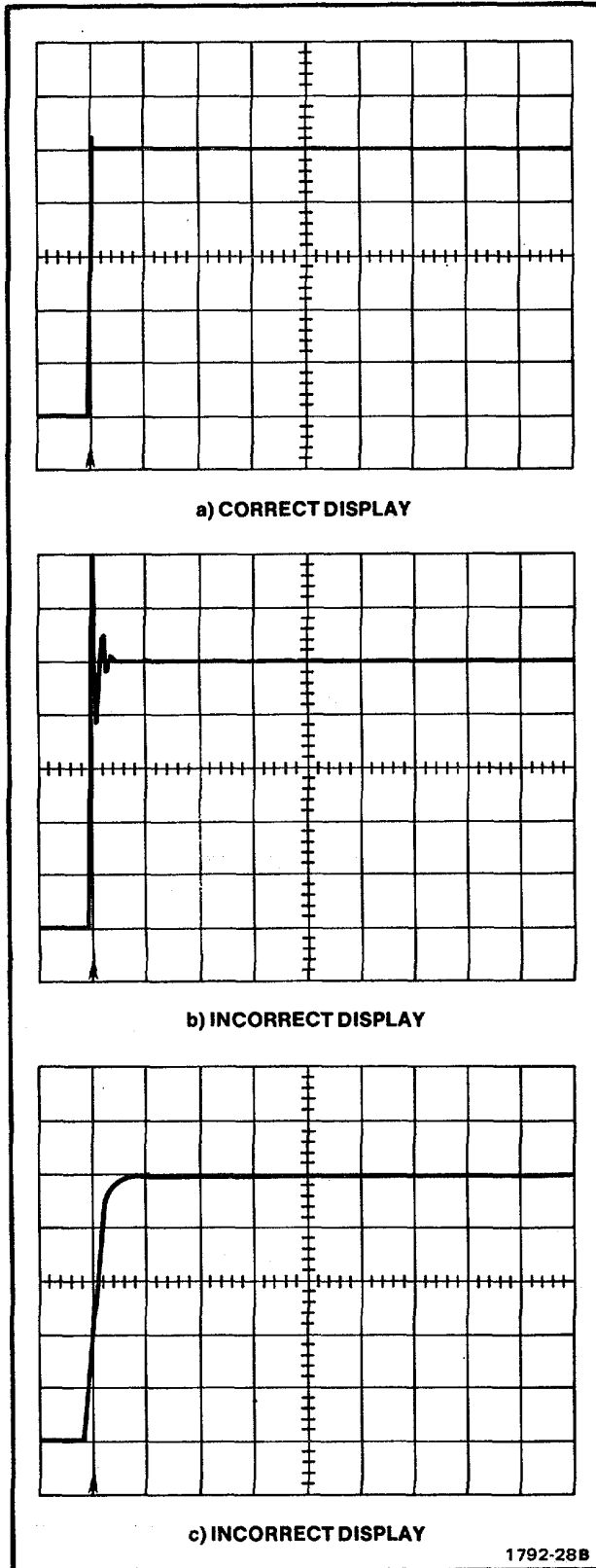


Figure 4-11. Loop Gain Adjustment.

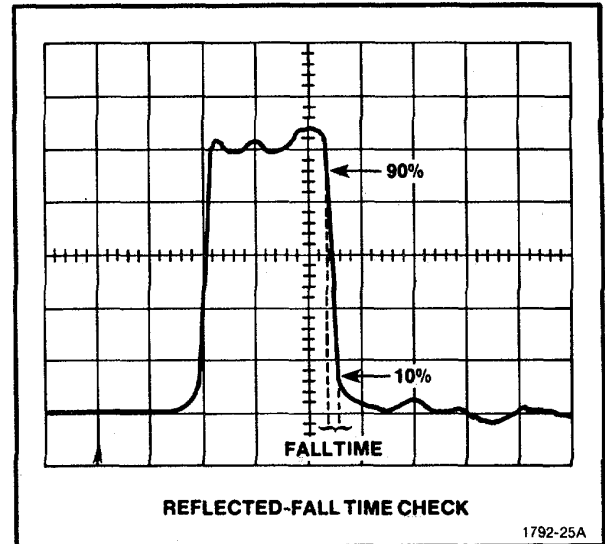


Fig. 4-12. Reflected-Fall Time Check.

106. Remove the 50 n terminator and check that the trace shift is less than 1/2 division.

107. Adjust-R1659(DC BAL) located on the MAIN board, for the minimum trace shift between the terminated and unterminated pulse.

Vertical Attenuation

108. Turn the 1502 top side up on the bench.

109. Set the m μ /DIV to 500, and turn ZERO REF fully clockwise.

110. Set the DM 501 RANGE/FUNCTION switch to 2 on the DC VOLTS scale.

111. Connect the lead from the DM 501 LO terminal to the ground braid of P21 (on the VERT AMP/SLOW RAMP board).

112. Connect the lead from the HI terminal to the left end of R2229. See Fig. 4-13 for the proper connection points.

113. Set the 1502 ZERO REF and POSITION controls so that the DVM reads 1.000 \pm 0.008 volt. If the POSITION control cannot be adjusted to obtain this reading on the DVM, adjust R1659 (DC BAL) located on the MAIN board, for a fully counterclockwise setting. Then adjust the POSITION control for a DVM reading of 1.000 \pm 0.008 volt.

114. Move the test lead from R2229 to R2326 (see Fig. 4-13). The DVM should read 0.400 ± 0.008 volt.

115. Move the test lead from R2326 to R2325 (see Fig. 4-13). The DVM should read 0.199 ± 0.004 volt.

116. Move the test lead from R2325 to R2323 (see Fig. 4-13). The DVM should read 0.0991 ± 0.002 volt.

117. Move the test lead from R2323 to R2322 (see Fig. 4-13). The DVM should read 0.0405 ± 0.0008 volt.

118. Move the test lead from R2322 to R2321 (see Fig. 4-13). The DVM should read 0.0200 ± 0.0004 volt.

119. Move the test lead from R2321 to R2228 (see Fig. 4-13). The DVM should read 0.0100 ± 0.0002 volt.

120. Remove the test leads from the 1502 and turn the ZERO REF control fully counterclockwise. If R1659 (DC BAL) was adjusted during step 113, repeat steps 104 through 107.

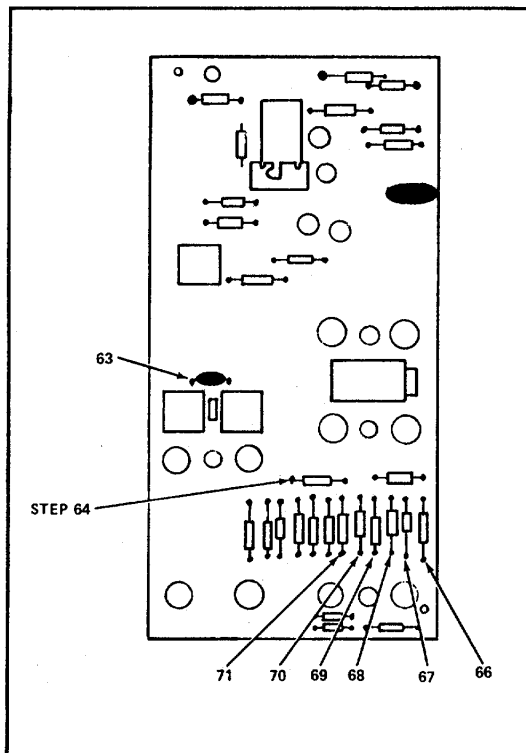


Figure 4-13. Vertical AMP/Slow Ramp Board.

X-Y OUTPUT MODULE CHECKS AND ADJUSTMENTS

Pen Lift Signal

1. Set the Digital Multimeter RANGE/FUNCTION control to 20 on the DC VOLTS scale.

2. Turn the 1502 upright.

3. Place the terminal connection link of the OUTPUT MODULE board on the negative slope terminals (see Fig. 4-14).

4. Connect the lead from the DVM HI terminal to the X- Y OUTPUT MODULE PEN LIFT red terminal and the lead from the DVM LO terminal to the X-Y OUTPUT MODULE PEN LIFT black terminal.

5. Check that the DVM shows approximately +5 volts.

6. Momentarily push the RECORD switch to RECORD, then release the switch. Check that the voltage goes to +0.5 volt or less and returns to approximately +5 volts at the end of the sweep.

7. Move the terminal connection link to the positive slope terminals on the X-Y OUTPUT MODULE board.

8. Check that the DVM reads approximately +0.5 V. volt.

9. Push the RECORD switch to RECORD and check that the DVM reads +4 volts or greater, then returns to approximately 0.5 volt at the end of the sweep.

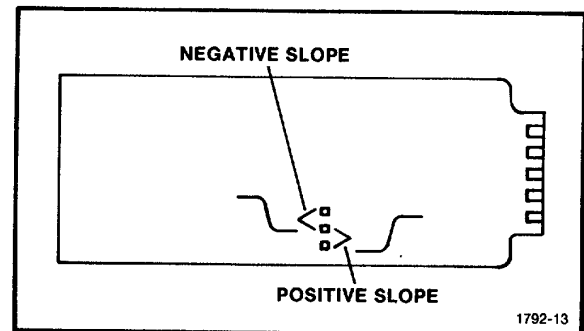


Figure 4-14. Output Module Connection Link.

Y OUTPUT

10. Move the test leads from the PEN LIFT terminals to the corresponding Y terminals of the X-Y OUTPUT MODULE.

11. Set the 1502 ZERO REF SET completely clockwise.

12. Push the RECORD switch to RECORD and adjust the 1502 POSITION controls so that the DVM reads 0.0 volt.

13. Turn the 1502 ZERO REF SET completely counter-clockwise and check that the DVM reads approximately +0.4 volt. Release the RECORD switch.

14. Adjust-R7225 (on X-Y OUTPUT MODULE board) until the DVM reads +0.4 volt while holding the RECORD switch to RECORD.

X OUTPUT

15. Move the test leads to the X terminals.

16. Press the RECORD switch.

17. Check that the voltage reads from 0 to 1 V (100 mV/div) as the dot moves across the screen.

REPLACING THE CASE ON THE 1502

To replace the case on the 1502, proceed as follows:

1. Remove any termination and adapters from the CABLE connector.
2. Remove the battery pack and power cord from the back of the 1502.
3. Place the EMI shields on the top and bottom of the 1502.
4. Stand the 1502 on its face. Lubricate the surface of rubber seals around edge of subpanel with a waterproof lubricant.
5. Slide the case over the back of the unit, until it has reached the subpanel.
6. Tighten the 4 screws on the back of the case until the case is aligned with the groove at the back of the subpanel.
7. Make sure the case is in the groove; then, using a torque-limiting screwdriver, tighten the 4 screws to 8 inch-pounds.

NOTE

If the screws are tightened more than 8 inch-pounds, the case may crack. If the screws are not tightened equally to the required torque, the watertight integrity of the case may be compromised.

8. Place the battery pack in its compartment and tighten the 2 screws (finger tight is sufficient).
9. Place the power cord and the rest of the accessories in the front cover storage compartment and latch it closed.
10. Place the front cover over the front cover panel and close the latches.

NOTE

For detailed sealing instructions, see the Maintenance instructions in Section 5.

MAINTENANCE

NOTE

It is recommended that the 1502 be serviced at a Tektronix Service Center. The instrument should be serviced by a technician skilled in sampling and pulse techniques.

This section of the manual provides information used for preventive maintenance, corrective maintenance, and troubleshooting the 1502. The physical location of all circuit components on the circuit boards are shown on the circuit diagram pullouts.

Preventive Maintenance

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis will help improve the reliability of the instrument. The severity of the environment to which the 1502 is subjected determines the frequency of needed maintenance. A convenient time to perform preventive maintenance is preceding recalibration of the instrument.

Cleaning

Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It also provides an electrical conduction path.

Interior. The 1502 construction protects the interior of the instrument from dust.

The interior of the 1502 should not normally require cleaning unless the unit has been left with the front cover removed and the plug-in compartment empty. The best way to clean the interior is to blow off the accumulated dust with low-pressure air. Remove any dirt that remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces on circuit boards.

NOTE

To remove the instrument cabinet, see Preliminary Procedure at the beginning of the Calibration procedure. When the cabinet is removed, the watertight feature may be compromised when the case is reinstalled. See the instructions at the end of the Calibration procedure on replacing the case on the 1502. Detailed parts replacement instructions are contained at the end of this section.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain benzene, toluene, xylene, acetone or similar solvents.

Exterior. The cabinet exterior can be washed with soap and water and rinsed with clear water. Loose dust accumulated on the front panel is best removed with a small brush or a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners should not be used on the front panel.

CRT Implosion Shield. The face of the crt can be cleaned by using ISOPROPHYL ALCOHOL applied and wiped very gently dry with KENDALL "NEBRIL" non-woven wipes.

Lubrication

The reliability of potentiometers, switches and other moving parts can be maintained if they are kept properly lubricated. However, too much lubricant is as detrimental as too little lubricant. A lubrication kit containing the necessary lubricants and instructions is available from Tektronix, Inc.

Visual Inspection

Prior to recalibration, the 1502 should be inspected for such defects as broken connections, damaged circuit boards, improperly seated pin connectors, frayed cable shields and heat-damaged components.

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

In order to maintain the water-tight integrity of the 1502, it is important to visually inspect the water-tight seals periodically. Seals around the X-Y Output Module, the battery pack and the front cover seal on the front panel should be checked regularly to see that they have not become damaged. The clam shell seal on the back of the front-panel casting and the seals around the front-panel controls and connectors should be inspected when the cabinet has been removed for maintenance, calibration purposes, or if a leak is suspected.

| |
|----------------|
| CAUTION |
|----------------|

Anytime the cabinet has been removed from the 1502 or when any front panel controls or connectors have been removed from the front panel, the water-tight integrity of the 1502 will be jeopardized.

Semiconductor Checks

Periodic checks of the semiconductors in the 1502 are not recommended. The best check of semiconductor performance is actual operation in the instrument. More details on checking semiconductor operation are given under troubleshooting.

Recalibration

To ensure accurate measurements, check the calibration of the 1502 after each 1000 hours of operation or every six months if used infrequently. In addition, replacement of components may necessitate recalibration of the affected circuits. The calibration procedure can also be helpful in localizing certain troubles in the instrument. In some cases, problems may be revealed or corrected by recalibration.

Servicing the Battery

The battery pack should be inspected every six months or every 500 hours of operation, whichever occurs first. The entire battery pack should be replaced if venting or corrosion has occurred.

TROUBLESHOOTING

The following information is provided to help in troubleshooting the 1502. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component(s). An understanding of the circuit operation is helpful in locating troubles. See the Circuit Description section for information.

Troubleshooting Aids

Diagrams. Circuit diagrams and corresponding circuit board layouts are located on foldout pages at the rear of the manual. Section 7 contains the Electrical Parts List. From these schematics and parts lists, the component number, location, electrical characteristics and Tektronix, Inc. part number can be cross-referenced. The components that are located on the front panel are shown on the circuit diagrams with their front-panel titles enclosed in a block. Additional aids for troubleshooting can be found in the Calibration section of this manual.

COMPONENT REMOVAL AND REPLACEMENT

Fuses

The ac line fuses are located on the front panel. The dc fuses and spares are located on the Power Supply board inside the instrument. Remove the 1502 from its case. Remove the aluminum shield from the top of the unit. The fuses are upright plug-in types located near the center of the instrument (see Fig. 5-1).

Transistors and Integrated Circuits

See Fig. 5-2 for the lead configurations of the transistors and integrated circuits used in the 1502.

Circuit Board Replacement

Most of the components mounted on the circuit boards can be replaced without removing the boards from the instrument. An exception is the HV circuit board which is located underneath the Power Supply board. If a circuit board is damaged beyond repair, the entire assembly (including all soldered-on-components) can be replaced. The number is given in the Electrical Parts list for the completely wired board.

Use the following procedure to remove a circuit board. Reverse the procedure to replace boards.

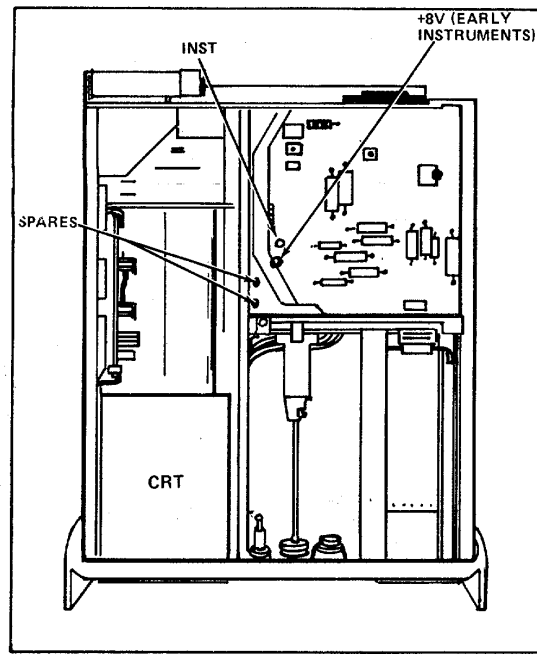


Figure 5-1. DC Fuse Location.

NOTE

All screw fasteners used on circuit boards, on or near a cam switch, should be tightened to no more than 3 inch-pounds using a torque-limiting screwdriver.

Power Supply Boards

1. Remove the four screws.
2. Remove the pin connectors to P1, P2, and P3 near the rear edge of the board.
3. Carefully lift the rear of the board until the pin connectors underneath come into view.
4. Remove the pin connectors from the bottom of the board and lift it out of the chassis.

HV Board

1. Remove the Power Supply board following the previous procedure.

WARNING

2 kV may be present on the HV board from charged capacitors.

2. Discharge the possible 2 kV potential by placing a short between point A, Fig. 5-3 and ground. This point is accessible by removing the Battery Pack and turning the 1502 upside down.
3. Remove the pin connectors.
4. Remove the four screws holding the board in the chassis.
5. Lift the HV board out of the chassis.

Power Transformer

1. Remove the Power Supply and the HV boards from the chassis using the previous procedures.
2. Unsolder the two leads on the bottom of the Power Transformer.
3. Remove the four bolts holding the transformer in place. The ground wire and lug on the bottom will come off when the bolt and nut are removed.
4. Lift the Power Transformer out of the chassis.

Power Cord Conductor Identification

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

Output Amplifier Board

1. Remove the four pin connectors from the top of the Output Amps board.
2. Remove the four screws holding the board in the chassis.
3. Lift the board out of the hole in the side of the chassis.

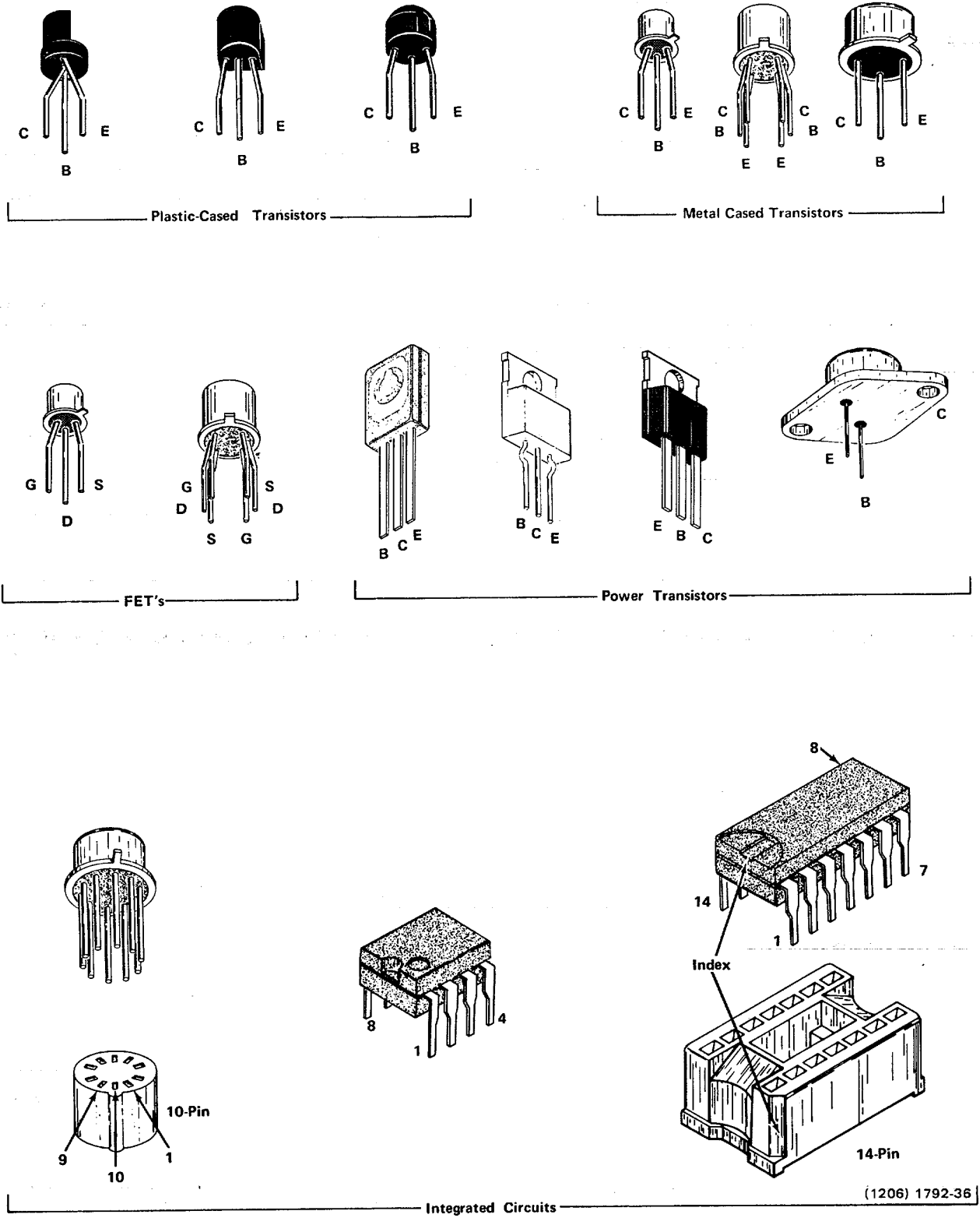


Figure 5-2. Transistor and Integrated Circuit Lead Configuration.

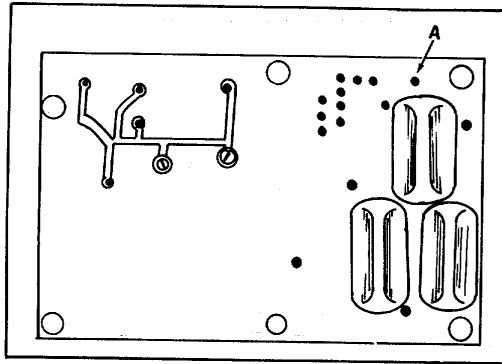


Figure 5-3. Rear View of The HV Board.

Logic Board

1. Remove the three pin connectors from the Logic board.
2. Remove the four screws holding it in the chassis.
3. CAREFULLY lift on the rear of the Logic board to pull the board off the ten feed-thru pins which are mounted on the chassis. Lift the board off the chassis when clear of the pins.
4. Use care when replacing the board to prevent bending the pins or the pin connectors on the board.

Main Board and Vertical Amp/Slow Ramp Board

Removal of the main board and the Vertical Amp/Slow Ramp board requires removal of some front panel controls. This will destroy the water-tight seals. Sealing instructions are included in this section. It is usually preferable to have this done at a Tektronix Service Center.

Cathode-Ray Tube Replacement

To replace the crt, proceed as follows:

WARNING

Use care when handling a crt. Protective clothing and safety glasses should be worn. Avoid striking it on any object which might cause it to crack or implode. When storing a crt, place it in a protective carton or set it face down in a protected location on a smooth surface with a soft mat under the faceplate to protect it from scratches.

1. Remove the Battery Pack from the 1502.
2. Remove the pin connectors from the top of the Output Amps board.
3. Remove the four screws holding the crt socket bracket to the frame.
4. Remove the screw bracing the rear of the crt socket to the chassis.
5. Slide the entire assembly (crt, socket bracket, and crt shield) to the rear about 1/4 inch. Lift straight up on the entire assembly, clearing the tabs on the front panel casting.
6. Set the assembly on top of the 1502 with the socket wiring still attached.
7. Remove the gasket from the front of the crt.
8. Unplug the socket from the crt.
9. Carefully remove the crt from the shield, guiding the two-wire pin connector through the hole in the shield as the crt comes out the front.
10. The Trace Rotation Yoke (L0234) can now be removed and installed on the new crt. Position of the Yoke is not critical. Make sure it is tight against the neck of the crt and fastened with tape.
11. Install the crt using the above procedure in reverse. Use care when tightening the screw bracing the crt from the rear of the chassis.

Tunnel Diode Replacement

Tunnel diode (CR1703) may be replaced using the following procedures:

1. Remove the screws from the Main board shield and cavity shield.

If the front of the shield was soldered to the bnc connector, unsolder the connection between the CABLE bnc connector and the cavity shield. Use a solder wick or other desoldering tool to remove all solder.

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2. Lift up carefully on the rear of the cavity shield, applying heat to the solder connections to the bnc connector if necessary.

If the front of the shield was fastened by Econobond, it can be removed by lifting the rear of the shield carefully until the bonding comes loose.

3. With the shields removed, pull the wire attached to the rear of the tunnel diode holder until the tunnel diode can be raised free of its holder.

4. Place a new tunnel diode in the holder with its fins pointing towards the rear of the 1502.

5. Re-assemble the shields in reverse order, soldering or if it was bonded, rebonding the cavity shield to the bnc connector. Do not use too much heat or solder. The bonding material is listed at the end of this section.

230 V Operation

The battery charger is factory wired for 115 V ac or 230 V ac if Option 6 is ordered. The standard 115 V ac unit can be changed to 230 V ac operation by rewiring the line transformer. The Power Supply circuit diagram (number 6) and Fig. 5-4 show the proper wiring configuration for 230 V operation.

CAUTION

When the 1502 is wired for 230 V ac, be sure that the plug is installed on the ac cable and that the proper fuses are installed. Refer to the Electrical Parts list.

REPACKAGING FOR SHIPMENT

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

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

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

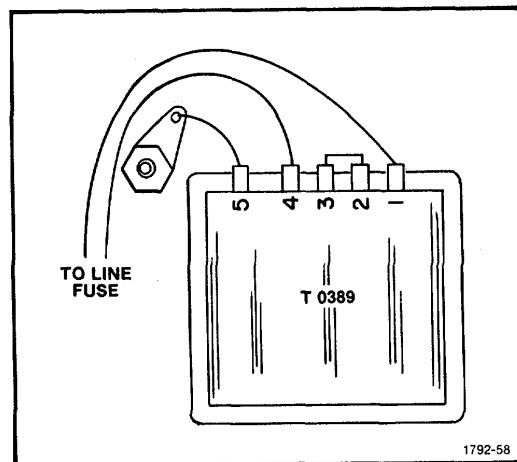


Figure 5-4. 230 Vac Transformer Wiring.

The carton test strength for your instrument is 275 pounds.

Water-tight Seals

The 1502 is prepared to be operated in any weather (rain, snow, dust, etc.). To prevent moisture and dust from getting inside the Instrument, special seals are used.

In order to maintain the water-tight integrity of the 1502, it is important to visually inspect the water-tight seals periodically. Seals around the X-Y Output Module, the battery pack and the front cover seal on the front panel should be checked regularly to see that they have not become damaged. The clam shell seal on the back of the front-panel casting and the seals around the front-panel controls and connectors should be inspected when the cabinet has been removed for maintenance calibration purposes, or if a leak is suspected.

CAUTION

Anytime the cabinet has been removed from the 1502 or when any front panel controls or connectors have been removed from the front panel, the watertight integrity of the 1502 will be jeopardized.

SEALING PROCEDURES

NOTE

In the following assembly steps, the part being discussed is identified by its location in the Mechanical Parts List (MPL) of the Instruction Manual for the 1502. Example, in Step 1 the Front Subpanel is being discussed. In the 1502 manual, the part is listed in the MPL under Fig. & Index No. 3-26.

1. Preparation of the Subpanel for further assembly (see Fig. 5-5)

- a. SUBPANEL, FRONT MPL Item 3-26.
- b. Procedure
 1. Clean entire Subpanel with isopropyl alcohol.

2. Install the Holder for the Battery Level Indicator in the Subpanel

- a. HOLDER MPL Item 2-54.
- b. Procedure
 1. Insert the holder into the Subpanel.
 2. This item does not require the application of a sealing compound.

3. Install the seal for the Power Switch in the Subpanel

- a. SEAL, SWITCH MPL Item 2-52.
- b. Procedure
 1. Clean mating surface of seal with acetone.
 2. Coat mating surface of seal with No. 3144 sealant.
 3. Install seal in Subpanel.

4. Install washers for the Fuseholders in the Subpanel

- a. WASHER, FLAT (2 ea.) MPL Item 2-49.
- b. Procedure
 1. Clean the washers with acetone.
 2. Coat the mating surfaces of the washers with No. 3144 sealant.
 3. Insert the washers in the Subpanel.

5. Install the Pushbutton seals in the Subpanel

- a. SEAL, PUSHBUTTON MPL Item 2-51, and MPL Item 2-50.

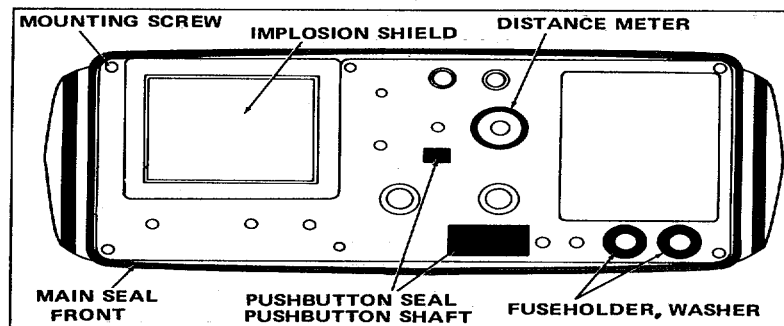


Figure 5-5. Subpanel, Identification of Parts.

b. Procedure

1. Clean mating surfaces of seals with acetone.
2. Coat mating surfaces with No. 3144 sealant.
3. Install seals in subpanel.

6. Installation of rubber seals in two grooves located on the outer (see Figs. 5-5 and 5-6) edges of the front and rear sides of the Subpanel

a. SEAL, RUBBER (2 ea.) MPL Item 2-55.

b. Procedure

1. Clean the rubber seals with acetone.
2. Apply a film of No. 3140 sealant to the inner surface of each groove. See Fig. 5-6. Do not apply the sealant to the other surfaces of the grooves. No.3140 is more fluid than No. 3144 and can be applied with a hypodermic type applicator.
3. Place a seal in each groove. Trim each seal to a length such that its ends butt together. Apply a film of No. 3140 sealant to the Butt joint.
4. Before installing the instrument in a cabinet, lubricate the outer edges of the seals as shown in Fig. 5-6.

7. Install the implosion shield and its retainer on the Subpanel (see Figs. 5-5 and 5-7)

a. SHIELD, IMPLOSION MPL Item 2-94.

b. RETAINER MPL Item 2-93.

c. Procedure

1. Clean the retainer and the implosion shield mounting area of the Subpanel with acetone.
2. Remove the protective paper from the implosion shield.
3. Position the shield on the Subpanel and form a continuous bead of No. 3144 sealant, approximately .090 inch in diameter, around the shield/Subpanel interface.
4. Position the retainer over the bead of sealant and press into place.

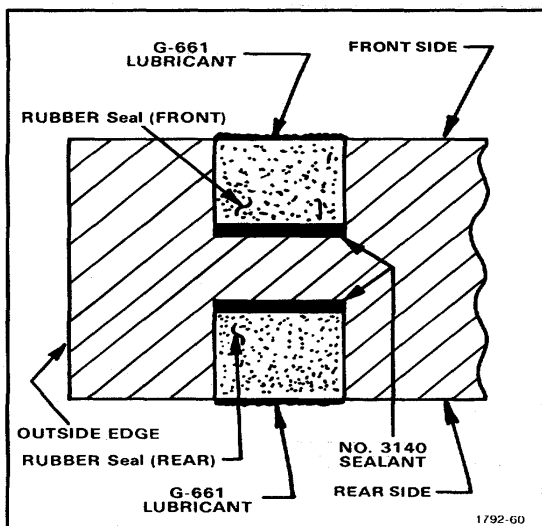


Figure 5-6. Rubber Seals, edge sealing for subpanel.

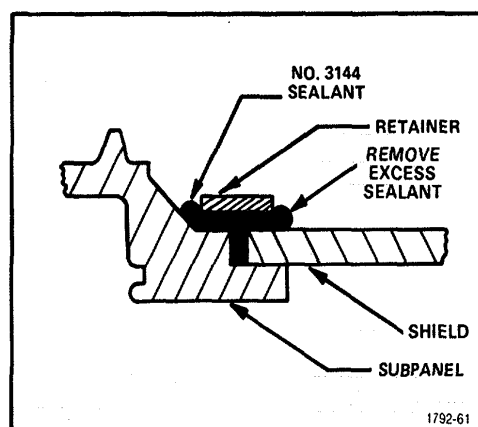


Figure 5-7. Detail of implosion shield sealing.

NOTE

1. Pressing the retainer should cause some of the sealant to appear outside the retainer area, see Fig. 5-7. Failure of the sealant to appear at any point around the retainer is an indication of inadequate sealing.

2. When performing this step, assure that the shield makes flush contact with the subpanel, see Fig. 5-7.

5. After a curing time of approximately 4 hours, use a small wooden dowel, such as a Q-tip handle, and remove the excess sealant that is visible between the shield and retainer.

8. Preparation of Front Panel for assembly (see Fig. 5-8)

a. FRONT PANEL MPL Item 2-47.

b. Procedure

1. Clean mating surface of front panel with acetone.

2. Coat mating surface of panel with No. 1204 primer. Allow 2 hours curing time.

9. Bonding of Plug-in Compartment seal to Front Panel (see Fig. 5-9)

a. SEAL, PLUG-IN MPL Item 2-48

b. Procedure

1. Clean mating surfaces of seal with acetone.

2. Apply No. 3144 sealant to mating surface of seal.

3. Position seal on rear side of Front Panel.

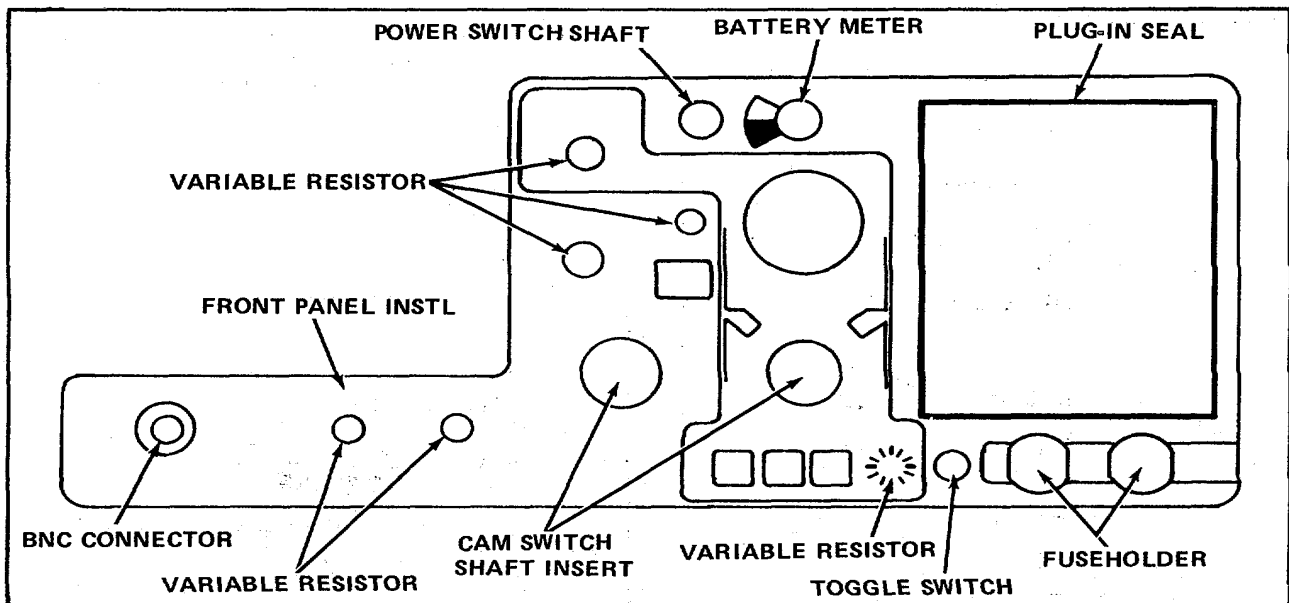


Figure 5-8. Front Panel, Identification of Parts For Assembly Step 8 Through 26.

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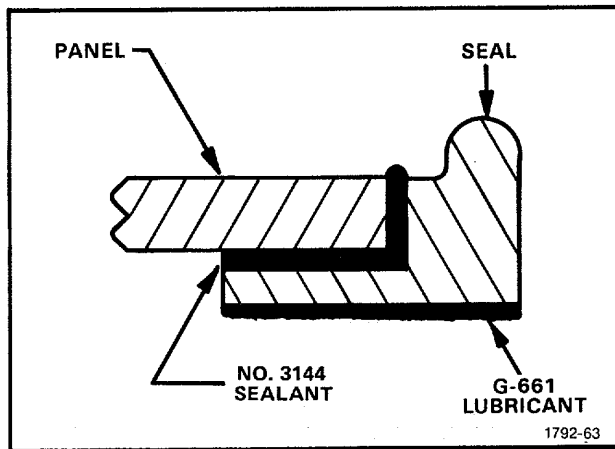


Figure 5-9. Detail of Plug-In Compartment seal.

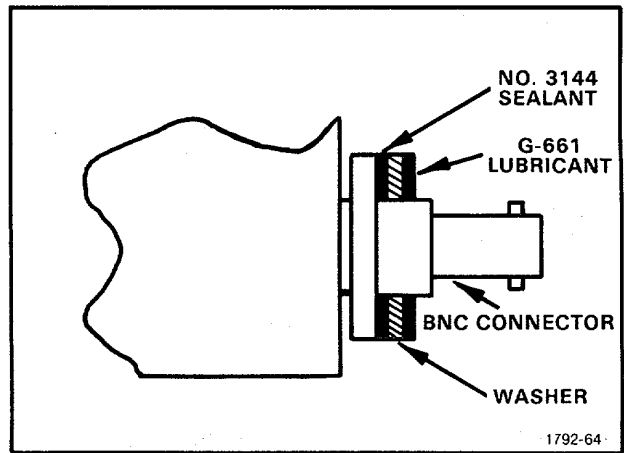


Figure 5-10. Detail of BNC Connector and Washer.

4. Clamp Seal in place.
5. Allow 2 hour curing time. Remove clamp, inspect seal bond, and remove any excess sealant. Allow an additional 22 hour curing time.

NOTE

Be sure seal is bonded securely to edge of panel as well as rear surface of panel.

10. Bonding of washer to BNC type connector that is located on the Main Circuit Board Assembly (see Fig. 5-10)
 - a. CONNECTOR, RECEPTACLE MPL Item 2-125.
 - b. WASHER, FLAT SPONGE. MPL Item 2-111
 - c. Procedure
 1. Clean mating surfaces of BNC Connector and Washer with acetone. Allow to dry.
 2. Apply No. 1204 Primer to mating surface of BNC connector. Allow 2 hour curing time.
 3. Coat mating surface of washer with No. 3144 sealant.
 4. Assemble washer on BNC connector.

11. Install pushbuttons and their shaft assemblies (see Fig. 5-11)

- a. PUSHBUTTONS MPL Item 2-8; MPL Item 2-9; MPL Item 2-10; MPL Item 2-11.
- b. EXTENSION SHAFT MPL 2-1114, (4 ea.),.
- c. Procedure
 1. Clean the mating surfaces of each shaft with isopropyl alcohol.
 2. Insert the shafts into the pushbutton seals. See Fig. 5-11.

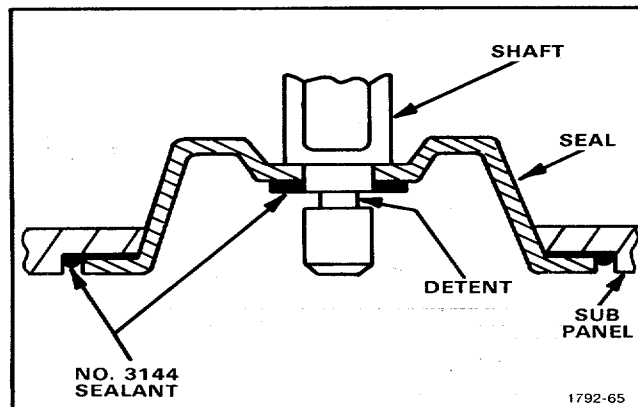


Figure 5-11. Detail of Pushbuttons and their shafts.

3. Apply bead of No. 3144 sealant to each shaft/seal interface.
4. Install pushbuttons in their respective locations.

12. Attach Subpanel to the three Frame Sections (See Fig. 5-12)

- a. FRAME SECTIONS MPL Item 3-116; Center, MPL Item 3-117; Right, M PL Item 3-118.
- b. SCREWS MPL Item 3-27 (1 ea.); MPL Item 3-28 (5 ea.).
- c. Procedure

1. Fill the countersunk screw holes on the Subpanel with No. 3144 sealant. See Fig. 5-12.
2. Attach the Subpanel to the three Frame sections. The decorative screw is installed in the upper-left corner of the subpanel.

13. Install Front Panel on Subpanel

- a. Procedure
 1. Apply G-661 lubricant to the rear surface of the Plug-in Seal, and to the two Fuse Holder Seals.
 2. Place Front Panel on the Subpanel.

14. Install Fuseholders In Front Panel (see Fig. 5-13)

- a. FUSEHOLDERS MPL Item 2-24.
- b. Procedure
 1. Install the two Fuseholders as shown in Fig. 5-13.
 2. Tighten the retaining nut on the fuseholder until the Front Panel is pulled flush with the Subpanel.

CAUTION

Do not overtighten.

15. Install Fuseholder Caps (see Fig. 5-14)

- a. WASHERS MPL Item 2-25.
- b. Procedure
 1. Clean washers and Fuseholder Caps with isopropyl alcohol.
 2. Apply No.3144 sealant to one surface of a washer and place the washer in one of the Fuseholder Caps. Repeat for the other washer and cap.

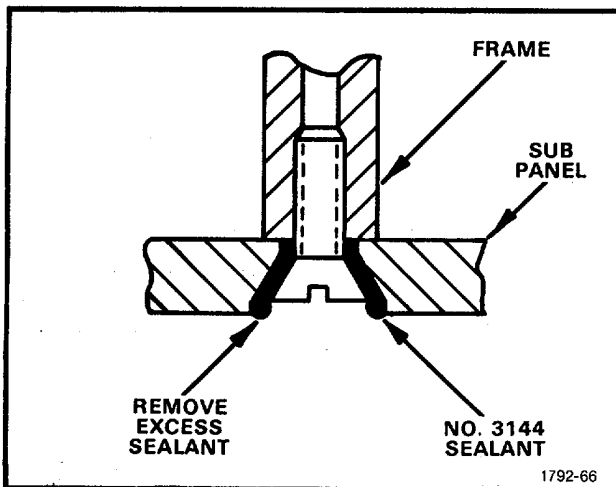


Figure 5-12. Detail of Subpanel screwhole sealing.

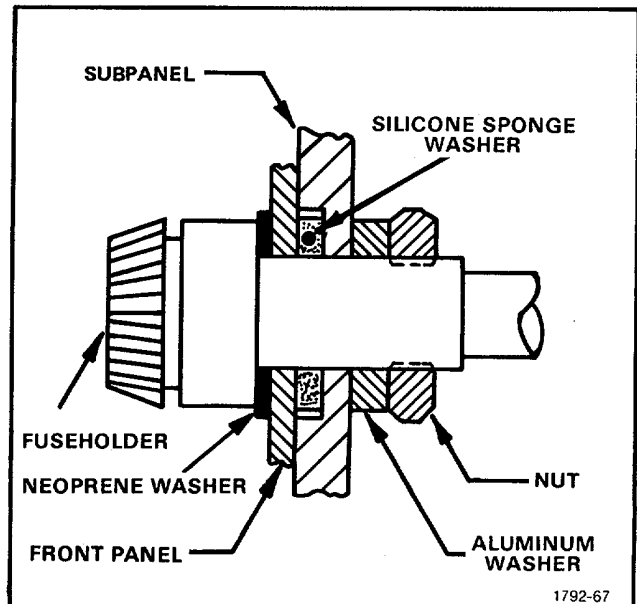


Figure 5-13. Detail of Fuseholder installation.

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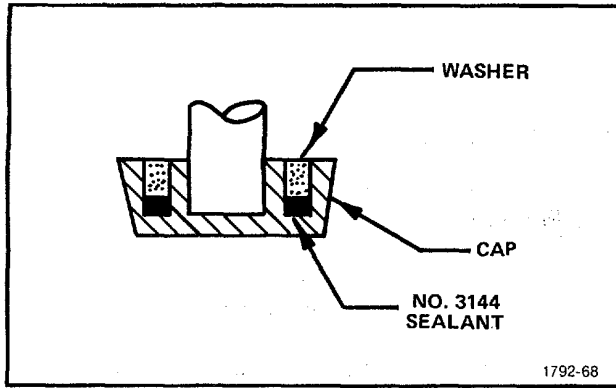


Figure 5-14. Detail of Fuseholder Caps.

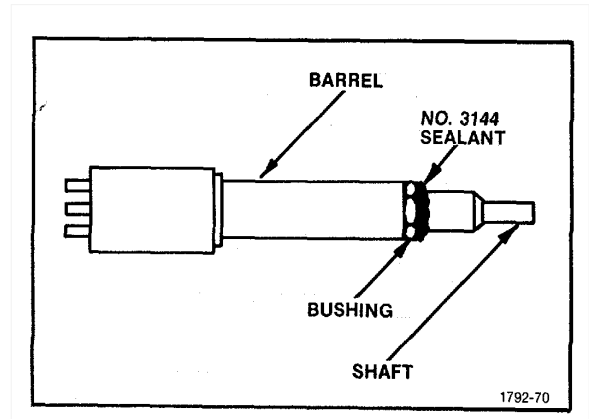


Figure 5-16. Alignment of Battery Meter

3. Insert the caps in the Fuseholders and press to ensure the washers are fully seated.
4. Remove the caps, inspect, and remove any excess sealant.
5. Apply a film of G-661 lubricant to exposed surface of washer.
6. Insert fuse (see Electrical Parts list for correct value) into cap and install cap with fuse in the Fuseholder.

16. Install Battery Meter (see Figs. 5-15 and 5-16)

- a. METER MPL Item 2-53.

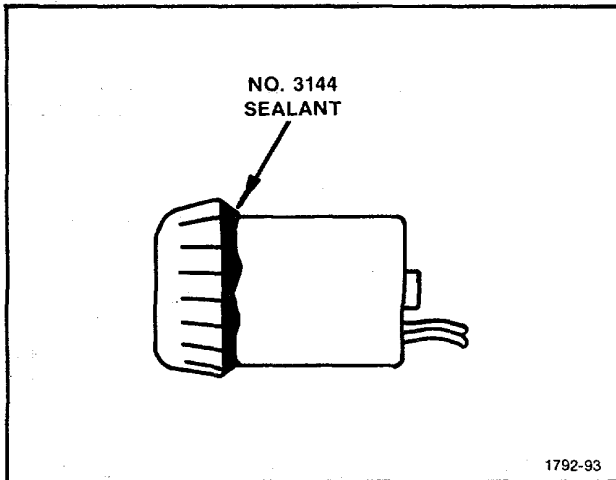


Figure 5-15. Application of sealant to Battery Meter.

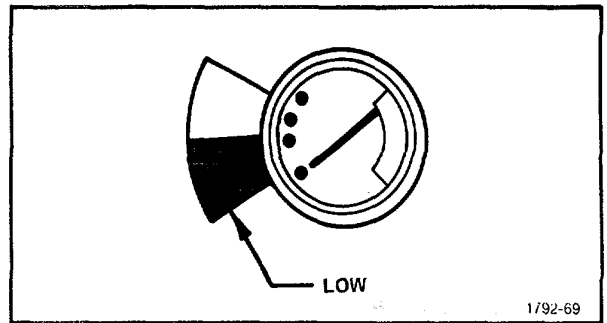


Figure 5-17. Application of sealant to FOCUS and INTENSITY controls.

b. Procedure

1. Apply a thin bead of No. 3144 sealant to the junction of the bezel and meter canister (see Fig. 5-15).
2. Install Meter in Front Panel with markings aligned as shown in Fig. 5-16.

17. Install the FOCUS and INTENSITY controls (see Fig. 5-17)

- a. RESISTOR, VARIABLE (2 ea.). MPL Item 2-38 and Item 2-41

These two variable resistors are used for FOCUS and INTENSITY control and are listed in the Electrical Parts list.

b. Procedure

1. Unscrew the bushing part of the resistor assembly and pack the barrel/shaft interface with G-661 lubricant.

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2. Screw the bushing into the resistor assembly.
3. Form a bead of No. 3144 sealant around the fillet area of the bushing.
4. Use the washers and nuts supplied and install these two controls in the Front Panel.

18. Install FINE POSITION control (See Figs. 5-18 and 5-19)

- a. RESISTOR, VARIABLE MPL Item 2-30.

The part number for this variable resistor is listed in the Electrical Parts list.

b. Procedure

1. Form a bead of No. 3144 sealant around the bushing threads as shown in Fig. 5-18.
2. Install nut on bushing as shown in Fig. 5-19.
3. Form a bead of No. 3144 sealant at the interface of the nut and bushing as shown in Fig. 5-19.
4. Use washer and nut supplied and install the control in the Front Panel.

19. Install the DISTANCE METER in the Front Panel (see Fig. 5-20)

- a. RESISTOR, VARIABLE MPL Item 2-44.

This variable resistor is listed in the Electrical Parts list as the Distance Meter.

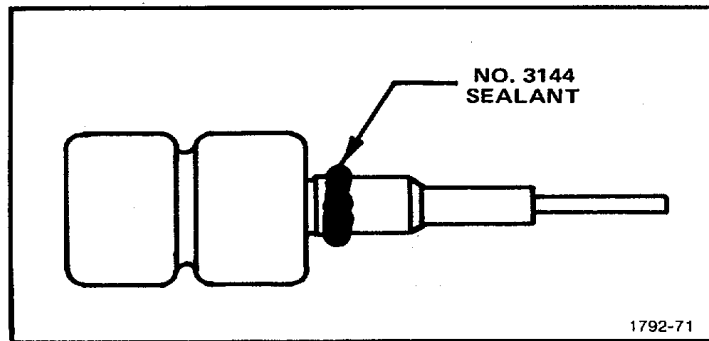


Figure 5-18. Application of sealant to FINE control bushing

b. Procedure

1. Insert the resistor assembly in the Front Panel.
2. Form a bead of No. 3144 sealant at the interface of the resistor assembly and the Front Panel. The bead should include the threads and anti-rotation lug.
3. Use the flat-washer, lock-washer, and nut to secure the resistor assembly to the Front Panel.

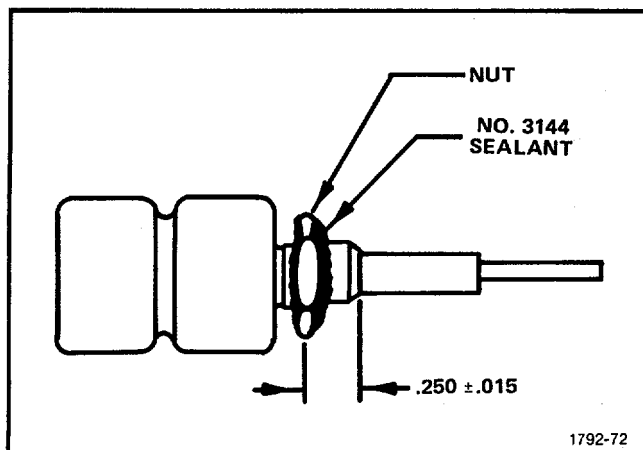


Figure 5-19. Application of sealant to FINE control nut.

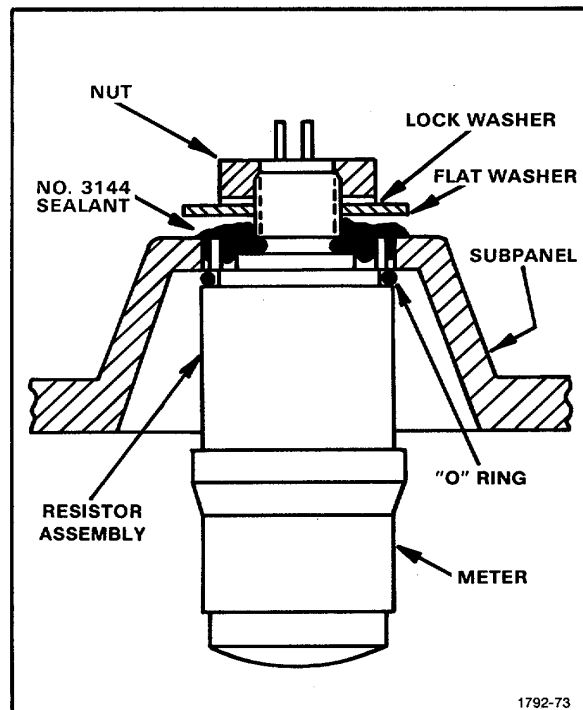


Figure 5-20. Installation of Distance Meter.

20. Install the ZERO REFERENCE control in the Front Panel (see Figs. 5-21 and 5-22)

- a. RESISTOR, VARIABLE MPL Item 2-27.

This variable resistor is listed in the Electrical Parts list.

- b. Procedure

1. Form a bead of No. 3144 sealant around the threads of the bushing as shown in Fig. 5-21.
2. Flatten or remove the anti-rotation lug on the resistor housing.
3. Install nut as shown in Fig. 5-22.
4. Form a bead of No. 3144 sealant around the nut/bushing interface.
5. Use attaching hardware and install resistor in Front Panel.

21. Install the Record control (see Figs. 5-23, 5-24, and 5-25)

- a. SWITCH, TOGGLE MPL Item 2-20.

- b. CAP, TOGGLE SWITCH, SEAL MPL Item 2-21.

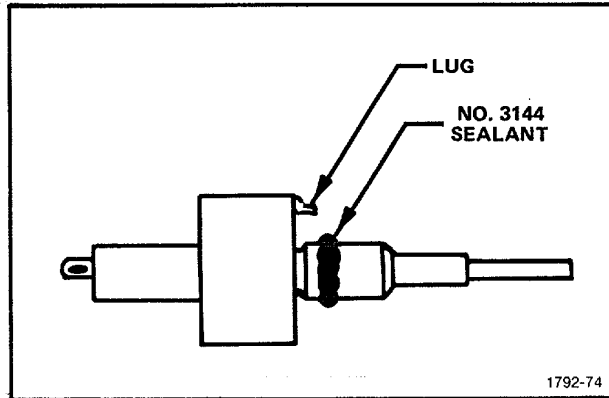


Figure 5-21. Application of sealant to ZERO REFERENCE control bushing.

- c. Procedure

1. Form a bead of No. 3144 sealant around the bushing/switch body interface as shown in Fig. 5-23.
2. Install nut that was supplied with the switch, as shown in Fig. 5-24.
3. Form a bead of No. 3144 sealant around the bushing/nut interface as shown in Fig. 5-24.
4. Use attaching hardware and install the toggle switch in the Front Panel.
5. Install the cap-seal on the toggle switch (see Fig. 5-25).

22. Install the VAR control and the GAIN control (see Figs. 5-26 and 5-27)

- a. RESISTOR, VARIABLE

MPL Item 2-16 (VAR control); MPL Item 2-33 (GAIN control).

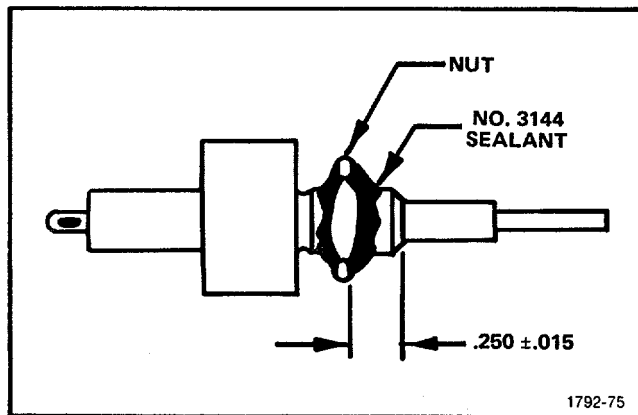


Figure 5-22. Application of sealant to ZERO REFERENCE control bushing.

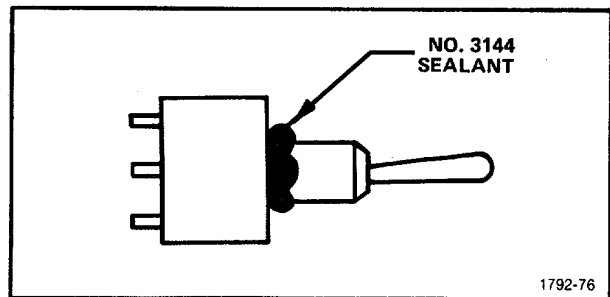


Figure 5-23. Application of sealant to RECORD toggle-switch bushing.

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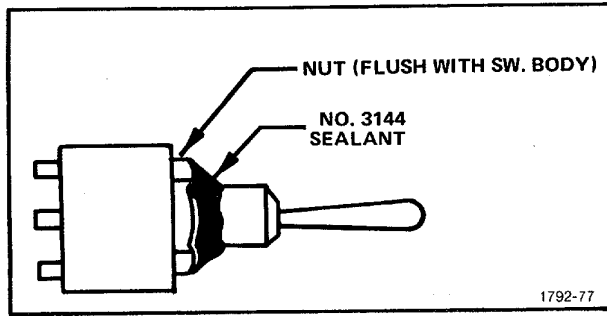


Figure 5-24. Application of sealant to RECORD toggle-switch nut.

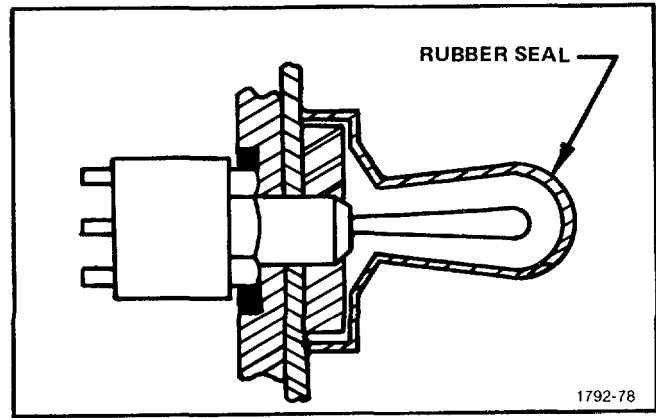


Figure 5-25. Installation of rubber Cap-Seal on RECORD toggle-switch.

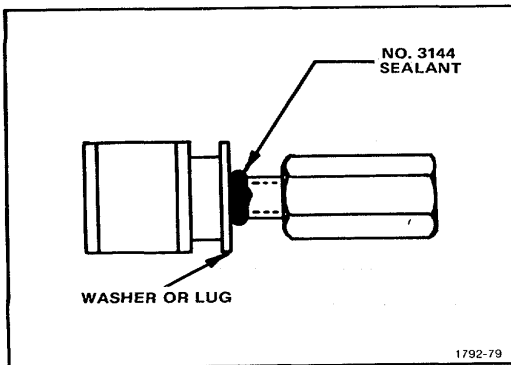


Figure 5-26. Application of sealant to the GAIN or the 0-dB SET control bushing.

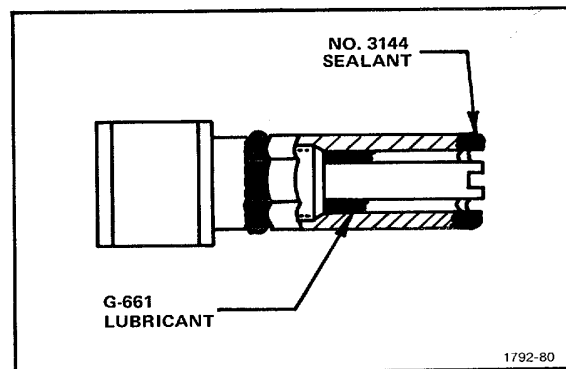


Figure 5-27. Application of sealant to the GAIN or the 0-dB SET control bushing.

b. Procedure

1. Partially unscrew Hex spacer nut and form a bead of No. 3144 sealant around the bushing threads as shown in Fig. 5-26.
2. Re-tighten the Hex spacer nut.
3. Pack the Shaft/Threaded Bushing interface with G-661 lubricant as shown in Fig. 5-27.
4. Form a bead of No. 3144 sealant on the end of the Hex spacer nut as shown in Fig. 5-27.
5. Install the resistor in the Front Panel.

23. Partial installation procedure for Main Circuit Board Assembly

a. MAIN CIRCUIT BOARD ASSY. Not shown in MPL as separate item.

b. Procedure

1. Lubricate washer on BNC connector with G-661 lubricant.
2. Insert Main Circuit Board Assembly into instrument chassis engaging pushbutton shafts with their respective switches. (Take care not to damage pushbutton seals.)

3. Do not install Main Circuit Board holding screws at this point.

24. Install cam switch Inserts (see Fig. 5-28)

- a. INSERT, SHAFT SEAL (2 ea.) MPL Item 2-155.
- b. PACKING (O-ring, 2 ea.) MPL Item 2-116.
- c. Procedure

1. Apply G-661 lubricant to o-ring and install as shown in Fig. 5-28.
2. Form a bead of No. 3144 sealant around the fillet area of the insert.
3. Install the two inserts in the Front Panel. Tighten until snug, then back off 2° to 3°. Remove any excess sealant.

25. Finish installation procedure for Main Circuit Board Assembly

- a. Procedure

1. Install washer and nut on BNC connector. Tighten nut to a torque reading of 20 ± 3 inch-pounds.
2. Install Main Circuit Board holding screws.

26. Install Power Switch Shaft Into Front Panel (see Fig. 5-29)

- a. EXTENSION-SHAFT MPL Item 2-14.
- b. BUSHING MPL Item 2-15.
- c. Procedure

1. Insert the bushing into the Power Switch Seal that was previously installed in the Front Panel.
2. Apply G-661 lubricant to the detent area of the Power Switch Shaft.
3. Install as shown in Fig. 5-29.

27. Installation of the POSITION knob and the FINE POSITION knob (see Figs. 5-30 and 5-31)

- a. KNOB, POSITION MPL Item 2-4.
- b. KNOB, FINE POSITION MPL Item 2-2.
- c. Procedure

1. Apply G-661 lubricant to the POSITION knob as shown in Fig. 5-30.

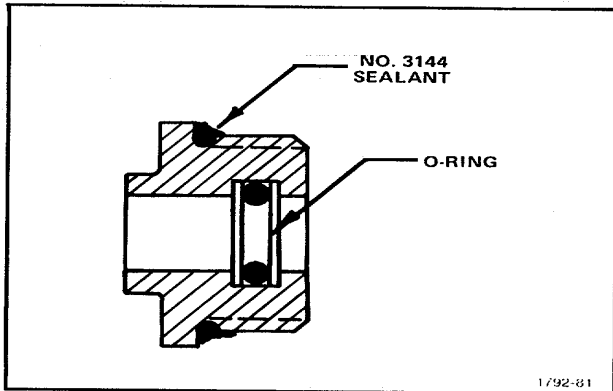


Figure 5-28. Lubrication of the O-rings and sealing for the cam switches

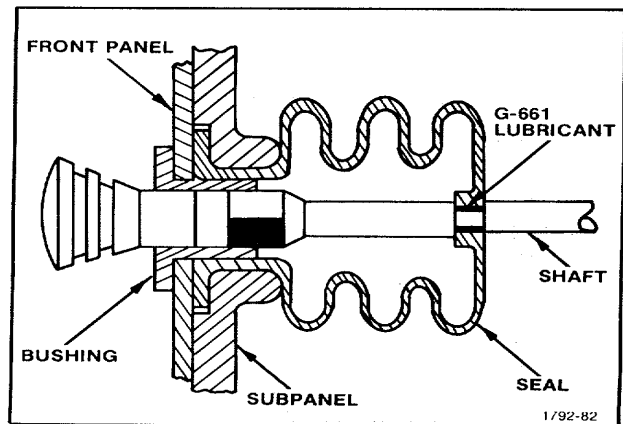


Figure 5-29. Installation of the POWER SWITCH.

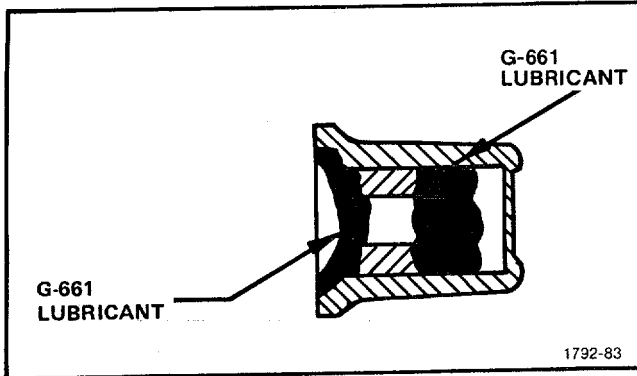


Figure 5-30. Lubrication of POSITION control knob.

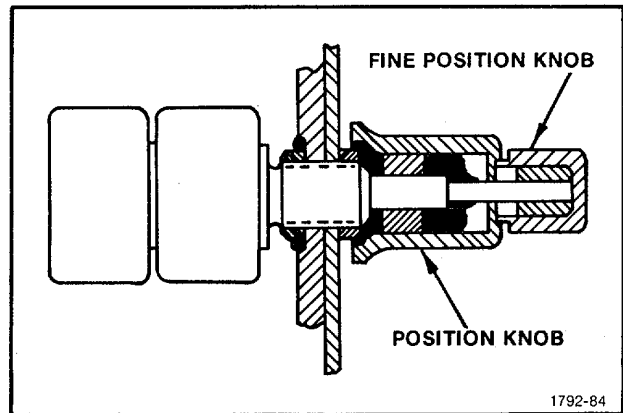


Figure 5-31. Installation of knob on shaft..

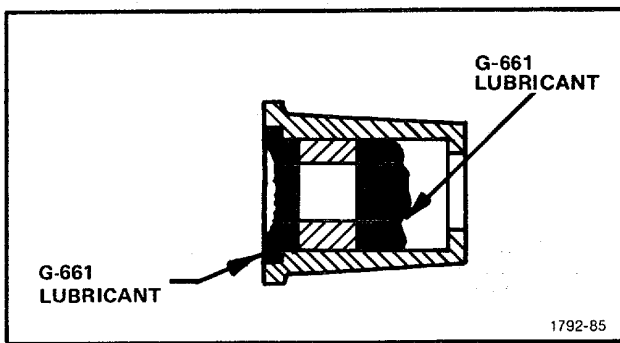


Figure 5-32. Lubrication of ZERO REFERENCE knob.

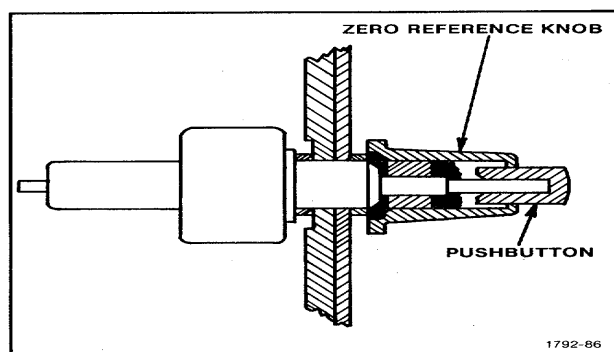


Figure 5-33. Installation of knob on ZERO REFERENCE control.

2. Assemble the POSITION knob and the FINE POSITION knob on the control shafts as shown in Fig. 5-31.

28. Installation of the ZERO REFERENCE knob and the zero reference CHECK pushbutton (see Figs. 5-32 and 5-33)

- a. KNOB, ZERO REFERENCE MPL Item 2-4 (same as FINE POSITION knob).
- b. PUSHBUTTON MPL Item 2-3.
- c. Procedure

- 1. Apply G-661 lubricant to the ZERO REFERENCE knob as shown in Fig. 5-32.
- 2. Assemble the knob and pushbutton on the control shafts as shown in Fig. 5-33.
- 3. Actuate the pushbutton several times. Remove any excess lubricant.

29. Install the FOCUS and INTENSITY knobs (see Fig. 5-34)

- a. KNOB, 2 ea. MPL Item 2-1.
- b. Procedure

- 1. Apply G-661 lubricant to both knobs as shown in Fig. 5-34.

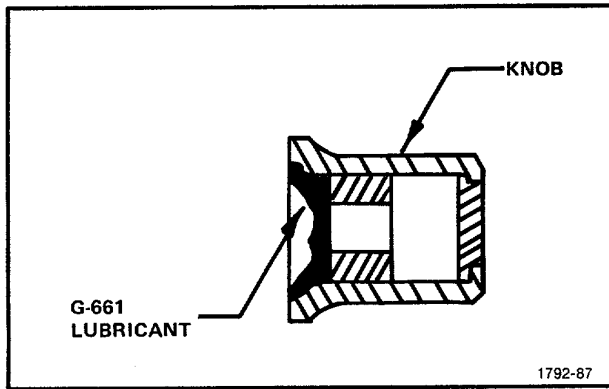


Figure 5-34. Lubrication of FOCUS and INTENSITY control knobs.

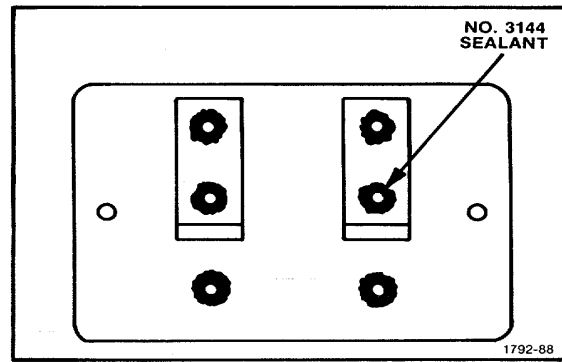


Figure 5-35. Sealing of Battery Pack screwholes

2. Install the knobs on the shafts of the FOCUS and INTENSITY controls.

30. Watertight sealing procedures for the Battery Pack (see Figs. 5-35 and 5-36)

- a. BATTERY PACK MPL Item 2-37.
- b. PANEL Not shown in MPL.
- c. HEAT SINKS Not shown in MPL.
- d. GASKET Not shown in MPL.
- e. Procedure

1. Clean Panel with isopropyl alcohol.
2. Form a bead of No. 3144 sealant in and around each of the six screw holes in the Panel. See Fig. 5-35.
3. Apply a film of Dow Corning No. 4. Compound to the mating surfaces of the heat sinks and the Panel and join as shown in Fig. 5-36.
4. Clean the gasket with acetone.
5. Apply a bead of G-661 silicone grease on and around the gasket and attach it to the Panel as shown in Fig. 5-36.

31. Watertight sealing procedures for the Front Panel jacks of the X-Y Output Module, 016-0606-00 (see Fig. 5-37)

- a. FRONT PANEL MPL Item 3-13.
- b. SUB PANEL MPL Item 3-14.
- c. JACK, TIP: BLACK MPL Item 3-5.

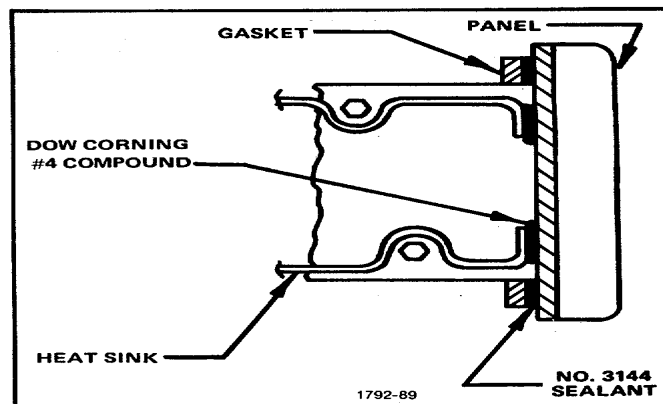


Figure 5-36. Application of dielectric type compound.

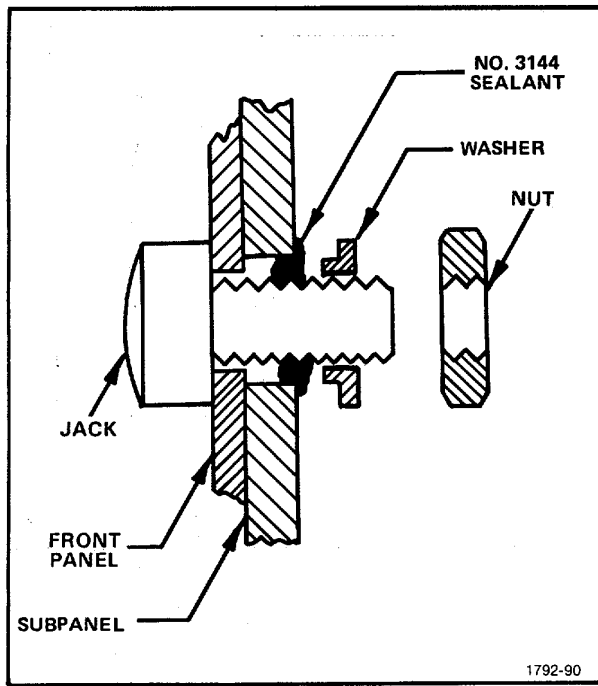


Figure 5-37. Detail of front panel jacks.

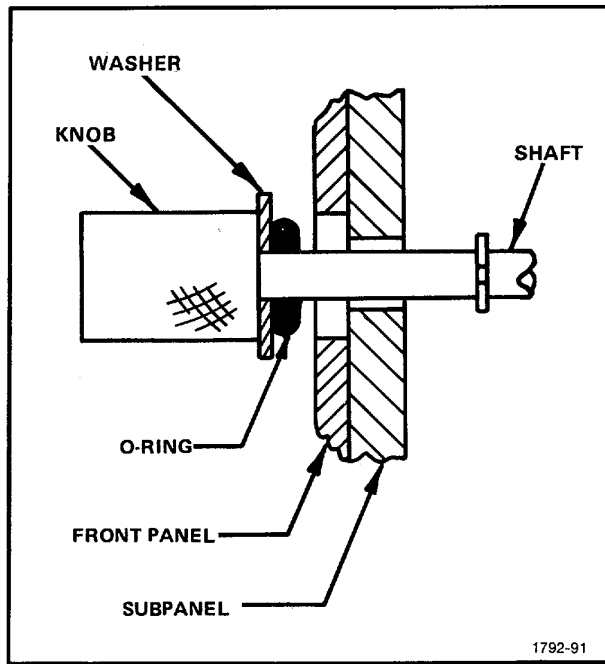


Figure 5-38. Detail of X-Y Module thumbscrews

- d. JACK, TIP: RED MPL Item 3-6.
- e. Procedure

1. Clean the mating surface of the Subpanel with isopropyl alcohol.
2. Align the Front Panel over the Subpanel and insert one of the jacks in its respective position.
3. Form a bead of No. 3144 sealant around the Jack/Subpanel interface as shown in Fig. 5-37.
4. Use the supplied washer and nut to secure the jack in position.
5. Repeat steps 3 and 4 for the remaining five jacks.

32. Preparation of the Thumbscrews that are used for securing the X-Y Output Module (see Fig. 5-38)

- a. PACKING (O-ring) MPL Item 3-11.
- b. PIN, (shaft) MPL Item 3-8.
- c. KNOB MPL Item 3-7.
- d. Procedure

1. Insert one of the Pins (shaft) through the Front Panel and Subpanel.
2. Apply G-661 lubricant to the O-ring.
3. Position the O-ring on the shaft as shown in Fig. 5-38.
4. Place the knob on the shaft and tighten the setscrew.
5. Repeat procedure for the second thumbscrew.

33. Attach Latch Assemblies (2 ea.) to the Front Cover (See Fig. 5-39)

- a. COVER, FRONT MPL Item 1-29.
- b. LATCH ASSY. MPL Item 1-0.
- c. Procedure

1. Clean mating surfaces of Front Cover and Latch Assembly with isopropyl alcohol.
2. Apply No. 3144 sealant to the two screw-holes in each Latch Assembly as shown in Fig. 5-39.
3. Attach the two Latch Assemblies to the Front Cover.

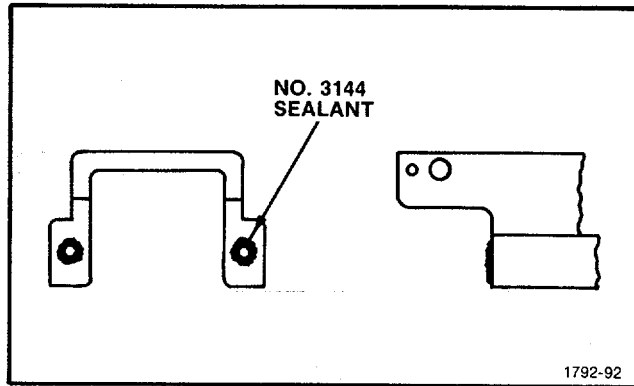


Figure 5-39. Sealing of latch assembly screwholes.

REMINDER: Don't forget to lubricate surfaces of rubber seals around edge of subpanel with G-661 lubricant before installing instrument in cabinet and attaching front cover.

MATERIALS

| Tektronix Part No. | Description | Notes |
|--------------------|--|---|
| 006-2302-00 | Dow Corning No. 3144 Adhesive Sealant | This Room Temperature Vulcanizing agent (RTV) is used to form water-tight gaskets. (After application, allow 24 hours curing time.) |
| 006-1171-00 | Dow Corning No. 3145 Adhesive Sealant | |
| 252-0199-00 | Dow Corning No. 3140 Coating | This RTV agent is used where the application requires a sealant more fluid than the No. 3144 sealant. (Allow 24 hours curing time.) |
| 006-0315-00 | Dow Corning No. 4 Silicone Dielectric Compound | This compound is used in the Battery Pack assembly. |
| 006-2475-00 | Dow Corning No. 1204 Primer | Used as a primer for No. 3144 sealant applications. |
| 006-2207-00 | General Electric No. G-661 Silicone grease | Used as a waterproof lubricant. |
| 006-0034-00 | Isopropyl Alcohol | Cleaning Agent. |
| 006-2513-00 | Econobond #59C | Bonding Material. |

OPTIONS

Option 04 Chart Recorder

Option 05 Metric Version

Option 76 P7 Phosphor

POWER CORD OPTIONS

Option A1: 220 V/16 A, Universal Europe, 161-0132-00.

Option A2: 240 V/13 A, United Kingdom, 161-0133-00.

Option A3: 240 V/10 A, Australian, 161-0135-00.

Option A4: 240 V/15 A, North American, 161-0134-00.

Option A5: 250 V/6 A, Swiss, 161-0154-00.

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**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 |
|-----------|---|----------------------------------|--------------------------|
| 0000M | SONY/TEKTRONIX CORPORATION | P O BOX 14, HANEDA AIRPORT | TOKYO 149, JAPAN |
| 00853 | SANGAMO ELECTRIC CO., S. CAROLINA DIV. | P.O. BOX 128 | PICKENS, SC 29671 |
| 01121 | ALLEN-BRADLEY COMPANY | 1201 2ND STREET SOUTH | MILWAUKEE, WI 53204 |
| 01295 | TEXAS INSTRUMENTS, INC. SEMICONDUCTOR GROUP | P.O. BOX 5012 | DALLAS, TX 75222 |
| 02735 | RCA CORPORATION, SOLID STATE DIVISION | ROUTE 202 | SOMERVILLE, NY 08876 |
| 03508 | GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT | ELECTRONICS PARK | SYRACUSE, NY 13201 |
| 03888 | KDI PYROFILM CORPORATION | 60 S JEFFERSON ROAD | WHIPPANY, NJ 07981 |
| 04222 | AVX CERAMICS, DIVISION OF AVX CORP. | P O BOX 867 | MYRTLE BEACH, SC 29577 |
| 04713 | MOTOROLA, INC., SEMICONDUCTOR PROD. DIV. | 5005 E MCDOWELL RD, PO BOX 20923 | PHOENIX, AZ 85036 |
| 07263 | FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP. | 464 ELLIS STREET | MOUNTAIN VIEW, CA 94042 |
| 07716 | TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, BURLINGTON DIV. | 2850 MT. PLEASANT | BURLINGTON, IA 52601 |
| 09353 | C AND K COMPONENTS, INC. | 103 MORSE STREET | WATERTOWN, MA 02172 |
| 12697 | CLAROSTAT MFG. CO., INC. | LOWER WASHINGTON STREET | DOVER, NH 03820 |
| 14099 | SEMTECH CORP. | 652 MITCHELL RD. | NEWBURY PARK, CA 91320 |
| 14552 | MICRO SEMICONDUCTOR CORP. | 2830 E FAIRVIEW ST. | SANTA ANA, CA 92704 |
| 14752 | ELECTRO CUBE INC. | 1710 S. DEL MAR AVE. | SAN GABRIEL, CA 91776 |
| 14936 | GENERAL INSTRUMENT CORP., SEMICONDUCTOR PRODUCTS GROUP | P.O. BOX 600, 600 W. JOHN ST. | HICKSVILLE, NY 11802 |
| 15238 | ITT SEMICONDUCTORS, A DIVISION OF INTER NATIONAL TELEPHONE AND TELEGRAPH CORP. | P.O. BOX 168, 500 BROADWAY | LAWRENCE, MA 01841 |
| 17856 | SILICONIX, INC. | 2201 LAURELWOOD DRIVE | SANTA CLARA, CA 95054 |
| 19396 | ILLINOIS TOOL WORKS, INC. PAKTRON DIV. | 900 FOLLIN LANE, SE | VIENNA, VA 22180 |
| 22229 | SOLITRON DEVICES, INC., SEMICONDUCTOR GROUP | 8808 BALBOA AVENUE | SAN DIEGO OPERS, CA |
| 92123 | INTERNATIONAL ELECTRONIC CORP. | 316 S SERVICE RD, HUNTINGTON STA | MELVILLE, L.I., NY 11746 |
| 24138 | CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION | 550 HIGH STREET | BRADFORD, PA 16701 |
| 24546 | SPECIALITY CONNECTOR CO., INC. | 2620 ENDRESS PLACE | GREENWOOD, IN 46142 |
| 24931 | NATIONAL SEMICONDUCTOR CORP. | 2900 SEMICONDUCTOR DR. | SANTA CLARA, CA 95051 |
| 27014 | BOURNS, INC., TRIMPOT PRODUCTS DIV. | 1200 COLUMBIA AVE. | RIVERSIDE, CA 92507 |
| 32997 | GHZ DEVICES, INC. | 16 MAPLE ROAD | SOUTH CHELMSFORD, MA |
| 50101 | CENTRE ENGINEERING INC. | 2820 E COLLEGE AVENUE | STATE COLLEGE, PA 16801 |
| 01824 | PLESSEY CAPACITORS, DIV. OF PLESSEY INC. | 5334 STERLING CENTER DR. | WEST LAKE VILLAGE, CA |
| 55112 | SPRAGUE ELECTRIC CO. | 87 MARSHALL ST. | NORTH ADAMS, MA 01247 |
| 56289 | TUSONIX INC. | 2155 N FORBES BLVD | TUCSON, AZ 85705 |
| 59660 | CENTRALAB INC | 7158 MERCHANT AVE | EL PASO, TX 79915 |
| 59821 | SUB NORTH AMERICAN PHILIPS CORP | | |
| 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 |
| 72982 | ERIE TECHNOLOGICAL PRODUCTS, INC. | 644 W. 12TH ST. | ERIE, PA 16512 |
| 73138 | BECKMAN INSTRUMENTS, INC., HELIPOT DIV. | 2500 HARBOR BLVD. | FULLERTON, CA 92634 |
| 75915 | LITTELFUSE, INC. | 800 E. NORTHWEST HWY | DES PLAINES, IL 60016 |
| 80009 | TEKTRONIX, INC. | P O BOX 500 | BEAVERTON, OR 97077 |
| 80031 | ELECTRA-MIDLAND CORP., MEPCO DIV. | 22 COLUMBIA ROAD | MORRISTOWN, NJ 07960 |
| 90201 | MALLORY CAPACITOR CO., DIV. OF P.R. MALLORY AND CO., INC. | 3029 E. WASHINGTON STREET | |
| 91637 | DALE ELECTRONICS, INC. | P. O. BOX 372 | INDIANAPOLIS, IN 46206 |
| 93958 | REPUBLIC ELECTRONICS CORPORATION | P. O. BOX 609 | COLUMBUS, NE 68601 |
| 95275 | VITRAMON, INC. | 176 E 7TH STREET | PATERSON, NJ 07524 |
| 96733 | SAN FERNANDO ELECTRIC MFG CO | P O BOX 544 | BRIDGEPORT, CT 06601 |
| S3629 | PANEL COMPONENTS CORP. | 1501 FIRST ST | SAN FERNANDO, CA 91341 |
| | | 2015 SECOND ST. | BERKELEY, CA 94170 |

REV SEP 1983

| Ckt No. | Tektronix Part No. | Serial/Model No. | | Name & Description | Mfr Code | Mfr Part Number |
|---------|--------------------|------------------|---------|--|----------|------------------|
| | | Eff | Dscont | | | |
| A1 | 670-4338-00 | | | CKT BOARD ASSY:MAIN | 80009 | 670-4338-00 |
| A1 | ---- | | | (OPTION 5 ONLY) | | |
| A1 | 670-4338-01 | B102648 | | CKT BOARD ASSY:MAIN | 80009 | 670-4338-01 |
| A1 | ---- | | | (OPTION 5 ONLY) | | |
| A1 | 670-3008-00 | B010100 | B020394 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-00 |
| A1 | 670-3008-01 | B020395 | B029999 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-01 |
| A1 | 670-3008-02 | B030000 | B069999 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-02 |
| A1 | 6703008-03 | B070000 | B081980 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-03 |
| A1 | 670-3008-04 | B081981 | B102647 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-04 |
| A1 | 670-3008-05 | B102648 | B114129 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-05 |
| A1 | 6703008-06 | B114130 | | CKT BOARD ASSY:MAIN | 80009 | 670-3008-06 |
| A2 | 670-3009-00 | B010100 | B049999 | CKT BOARD ASSY:VERTICAL AMPLUSLOW RAMP | 80009 | 670-3009-00 |
| A2 | 670-3009-01 | B050000 | B102647 | CKT BOARD ASSY:VERTICAL AMPLUSLOW RAMP | 80009 | 670-3009-01 |
| A2 | 670-3009-02 | B102648 | B114112 | CKT BOARD ASSY:VERTICAL AMPUSLOW RAMP | 80009 | 670-3009-02 |
| A2 | 670-3009-03 | B114113 | | CKT BOARD ASSY:VERTICAL AMPUSLOW RAMP | 80009 | 670-3009-03 |
| A3 | 670-3130-00 | B010100 | B099999 | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 670-3130-00 |
| A3 | 670-3130-02 | B100000 | B102647 | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 670-3130-02 |
| A3 | 670-3130-03 | B102648 | B113809 | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 6703130-03 |
| A3 | 670-3130-04 | B113810 | | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 670-3130-00 |
| A4 | 670-3010-00 | B010100 | B099999 | CKT BOARD ASSY:SWEEP GEN | 80009 | 670-3010-00 |
| A4 | 670-3010-01 | B100000 | B102647 | CKT BOARD ASSY:SWEEP GEN | 80009 | 670-3010-01 |
| A4 | 670-3010-02 | B102648 | | CKT BOARD ASSY:SWEEP GEN | 80009 | 670-3010-02 |
| A5 | 670-3513-00 | B010100 | B029999 | CKT BOARD ASSY:CHART RECORDER LOGIC | 80009 | 670-3513-00 |
| A5 | 670-3513-01 | B030000 | B102647 | CKT BOARD ASSY:CHART RECORDER LOGIC | 80009 | 670-3513-01 |
| A5 | 670-3513-02 | B102648 | | CKT BOARD ASSY:CHART RECORDER LOGIC | 80009 | 670-3513-02 |
| A6 | 670-3520-00 | B010100 | B020394 | CKT BOARD ASSY:POWER | 80009 | 670-3520-00 |
| A6 | 670-3520-01 | B020395 | B102647 | CKT BOARD ASSY:POWER | 80009 | 670-3520-01 |
| A6 | 670-3520-02 | B102648 | | CKT BOARD ASSY:POWER | 80009 | 670-3520-02 |
| A7 | 670-3865-00 | B010100 | B102647 | CKT BOARD ASSY:X-Y PLUG IN | 80009 | 670-3865-00 |
| A7 | 670-3865-01 | B102648 | | CKT BOARD ASSY:X-Y PLUG IN | 80009 | 670-3865-01 |
| A9 | 670-6592-00 | B110000 | | CKT BOARD ASSY:POWER FUSE JACK | 80009 | 670-6592-00 |
| A10 | 670-0364-00 | B113073 | | CKT BOARD ASSY:RESISTANCE SOCKET | 80009 | 670-0364-00 |
| A10 | | | | (NO ELECTRICAL PARTS) | | |
| A1 | 670-4338-00 | B010100 | B102647 | CKT BOARD ASSY:MAIN | 80009 | 670-4338-00 |
| A1 | | | | (OPTION 5 ONLY) | | |
| A1 | 670-4338-01 | B102648 | | CKT BOARD ASSY:MAIN | 80009 | 670-4338-01 |
| A1 | | | | (OPTION 5 ONLY) | | |
| A1 | 670-3008-00 | B010100 | B020394 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-00 |
| A1 | 670-3008-01 | B020395 | B029999 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-01 |
| A1 | 670-3008-02 | B030000 | B069999 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-02 |
| A1 | 670-3008-03 | B070000 | B081980 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-03 |
| A1 | 670-3008-04 | B081981 | B102647 | CKT BOARD ASSY:MAIN | 80009 | 670-3008-04 |
| A1 | 670-3008-05 | B102648 | | CKT BOARD ASSY:MAIN | 80009 | 670-3008-05 |
| C1155 | 290-0534-00 | | | CAP.,FXD,ELCTLT:1UF,20%,35V | 56289 | 196D105X0035HA1 |
| C1161 | 290-0534-00 | | | CAP.,FXD,ELCTLT:1UF,20%,35V | 56289 | 196D105X0035HA1 |
| C1237 | 283-0622-00 | | | CAP.,FXD,MICA D:450PF,1%,300V | 00853 | D155F451FO |
| C1313 | 283-0204-00 | | | CAP.,FXD,CER DI:0.01UF,20%,50V | 96733 | R2676 |
| C1325 | 285-1062-00 | | | CAP.,FXD,PLSTC:0.005UF,0.1%,200V | 19396 | 502F02PP460 |
| C1332 | 281-0205-00 | | | CAP.,VAR,PLSTC:5.5-65PF,100V | 80031 | 281OC5R565QJ02FO |
| C1341 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273C11 |
| C1345 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 56289 | 2C2025U105Z025B |

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| C1435 | 283-0003-00 | | | CAP.,FXD,CER DI:0.01UF,+80-20%,150V | 59821 | 2DDH66J103Z |
| C1464 | 283-0154-00 | | | CAP.,FXD,CER DI:22PF,5%,50V | 72982 | 8111B061C0G220J |
| C1504 | 283-0119-00 | B030000 | | CAP.,FXD,CER DI:2200PF,5%,200V | 59660 | 855-536Y5E0222J |
| C1506 | 290-0530-00 | B020395 | | CAP.,FXD,ELCTLT:68UF,20%,6V | 90201 | TDC686M006NLF |
| C1507 | 283-0176-00 | | | CAP.,FXD,CER DI:0.0022UF,20%,50V | 56289 | 272C5 |
| C1508 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273C11 |
| C1531 | 285-0598-00 | | | CAP.,FXD,PLSTC.:001UF,5%,100OOV | 19396 | DU490B103J |
| C1534 | 283-0201-00 | | | CAP.,FXD,CER DI:27PF,10%,200V | 51642 | W150-200 X7R270K |
| C1542 | 283-0201-00 | | | CAP.,FXD,CER DI:27PF,10%,200V | 51642 | W150-200 X7R270K |
| C1543 | 283-0196-00 | | | CAP.,FXD,CER DI:270PF,10%,50V | 72982 | 8101B057X7R0271K |
| C1546 | 283-0204-00 | | | CAP.,FXD,CER DI:0.01UF,20%,50V | 96733 | R2676 |
| C1551 | 283-0060-00 | | | CAP.,FXD,CER DI:100PF,5%,200V | 59660 | 855-535U2J101J |
| C1555 | 283-0111-00 | B010100 | B020394 | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273C11 |
| C1556 | 283-0067-00 | | | CAP.,FXD,CER DI:0.001UF,10%,200V | 59660 | 835-515-Z5D0102K |
| C1566 | 290-0723-00 | | | CAP.,FXD,ELCTLT:150UF,20%,6V | 56289 | 196D157X0006PE3 |
| C1567 | 283-0067-00 | | | CAP.,FXD,CER DI:0.001UF,10%,200V | 59660 | 835-515-Z5D0102K |
| C1572 | 283-0032-00 | | | CAP.,FXD,CER DI:470PF,5%,500V | 59660 | 0831085Z5E00471J |
| C1581 | 281-0523-00 | | | CAP.,FXD,CER DI:100PF,+/-20PF,500V | 72982 | 301-000U2M0101M |
| C1592 | 281-0523-00 | | | CAP.,FXD,CER DI:100PF,+/-20PF,500V | 72982 | 301-000U2M0101M |
| C1596 | 281-0546-00 | B010100 | B029999 | CAP.,FXD,CER DI:330PF,10%,500V | 04222 | 7001-1380 |
| C1596 | 281-0580-00 | B030000 | B114129 | CAP.,FXD,CER DI:470PF,10%,500V | 04222 | 7001-1374 |
| C1596 | 283-0597-00 | B114130 | | CAP.,FXD,MICA D:470PF,10%,300V | 00853 | D155F471KO |
| C1605 | 290-0723-00 | | | CAP.,FXD,ELCTLT:150UF,20%,6V | 56289 | 196D157X0006PE3 |
| C1609 | 283-0160-00 | | | CAP.,FXD,CER DI:1.5PF,10%,50V | 93958 | 1C15RB |
| C1625 | 283-0003-00 | | | CAP.,FXD,CER DI:0.01UF,+80-20%,150V | 59821 | 2DDH66J103Z |
| C1630 | 283-0195-00 | | | CAP.,FXD,CER DI680PF,5%,50V | 72982 | 8121N075COG0681J |
| C1631 | 283-0139-00 | | | CAP.,FXD,CER DI:150PF,20%,50V | 51642 | W100-050-X5F151M |
| C1632 | 283-0139-00 | | | CAP.,FXD,CER DI-150PF,20%,50V | 51642 | W100-050-X5F151M |
| C1633 | 283-0318-00 | | | CAP.,FXD,CER DI:10PF,100V | 04222 | ULA151A100K2 |
| C1634 | 283-0318-00 | | | CAP.,FXD,CER DI:10PF,100V | 04222 | ULA151A100K2 |
| C1635 | 283-0175-00 | | | CAP.,FXD,CER DI:10PF,5%,200V | 96733 | TDR43BY100DP |
| C1636 | 283-0175-00 | | | CAP.,FXD,CER DI:10PF,5%,200V | 96733 | TDR43BY100DP |
| C1637 | 283-0260-00 | | | CAP.,FXD,CER DI:5.6PF,5%,200V | 51642 | 150 200NP0569C |
| C1638 | 283-0260-00 | | | CAP.,FXD,CER DI:5.6PF,5%,200V | 51642 | 150 200NP0569C |
| C1639 | 283-0195-00 | | | CAP.,FXD,CER DI:680PF,5%,50V | 72982 | 8121N075COG0681J |
| C1641 | 290-0534-00 | | | CAP.,FXD,ELCTLT: 1UF,20%,35V | 56289 | 196D105X0035HA1 |
| C1642 | 283-0252-00 | | | CAP.,FXD,CER DI 1000PF,10%,50V | 04222 | ULA105C102K2T60 |
| C1643 | 283-0320-00 | | | CAP.,FXD,CER DI 1PF,50V,LEADLESS | 95275 | VJ0805A1ROC-H |
| C1645 | 283-0191-00 | | | CAP.,FXD,CER DI:0.022UF,20%,50V | 72982 | 8121N075Z5U0223M |
| C1646 | 283-0070-00 | | | CAP.,FXD,CER DI:30PF,10%,50V | 72982 | 8121-060COG0300K |
| C1647 | 283-0070-00 | | | CAP.,FXD,CER DI:30PF,10%,50V | 72982 | 8121-060COG0300K |
| C1648 | 283-0157-00 | | | CAP.,FXD,CER DI:7PF,5%,500V | 59660 | 8111B065COH0709D |
| C1652 | 283-0067-00 | | | CAP.,FXD,CER DI.0.001UF,10%,200V | 59660 | 835-515-Z5D0102K |
| C1655 | 283-0003-00 | | | CAP.,FXD,CER DI:0.01UF,+80-20%,150V | 59821 | 2DDH66J103Z |
| C1661 | 290-0723-00 | | | CAP.,FXD,ELCTLT.150UF,20%,6V | 56289 | 196D157X0006PE3 |
| C1662 | 283-0067-00 | B010100 | B029999 | CAP.,FXD,CER DI.0.001UF,10%,200V | 59660 | 835-515-Z5D0102K |
| C1675 | 281-0523-00 | | | CAP.,FXD,CER DI:100PF, +/-20PF,500V | 72982 | 301-000U2M0101M |
| C1701 | 283-0320-00 | | | CAP.,FXD,CER DI:1PF,50V,LEADLESS | 95275 | VJ0805A1ROC-H |
| C1706 | 283-0354-00 | | | CAP.,FXD,CER DI:47PF,100V | 04222 | ULA151A4R7D2 |
| CR1359 | 152-0141-02 | | | SEMICOND DEVICE SILICON,30V,150MA | 01295 | 1N4152R |
| CR1609 | 152-0140-01 | | | SEMICOND DEVICE TUNNEL,8PF,10MA | 03508 | SMTD995 |
| CR1632 | 152-0335-01 | | | SEMICOND DEVICE SILICON,SNAP-OFF,40V | 50101 | GC20279 |
| CR1691 | 152-0141-02 | | | SEMICOND DEVICE.SILICON,30V,150MA | 01295 | 1N4152R |
| CR1703 | 152-0489-00 | | | SEMICOND DEVICE:TNL,GE,21MA,1.5PF W/GND | 80009 | 152-0489-00 |
| CR1732 | 152-0631-00 | | | SEMICOND DEVICE:SILICON,GATE,CER PKG | 80009 | 152-0631-00 |

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| Q1317 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| 01325 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| 01328 | 151-0325-00 | | | TRANSISTOR:SILICON,PNP,SEL FROM 2N4258 | 80009 | 151-0325-00 |
| 01329 | 151-0325-00 | | | TRANSISTOR:SILICON,PNP,SEL FROM 2N4258 | 80009 | 151-0325-00 |
| Q1336 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| 01337 | 151-04414)0 | | | TRANSISTOR:SILICON,NPN | 04713 | SRF501 |
| Q1338 | 151-03254)0 | | | TRANSISTOR:SILICON,PNP,SEL FROM 2N4258 | 80009 | 151-0325-00 |
| 01339 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| 01347 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| 01348 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| 01355 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q1357 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| 01358 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q1413 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q1425 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| 01431 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| 01443 | 151-0325-00 | | | TRANSISTOR:SILICON,PNP,SEL FROM 2N4258 | 80009 | 151-0325-00 |
| 01444 | 151-0325400 | | | TRANSISTOR:SILICON,PNP,SEL FROM 2N4258 | 80009 | 151-0325-00 |
| 01447 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| 01448 | 151-0192-00 | | | TRANSISTOR:SILICON,NPN,SEL FROM MPS652 | 04713 | SPS8801 |
| Q1502 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| 01504 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| 01529 | 151-0347-00 | | | TRANSISTOR:SILICON,NPN | 56289 | 2N5551 |
| 01535 | 151-0271-00 | | | TRANSISTOR:SILICON,PNP | 04713 | SPS8236 |
| Q1537 | 153-0558-00 | B010100 | B081649 | TRANSISTOR:SILICON,5V,SEL | 80009 | 153-0556-00 |
| Q1537 | 153-0556401 | B081650 | | TRANSISTOR:2N2501,SELECTED | 80009 | 153-0556-01 |
| 01539 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| 01544 | 151-0441-00 | | | TRANSISTOR:SILICON,NPN | 04713 | SRF501 |
| 01553 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| 1556 | 151-03024-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| 01583 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| 01589 | 151-0302-00 | B010100 | 8029999 | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| 01595 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| 01597 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q1802 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| 01603 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| Q1608 | 151-0325-00 | | | TRANSISTOR:SILICON,PNP,SEL FROM 2N4258 | 80009 | 151-0325-00 |
| 01643 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q1648 | 151-1054-01 | | | TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL | 22229 | FD1764 |
| 01656 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| 01675 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| 01683 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q1688 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q1693 | 151-1022-00 | | | TRANSISTOR:FET,N-CHAN,SI,F1782,T0-18 | 17856 | FN1234 |
| Q1695 | 151-0301-00 - | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| R1129 | 315-0271-00 | | | RES.,FXD,CMPSN:270 OHM,5%,0.25W | 01121 | CB2715 |
| R1132 | 311-1559-40 - | | | RES.,VAR,NONWIR:10K OHM,20%,0.50W | 73138 | 91-81-0 |
| R1135 | 315-0223-00 | B010100 | B069999 | RES.,FXD,CMPSN:22K OHM,5%,0.25W | 01121 | CB2235 |
| R1135 | 315-0682-00 | B070000 | | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W | 01121 | CB6825 |
| R1138 | 321-0135-00 | B010100 | B069999 | RES.,FXD,FILM:249 OHM,1%,0.125W | 91637 | MFF1816G249ROF |
| R1138 | 3154)121-00 | B070000 | B081980 | RES.,FXD,CMPSN:120 OHM,5",0.25W | 01121 | CB1215 |
| R1138 | 321-0172-00 | B081981 | | RES.,FXD,FILM:604 OHM,1%,C 25W | 91637 | MFF1816G604ROF |
| R1144 | 321-0193-00 | | | RES.,FXD,FILM:1K OHM,1%,0.1. SW | 91637 | MFF1816G10000F |
| R1148 | 3214208400 | | | RES.,FXD,FILM:1.43K OHM,1%,0.125W | 91637 | MFF1816G14300F |

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| R1148 | 321-1210-01 | | | RES.,FXD,FILM:1.52K OHM,0.5%,0.125W | 91637 | MFF1816G15200D |
| R1152 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R1216 | 321-0242-00 | | | RES.,FXD,FILM:3.24K OHM,1%,0.125W | 91637 | MFF1816G32400F |
| R1217 | 321-0271-00 | | | RES.,FXD,FILM:6.49K OHM,1%,0.125W | 91637 | MFF1816G64900F |
| R1218 | 321-0300-00 | | | RES.,FXD,FILM:13K OHM,1%,0.125W | 91637 | MFF1816G13001F |
| R1218 | 321-0309-00 | | | RES.,FXD,FILM:16.2K OHM,1%,0.125W | 91637 | MFF1816G16201F |
| R1218 | | | | (OPTION 5 ONLY) | | |
| R1219 | 321-0338-00 | | | RES.,FXD,FILM:32.4K OHM,1%,0.125W | 91637 | MFF1816G32401F |
| R1226 | 321-0367-00 | | | RES.,FXD,FILM:64.9K OHM,1%,0.125W | 91637 | MFF1816G64901F |
| R1227 | 321-0396-00 | | | RES.,FXD,FILM:130K OHM,1%,0.125W | 91637 | MFF1816G13002F |
| R1227 | 321-0405-00 | | | RES.,FXD,FILM:162K OHM,1%,0.125W | 91637 | MFF1816G16202F |
| R1227 | | | | (OPTION 5 ONLY) | | |
| R1235 | 321-0286-00 | B010100 | B069999 | RES.,FXD,FILM:9.31K OHM,1%,0.125W | 91637 | MFF1816G93100F |
| R1235 | 315-0472-00 | B070000 | B081980 | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R1235 | 321-0255-00 | B081981 | | RES.,FXD,FILM:4.42K OHM,1%,0.125W | 91637 | MFF1816G44200F |
| R1239 | 321-0289-00 | | | RES.,FXD,FILM:10K OHM,1%,0.125W | 91637 | MFF1816G10001F |
| R1312 | 321-0242-00 | | | RES.,FXD,FILM:3.24K OHM,1%,0.125W | 91637 | MFF1816G32400F |
| R1312 | 321-0213-00 | | | RES.,FXD,FILM:1.62K OHM,1%,0.125W | 91637 | MFF1816G16200F |
| R1312 | | | | (OPTION 5 ONLY) | | |
| R1315 | 311-1560-00 | | | RES.,VAR,NONWIR:5K OHM,20%,0.50W | 73138 | 91-82-0 |
| R1318 | 315-0682-00 | | | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W | 01121 | CB6825 |
| R1319 | 315-0273-00 | | | RES.,FXD,CMPSN:27K OHM,5%,0.25W | 01121 | CB2735 |
| R1323 | 321-0434-00 | | | RES.,FXD,FILM:324K OHM,1%,0.125W | 91637 | MFF1816G32402F |
| R1324 | 321-0463-00 | | | RES.,FXD,FILM:649K OHM,1%,0.125W | 91637 | MFF1816G64902F |
| R1326 | 315-0183-00 | | | RES.,FXD,CMPSN:18K OHM,5%,0.25W | 01121 | CB1835 |
| R1333 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R1335 | 315-0180-00 | | | RES.,FXD,CMPSN:18 OHM,5%,0.25W | 01121 | CB1805 |
| R1338 | 315-0183-00 | | | RES.,FXD,CMPSN:18K OHM,5%,0.25W | 01121 | CB1835 |
| R1341 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R1342 | 321-0164-00 | B010100 | B081980 | RES.,FXD,FILM:499 OHM,1%,0.125W | 91637 | MFF1816G499ROF |
| R1342 | 321-0210-00 | B081981 | | RES.,FXD,FILM:1.5K OHM,1%,0.125W | 91637 | MFF1816G15000F |
| R1352 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R1353 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R1354 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R1355 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1358 | 315-0222-00 | | | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W | 01121 | CB2225 |
| R1422 | 315-0821-00 | | | RES.,FXD,CMPSN:820 OHM,5%,0.25W | 01121 | CB8215 |
| R1431 | 315-0133-00 | | | RES.,FXD,CMPSN:13K OHM,5%,0.25W | 01121 | CB1335 |
| R1431 | 321-0196-00 | | | RES.,FXD,FILM:1.07K OHM,1%,0.125W | 91637 | MFF1816G10700F |
| R1431 | | | | (OPTION 5 ONLY) | | |
| R1432 | 321-0204-00 | | | RES.,FXD,FILM:1.3K OHM,1%,0.125W | 91637 | MFF1816G13000F |
| R1434 | 321-0277-00 | | | RES.,FXD,FILM:7.5K OHM,1%,0.125W | 91637 | MFF1816G75000F |
| R1435 | 311-1562-00 | | | RES.,VAR,NONWIR:2K OHM,20%,0.50W | 73138 | 91-84-0 |
| R1437 | 315-0821-00 | | | RES.,FXD,CMPSN:820 OHM,5%,0.25W | 01121 | CB8215 |
| R1441 | 321-0258-00 | | | RES.,FXD,FILM:4.75K OHM,1%,0.125W | 91637 | MFF1816G47500F |
| R1442 | 315-0821-00 | | | RES.,FXD,CMPSN:820 OHM,5%,0.25W | 01121 | CB8215 |
| R1443 | 315-0821-00 | | | RES.,FXD,CMPSN:820 OHM,5%,0.25W | 01121 | CB8215 |
| R1445 | 315-0682-00 | | | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W | 01121 | CB6825 |
| R1462 | 315-0223-00 | | | RES.,FXD,CMPSN:22K OHM,5%,0.25W | 01121 | CB2235 |
| R1463 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R1502 | 315-0332-00 | | | RES.,FXD,CMPSN:3.3K OHM,5%,0.25W | 01121 | CB3325 |
| R1507 | 321-0253-00 | | | RES.,FXD,FILM:4.22K OHM,1%,0.125W | 91637 | MFF1816G42200F |
| R1508 | 321-0209-00 | | | RES.,FXD,FILM:1.47K OHM,1%,0.125W | 91637 | MFF1816G14700F |

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| R1509 | 315-0510-00 | | | RES.,FXD,CMPSN:51 OHM,5%,0.25W | 01121 | CB5105 |
| R1525 | 311-1275-00 | | | RES.,VAR,NONWIR:1M OHM,10%,0.50W | 32997 | 3329P-L58-105 |
| R1528 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R1533 | 315-0103-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1035 |
| R1536 | 317-0332-00 | | | RES.,FXD,CMPSN:3.3K OHM,5%,0.125W | 01121 | BB3325 |
| R1537 | 317-0332-00 | | | RES.,FXD,CMPSN:3.3K OHM,5%,0.125W | 01121 | BB3325 |
| R1538 | 311-1267-00 | | | RES.,VAR,NONWIR:5K OHM,10%,0.50W | 32997 | 3329P-L58-502 |
| R1539 | 315-0101-00 | | | RES.,FXD,CMPSN:100 OHM,5%,0.25W | 01121 | CB1015 |
| R1540 | 315-0563-00 | | | RES.,FXD,CMPSN:56K OHM,5%,0.25W | 01121 | CB5635 |
| R1541 | 315-0222-00 | | | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W | 01121 | CB2225 |
| R1542 | 315-0183-00 | | | RES.,FXD,CMPSN:18K OHM,5%,0.25W | 01121 | CB1835 |
| R1543 | 311-1266-00 | | | RES.,VAR,NONWIR:2.5K OHM,10%,0.50W | 32997 | 3329P-L58-252 |
| R1544 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1545 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R1546 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1547 | 315-0101-00 | | | RES.,FXD,CMPSN:100 OHM,5%,0.25W | 01121 | CB1015 |
| R1548 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R1549 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R1553 | 315-0510-00 | | | RES.,FXD,CMPSN:51 OHM,5%,0.25W | 01121 | CB5105 |
| R1556 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R1558 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1559 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1574 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1577 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R1582 | 315-0103-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1035 |
| R1584 | 315-0472-00 | B010100 | B029999 | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R1587 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R1588 | 321-0263-00 | | | RES.,FXD,FILM:5.36K OHM,1%,0.125W | 91637 | MFF1816G53600F |
| R1593 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1594 | 315-0102-00 | B010100 | B029999 | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R1594 | 315-0681-00 | B030000 | | RES.,FXD,CMPSN:680 OHM,5%,0.25W | 01121 | CB6815 |
| R1597 | 321-0258-00 | | | RES.,FXD,FILM:4.75K OHM,1%,0.125W | 91637 | MFF1816G47500F |
| R1598 | 321-0250-00 | 8010100 | B029999 | RES.,FXD,FILM:3.92K OHM,1%,0.125W | 91637 | MFF1816G39200F |
| R1598 | 315-0100-00 | B030000 | | RES.,FXD,CMPSN:10 OHM,5%,0.25W | 01121 | CB1005 |
| R1599 | 321-0248-00 | B010100 | B029999 | RES.,FXD,FILM:3.74K OHM,1%,0.125W | 91637 | MFF1816G37400F |
| R1601 | 315-0151-00 | | | RES.,FXD,CMPSN:150 OHM,5%,0.25W | 01121 | CB1515 |
| R1602 | 315-0332-00 | | | RES.,FXD,CMPSN:3.3K OHM,5%,0.25W | 01121 | CB3325 |
| R1604 | 315-0361-00 | | | RES.,FXD,CMPSN:360 OHM,5%,0.25W | 01121 | CB3615 |
| R1606 | 317-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.125W | 01121 | BB1035 |
| R1607 | 317-0470-00 | | | RES.,FXD,CMPSN:47 OHM,5%,0.125W | 01121 | BB4705 |
| R1608 | 317-0391-00 | | | RES.,FXD,CMPSN:390 OHM,5%,0.125W | 01121 | BB3915 |
| R1625 | 317-0430-00 | | | RES.,FXD,CMPSN:43 OHM,5%,0.125W | 01121 | BB4305 |
| R1630 | 317-0107-00 | | | RES.,FXD,CMPSN:100M OHM,5%,0.125W | 01121 | BB1075 |
| R1631 | 317-0120-00 | | | RES.,FXD,CMPSN:12 OHM,5%,0.125W | 01121 | BB1205 |
| R1632 | 317-0120-00 | | | RES.,FXD,CMPSN:12 OHM,5%,0.125W | 01121 | BB1205 |
| R1633 | 317-0430-00 | | | RES.,FXD,CMPSN:43 OHM,5%,0.125W | 01121 | BB4305 |
| R1635 | 317-0151-00 | | | RES.,FXD,CMPSN:150 OHM,5%,0.125W | 01121 | BB1515 |
| R1636 | 317-0151-00 | | | RES.,FXD,CMPSN:150 OHM,5%,0.125W | 01121 | BB1515 |
| R1637 | 317-0151-00 | | | RES.,FXD,CMPSN:150 OHM,5%,0.125W | 01121 | BB1515 |
| R1638 | 317-0151-00 | | | RES.,FXD,CMPSN:150 OHM,5%,0.125W | 01121 | BB1515 |
| R1639 | 317-0107-00 | | | RES.,FXD,CMPSN:100M OHM,5%,0.125W | 01121 | BB1075 |
| R1641 | 317-0201-00 | B060986 | | RES.,FXD,CMPSN:200 OHM,5%,0.125W | 01121 | BB2015 |
| R1643 | 317-0201-00 | B060986 | | RES.,FXD,CMPSN:200 OHM,5%,0.125W | 01121 | BB2015 |
| R1645 | 315-0242-00 | | | RES.,FXD,CMPSN:2.4K OHM,5%,0.25W | 01121 | CB2425 |

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|---------|-------------|---------|------------------|--|--|----------|-----------------|
| | Part No. | Eff | Dscont | | | | |
| R1651 | 315-0472-00 | | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | C84725 |
| R1654 | 315-0103-00 | | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1656 | 315-0103-00 | | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1657 | 311-1266-00 | | | | RES.,VAR,NONWIFR:22.5K OHM,10%,0.50W | 32997 | 3329P-L58-252 |
| R1659 | 311-1562-00 | | | | RES.,VAR,NONWIR:2K OHM,20%,0.50W | 73138 | 91-84-0 |
| R1674 | 315-0103-00 | | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R1681 | 321-0221-00 | | | | RES.,FXD,FILM:1.96K OHM,1%,0.125W | 91637 | MFF1816G19600F |
| R1682 | 321-0148-00 | | | | RES.,FXD,FILM:340 OHM,1%,0.125W | 91637 | MFF1816G340ROF |
| R1683 | 321-0234-00 | | | | RES.,FXD,FILM:2.67K OHM,1%,0.125W | 91637 | MFF1816G26700F |
| R1684 | 321-0251-00 | | | | RES.,FXD,FILM:4.02K OHM,1%,0.125W | 91637 | MFF1816G40200F |
| R1685 | 315-0103-00 | | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1035 |
| R1691 | 315-0433-00 | B010100 | 8029999 | | RES.,FXD,CMPSN:43K OHM,5%,0.25W | 01121 | CB4335 |
| R1691 | 315-0133-00 | B030000 | | | RES.,FXD,CMPSN:13K OHM,5%,0.25W | 01121 | CB1335 |
| R1692 | 311-1560-00 | | | | RES.,VAR,NONWIR:5K OHM,20%,0.50W | 73138 | 9142-0 |
| R1693 | 315-0620-00 | B010100 | B029999 | | RES.,FXD,CMPSN:62 OHM,5%,0.25W | 01121 | CB6205 |
| R1693 | 315-0101-00 | B030000 | | | RES.,FXD,CMPSN:100 OHM,5%,0.25W | 01121 | CB1015 |
| R1701 | 307-0099-00 | | | | RES.,FXD,FILM:2.7 OHM,5%,0.25W | 03888 | 125R250T48ROOF |
| R1702 | 317-0221-00 | | | | RES.,FXD,CMPSN:220 OHM,5%,0.125W | 01121 | B82215 |
| R1703 | 317-0027-00 | | | | RES.,FXD,CMPSN:2.7 OHM,5%,0.125W | 01121 | BB2R705 |
| R1704 | 317-0390-00 | | | | RES.,FXD,CMPSN:39 OHM,5%,0.125W | 01121 | 883905 |
| R1707 | 317-0751-00 | | | | RES.,FXD,CMPSN:750 OHM,5%,0.125W | 01121 | 8B7515 |
| R1752 | 317-0103-00 | | | | RES.,FXD,CMPSN:100K OHM,5%,0.125W | 01121 | BB1035 |
| R1753 | 317-0202-00 | 8010100 | 8029999 | | RES.,FXD,CMPSN:2K OHM,5%,0.125W | 01121 | 882025 |
| R1753 | 317-0152-00 | B030000 | | | RES.,FXD,CMPSN:1.5K OHM,5%,0.125W | 01121 | BB1525 |
| S1222 | 263-1109-00 | | | | SW CAM ACTR AS: | 80009 | 263-1109-00 |
| S1251 | 263-0013-05 | | | | ACTR ASSY,PB:3 LATCHING,10 MM,6 CONTACT | 80009 | 263-0013-05 |
| T1538 | 120-0544-00 | | | | XFMR,TOROID: | 80009 | 1204-0544-00 |
| U1344 | 1560067-00 | B010100 | B082049 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U1344 | 156-0067-12 | B082050 | | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U1569 | 156-0519-00 | B010100 | B102647 | | MICROCIRCUIT,DI:PRESETTABLE DIV-BY-N-CNTR | 80009 | 156-0519-00 |
| U1569 | 156-0519-01 | B102648 | | | MICROCIRCUIT,DI:PRESET DIVIDE-BY-N CNTR | 80009 | 15680519-01 |
| U1575 | 156-0349-00 | | | | MICROCIRCUIT,DI:QUAD 2-INPUT NOR GATE | 27014 | CD4001CJ |
| U1671 | 156-0350-00 | 8010100 | B102647 | | MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE | 80009 | 156-0350-00 |
| U1671 | 1560350-02 | B102648 | | | MICROCIRCUIT,DI:QUAD 2 INPUT NAND GATE,SEL | 80009 | 156-0350-02 |
| VR1531 | 152-0513-00 | | | | SEMICONV DEVICE:ZENER,1W,91V,5% | 80009 | 152-0513-00 |

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| | | Eff | Dscont | | | |
| A2 | 6703009-00 | B010100 | B049999 | CKT BOARD ASSY:VERTICAL AMPLISLOW RAMP | 80009 | 6703009-00 |
| A2 | 6703009-01 | B050000 | B102647 | CKT BOARD ASSY:VERTICAL AMPUSLOW RAMP | 80009 | 6703009-01 |
| A2 | 6704009-02 | B102648 | | CKT BOARD ASSY:VERTICAL AMPUSLOW RAMP | 80009 | 670-3009-02 |
| C2137 | 2O3-0000-00 | | | CAP.,FXD,CER DI:0.001UF,+100-0%,500V | 59660 | 831610YSU0102P |
| C2138 | 290-0530-0 | | | CAP.,FXD,ELCTLT:68UF,20%,6V | 90201 | TDC686M006NLF |
| C2146 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273C11 |
| C2147 | 290-0530-00 | | | CAP.,FXD,ELCTLT:68UF,20%,6V | 90201 | TDC686M006NLF |
| C2158 | 283-0340-00 | B010201 | | CAP.,FXD,CER DI:45PF,5%,1000V | 59660 | 0808505COG0450J |
| C2229 | 290-0530-00 | | | CAP.,FXD,ELCTLT:68UF,20%,6V | 90201 | TDC686M006NLF |
| C2232 | 290-0530-00 | | | CAP.,FXD,ELCTLT:68UF,20%,6V | 90201 | TDC686M006NLF |
| C2241 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273C11 |
| C2252 | 285-1056-00 | | | CAP.,FXD,PLSTC:1 UF,2%,50V | 14752 | 650BIAI05G |
| C2325 | 2900534-00 | | | CAP.,FXD,ELCTLT:1 UF,20%,35V | 56289 | 196D105X0035HA1 |
| C2345 | 290-0512-00 | B050000 | | CAP.,FXD,ELCTLT:22UF,20%,15V | 56289 | 196D226X0015KA1 |
| C2349 | 283-0116-00 | | | CAP.,FXD,CER DI:47PF,5%,200V | 59660 | 805-519-COG0470J |
| C2351 | 283-0204-0 | B010100 | B114112 | CAP.,FXD,CER DI:0.01UF,20%,50V | 96733 | R2676 |
| C2351 | 285-1256-00 | 8114113 | | CAP.,FXD,MTLZD:0.01UF,10%,100v | 55112 | 168/.01 K63B |
| C2356 | 283-0624-00 | | | CAP.,FXD,MICA D:1300PF,2%,500V | 00853 | D195F132G0 |
| CR2161 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR2216 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR2217 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR2262 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR2324 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR2341 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150OMA | 01295 | 1N4152R |
| CR2344 | 152-0141-02 | B050000 | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR2353 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| 02246 | 151-1054-00 | | | TRANSISTOR:SILICON,JFE,N-CHANNEL,DUAL | 17856 | DN1114 |
| Q2248 | 151-1022-00 | | | TRANSISTOR:FET,N-CHAN,SI,F1782,TO-18 | 17856 | FN1234 |
| 02249 | 151-1022-00 | | | TRANSISTOR:FET,N-CHAN,SI,F1782,TO-18 | 17856 | FN1234 |
| 02257 | 151-1022-00 | | | TRANSISTOR:FET,N-CHAN,SI,F1782,TO-18 | 17856 | FN1234 |
| 02258 | 151-1022-00 | | | TRANSISTOR:FET,N-CHAN,SI,F1782,TO-18 | 17856 | FN1234 |
| Q2259 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| Q2261 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| 02262 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| 02341 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| 02342 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| Q2345 | 151-0410-00 | | | TRANSISTOR:SILICON,PNP | 80009 | 151-0410-00 |
| R2137 | 315-0623-00 | | | RES.,FXD,CMPSN:62K OHM,5%,0.25W | 01121 | CB6235 |
| R2138 | 315-0203-00 | | | RES.,FXD,CMPSN:20K OHM,5%,0.25W | 01121 | CB2035 |
| R2139 | 315-0153-00 | | | RES.,FXD,CMPSN:15K OHM,5%,0.25W | 01121 | CB1535 |
| R2142 | 315-0123-00 | | | RES.,FXD,CMPSN:12K OHM,5%,0.25W | 01121 | CB1235 |
| R2144 | 315-0393-00 | | | RES.,FXD,CMPSN:39K OHM,5%,0.25W | 01121 | CB3935 |
| R2146 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R2149 | 316-0186-00 | | | RES.,FXD,CMPSN:18M OHM,10%,0.25W | 01121 | CB1861 |
| R2157 | 31540473-00 | B010100 | B020384 | RES.,FXD,CMPSN:47K OHM,5%/o,0.25W | 01121 | CB4735 |
| R2157 | 315-0333-00 | B020385 | | RES.,FXD,CMPSN:33K OHM,5%,0.25W | 01121 | CB3335 |
| R2158 | 321-0422-00 | | | RES.,FXD,FILM:243K OHM,1%,0.125W | 91637 | MFF1816G24302F |
| R2166 | 315-0185-00 | | | RES.,FXD,CMPSN:1.8M OHM,5%,0.25W | 01121 | CB1855 |
| R2220 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R2221 | 321-0310-00 | | | RES.,FXD,FILM:16.5K OHM,1%,0.125W | 91637 | MFF1816G16501F |
| R2222 | 321-0298-00 | | | RES.,FXD,FILM:12.4K OHM,1%,0.125W | 91637 | MFF1816G12401F |
| R2223 | 321-0293-00 | | | RES.,FXD,FILM:11K OHM,1%,0.125W | 91637 | MFF1816G11001F |
| R2224 | 321-0291-00 | | | RES.,FXD,FILM:10.5K OHM,1%,0.125W | 91637 | MFF1816G10501F |
| R2225 | 315-0330-00 | | | RES.,FXD,CMPSN:33 OHM,5%,0.25W | 01121 | CB3305 |
| R2226 | 321-0290-00 | | | RES.,FXD,FILM:10.2K OHM,1%,0.125W | 91637 | MFF1816G10201F |

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|---------|--------------------|------------------|---------|--|----------|-----------------|
| | | Eff | Dscont | | | |
| R2227 | 321-0614-00 | | | RES.,FXD,FILM:10.1K OHM,1%,0.125W | 91637 | MFF1816G10101F |
| R2228 | 321-0481-00 | | | RES.,FXD,FILM:1M OHM,1%,0.125W | 24546 | NA4D10O04F |
| R2229 | 321-0289-00 | | | RES.,FXD,FILM:10K OHM,1%,0.125W | 91637 | MFF1816G10001F |
| R2233 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R2235 | 315-0330-00 | | | RES.,FXD,CMPSN:33 OHM,5%,0.25W | 01121 | CB3305 |
| R2236 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R2237 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R2242 | 315-0333-00 | | | RES.,FXD,CMPSN:33K OHM,5%,0.25W | 01121 | CB3335 |
| R2247 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R2251 | 315-0155-00 | | | RES.,FXD,CMPSN:1.5M OHM,5%,0.25W | 01121 | CB1555 |
| R2258 | 315-0223-00 | | | RES.,FXD,CMPSN:22K OHM,5%,0.25W | 01121 | CB2235 |
| R2266 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R2267 | 321-0318-00 | | | RES.,FXD,FILM:20K OHM,1%,0.125W | 91637 | MFF1816G20001F |
| R2311 | 315-0682-00 | B010100 | B049999 | RES.,FXD,CMPSN:6.8K OHM,5%,0.25W | 01121 | CB6825 |
| R2311 | ----- | B050000 | | SELECTED | | |
| R2321 | 321-0452-00 | | | RES.,FXD,FILM:499K OHM,1%,0.125W | 91637 | MFF1816G49902F |
| R2322 | 321-0423-00 | B010100 | B049999 | RES.,FXD,FILM:249K OHM,1%,0.125W | 91637 | MFF1816G24902F |
| R2322 | 321-0618-04 | B050000 | | RES.,FXD,FILM:250K OHM,0.1%,0.125W | 07716 | OBD |
| R2323 | 321-0385-00 | | | RES.,FXD,FILM:100K OHM,1%,0.125W | 91637 | MFF1816G10002F |
| R2324 | 315-0224-00 | | | RES.,FXD,CMPSN:220K OHM,5%,0.25W | 01121 | CB2245 |
| R2325 | 321-0356-00 | | | RES.,FXD,FILM:49.9K OHM,1%,0.125W | 91637 | MFF1816G49901F |
| R2326 | 321-0327-00 | | | RES.,FXD,FILM:24.9K OHM,1%,0.125W | 91637 | MFF1816G24901F |
| R2337 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R2345 | 315-0103-00 | B050000 | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1035 |
| R2346 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R2347 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R2348 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R2353 | 325-0199-00 | | | RES.,FXD,FILM:24M OHM,2%,0.25W | 03888 | PVC60-G24004G |
| R2354 | 315-0272-00 | | | RES.,FXD,CMPSN:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R2355 | 315-0223-00 | | | RES.,FXD,CMPSN:22K OHM,5%,0.25W | 01121 | CB2235 |
| R2361 | 321-0321-00 | | | RES.,FXD,FILM:21.5K OHM,1%,0.125W | 91637 | MFF1816G21501F |
| S2126 | 263-1108-00 | | | SW CAM ACTR AS: | 80009 | 263-1108-00 |
| S2254 | 260-1445-02 | | | SWITCH,PUSH:DPDT,W/8 POLE SPRING | 80009 | 260-1445-02 |
| U2131 | 156-0067-00 | B010100 | B082049 | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U2131 | 156-0067-12 | B082050 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U2136 | 156-0067-00 | B010100 | B082049 | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U2136 | 156-0067-12 | B082050 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U2143 | 156-0067-00 | B010100 | B082049 | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U2143 | 156-0067-12 | B082050 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U2332 | 156-0350-00 | B010100 | B102647 | MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE | 80009 | 156-0350-00 |
| U2332 | 156-0350-02 | B102648 | | MICROCIRCUIT,DI:QUAD 2 INPUT NAND GATE,SEL | 80009 | 156-0350-02 |
| VR2212 | 152-0149-00 | B010100 | B049999 | SEMICONV DEVICE:ZENER,0.4W,10V,5% | 04713 | SZG35009K3 |
| VR2212 | 152-0149-00 | B050000 | | SEMICONV DEVICE:ZENER,0.4W,10V,5% | 04713 | SZG35009K3 |
| VR2212 | ---- | | | (SELECTED) | | |

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|---------|--------------------|------------------|---------|-----------------------------------|----------|------------------|
| | | Eff | Dscont | | | |
| A3 | 670-3130-00 | B010100 | B099999 | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 670-3130-00 |
| A3 | 670-3130-02 | B100000 | B102647 | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 670-3130-02 |
| A3 | 670-3130-03 | B102648 | B113809 | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 670-3130-03 |
| A3 | 6703130-04 | B113810 | | CKT BOARD ASSY:OUTPUT AMPLIFIER | 80009 | 670-3130-00 |
| C3132 | 283-0067-00 | | | CAP.,FXD,CER DI:0.001UF,10%,200V | 59660 | 835-515-Z5D0102K |
| C3219 | 283-0116-00 | | | CAP.,FXD,CER DI:820PF,5%,500V | 59660 | 801547B821J |
| C3226 | 283-0116-00 | | | CAP.,FXD,CER DI:820PF,5%,500V | 59660 | 801547B821J |
| C3233 | 283-0114-00 | | | CAP.,FXD,CER DI:0.0015UF,5%,200V | 59660 | 805534Y5DO152J |
| C3241 | 290-0534-00 | | | CAP.,FXD,ELCTL:1UF,20%,35V | 56289 | 196D105X0035HA1 |
| C3246 | 290-0534-00 | | | CAP.,FXD,ELCTL:1 UF,20%,35V | 56289 | 196D105X0035HA1 |
| Q3113 | 151-0341-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S040065 |
| Q3114 | 151-0341-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S040065 |
| Q3118 | 151-0279-00 | | | TRANSISTOR:SILICON,NPN | 01295 | SGC2622 |
| Q3137 | 151-0341-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S040065 |
| Q3139 | 151-0341-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S040065 |
| Q3221 | 151-0279-00 | | | TRANSISTOR:SILICON,NPN | 01295 | SGC2622 |
| Q3232 | 151-0279-00 | | | TRANSISTOR:SILICON,NPN | 01295 | SGC2622 |
| Q3235 | 151-0341-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S040065 |
| Q3236 | 151-0279-00 | | | TRANSISTOR:SILICON,NPN | 01295 | SGC2622 |
| R3112 | 321-0280-00 | B010100 | B099999 | RES.,FXD,FILM:8.06K OHM,1%,0.125W | 91637 | MFF1816G80600F |
| R3112 | 321-0251-00 | B100000 | B113809 | RES.,FXD,FILM:4.02K OHM,1%,0.125W | 91637 | MFF1816G40200F |
| R3112 | 321-0263-00 | B113810 | | RES.,FXD,FILM:5.36K OHM,1%,0.125W | 91637 | MFF1816G53600F |
| R3114 | 321-0251-00 | B010100 | B099999 | RES.,FXD,FILM:4.02K OHM,1%,0.125W | 91637 | MFF1816G40200F |
| R3114 | 321-0222-00 | B100000 | B113809 | RES.,FXD,FILM:2K OHM,1%,0.125W | 91637 | MFF1816G20000F |
| R3114 | 321-0178-00 | B113810 | | RES.,FXD,FILM:698 OHM,1%,0.125W | 91637 | MFF1816G698ROF |
| R3115 | 321-0251-00 | B010100 | B099999 | RES.,FXD,FILM:4.02K OHM,1%,0.125W | 91637 | MFF1816G40200F |
| R3115 | 321-0222-00 | B100000 | B113809 | RES.,FXD,FILM:2K OHM,1%,0.125W | 91637 | MFF1816G20000F |
| R3115 | 321-0178-00 | B113810 | | RES.,FXD,FILM:698 OHM,1%,0.125W | 91637 | MFF1816G698ROF |
| R3116 | 321-0306-00 | B010100 | B099999 | RES.,FXD,FILM:15K OHM,1%,0.125W | 91637 | MFF1816G15001F |
| R3116 | 321-0277-00 | B100000 | | RES.,FXD,FILM:7.5K OHM,1%,0.125W | 91637 | MFF1816G75000F |
| R3121 | 315-0474-00 | B010100 | B099999 | RES.,FXD,CMPSN:470K OHM,5%,0.25W | 01121 | CB4745 |
| R3121 | 321-0420-00 | B100000 | | RES.,FXD,FILM:232K OHM,1%,0.125W | 91637 | MFF1816G23202F |
| R3122 | 315-0474-00 | B010100 | B099999 | RES.,FXD,CMPSN:470K OHM,5%,0.25W | 01121 | CB4745 |
| R3122 | 321-0420-00 | B100000 | | RES.,FXD,FILM:232K OHM,1%,0.125W | 91637 | MFF1816G23202F |
| R3124 | 315-0203-00 | | | RES.,FXD,CMPSN:20K OHM,5%,0.25W | 01121 | CB2035 |
| R3126 | 315-0123-00 | B010100 | B099999 | RES.,FXD,CMPSN:12K OHM,5%,0.25W | 01121 | CB1235 |
| R3126 | 321-0267-00 | B100000 | | RES.,FXD,FILM:5.9K OHM,1%,0.125W | 91637 | MFF1816G59000F |
| R3131 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R3133 | 315-0754-00 | B010100 | B099999 | RES.,FXD,CMPSN:750K OHM,5%,0.25W | 01121 | CB7545 |
| R3133 | 321-0440-00 | B100000 | | RES.,FXD,FILM:374K OHM,1%,0.125W | 91637 | MFF1816G37402F |
| R3134 | 315-0754-00 | B010100 | B099999 | RES.,FXD,CMPSN:750K OHM,5%,0.25W | 01121 | CB7545 |
| R3134 | 321-0440-00 | B100000 | | RES.,FXD,FILM:374K OHM,1%,0.125W | 91637 | MFF1816G37402F |
| R3135 | 321-0308-00 | B010100 | B099999 | RES.,FXD,FILM:15.8K OHM,1%,0.125W | 91637 | MFF1816G15801F |
| R3135 | 321-0279-00 | B100000 | | RES.,FXD,FILM:7.87K OHM,1%,0.125W | 91637 | MFF1816G78700F |
| R3136 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R3138 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R3139 | 321-0251-00 | B010100 | B099999 | RES.,FXD,FILM:4.02K OHM,1%,0.125W | 91637 | MFF1816G40200F |
| R3139 | 321-0222-00 | B100000 | | RES.,FXD,FILM:2K OHM,1%,0.125W | 91637 | MFF1816G20000F |
| R3142 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R3143 | 311-1556-00 | | | RES.,VAR,NONWIR:50K OHM,20%,0.50W | 73138 | 91-78-0 |
| R3146 | 321-0251-00 | B010100 | B099999 | RES.,FXD,FILM:4.02K OHM,1%,0.125W | 91637 | MFF1816G40200F |
| R3146 | 321-0222-00 | B100000 | | RES.,FXD,FILM:2K OHM,1%,0.125W | 91637 | MFF1816G20000F |
| R3148 | 315-0204-00 | | | RES.,FXD,CMPSN:200K OHM,5%,0.25W | 01121 | CB2045 |

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|---------|--------------------|------------------|---------|--|----------|------------------|
| | | Eff | Dscont | | | |
| R3149 | 315-0224-00 | | | RES.,FXD,CMPSN:220K OHM,5%,0.25W | 01121 | CB2245 |
| R3212 | 321-0325-00 | B010100 | B099999 | RES.,FXD,FILM:23.7K OHM,1%,0.125W | 91637 | MFF1818G23701F |
| R3212 | 321-0297-00 | B100000 | | RES.,FXD,FILM:12.1K OHM,1%,0.125W | 91637 | MFF1816G12101F |
| R3213 | 311-1556-00 | B010100 | B099999 | RES.,VAR,NONWIR:50K OHM,20%,0.50W | 73138 | 91-78-0 |
| R3213 | 311-1557-00 | B100000 | | RES.,VAR,NONWIR:25K OHM,20%,0.50W | 73138 | 91-79-0 |
| R3216 | 321-0325-00 | B010100 | B099999 | RES.,FXD,FILM:23.7K OHM,1%,0.125W | 91637 | MFF1816G23701F |
| R3216 | 321-0297-00 | B100000 | | RES.,FXD,FILM:12.1K OHM,1%,0.125W | 91637 | MFF1816G12101F |
| R3217 | 311-1557-00 | B010100 | B099999 | RES.,VAR,NONWIR:25K OHM,20%,0.50W | 73138 | 91-79-0 |
| R3217 | 311-1559-00 | B100000 | | RES.,VAR,NONWIR:100K OHM,20%,0.50W | 73138 | 91-81-0 |
| R3219 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R3225 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,50/,0.25W | 01121 | CB1045 |
| R3226 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R3229 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R3233 | 315-0363-00 | B010100 | B099999 | RES.,FXD,CMPSN:36K OHM,5%,0.25W | 01121 | CB3835 |
| R3233 | 321-0313-00 | B100000 | | RES.,FXD,FILM:17.8K OHM,1%,0.125W | 91637 | MFF1816G17801F |
| R3234 | 315-0183-00 | B010100 | B099999 | RES.,FXD,CMPSN:18K OHM,5%,0.25W | 01121 | CB1835 |
| R3234 | 321-0284-00 | B100000 | | RES.,FXD,FILM:8.87K OHM,1%,0.125W | 91837 | MFF1818G88700F |
| R3237 | 311-1554-00 | | | RES.,VAR,NONWIR:200K OHM,20%,0.50W | 73138 | 91-760 |
| R3238 | 315-0183-00 | B010100 | B099999 | RES.,FXD,CMPSN:18K OHM,5%,0.25W | 01121 | CB1835 |
| R3238 | 321-0284-00 | B100000 | | RES.,FXD,FILM:8.87K OHM,1%,0.125W | 91637 | MFF1816G88700F |
| R3242 | 311-1554-00 | | | RES.,VAR,NONWIR:200K OHM,20%,0.50W | 73138 | 91-76-4 |
| R3248 | 311-1554-00 | | | RES.,VAR,NONWIR:200K OHM,20%,0.50W | 73138 | 91-76-0 |
| R3249 | 315-0204-00 | | | RES.,FXD,CMPSN:200K OHM,5%,0.25W | 01121 | CB2045 |
| U3123 | 156-0350-00 | B010100 | B102647 | MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE | 80009 | 156840350-00 |
| U3123 | 156-0350-02 | B102648 | | MICROCIRCUIT,DI:QUAD 2 INPUT NAND GATE,SEL | 80009 | 156-0350402 |
| U3223 | 156-0289-00 | | | MICROCIRCUIT,DI:OUAD BILATERAL SWITCH | 07263 | 74LS95(PC OR DC) |

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| | | Eff | Dscont | | | |
| A4 | 670-3010-00 | B010100 | B099999 | CKT BOARD ASSY:SWEEP GEN | 80009 | 670-3010-00 |
| A4 | 670-3010-01 | B100000 | B102647 | CKT BOARD ASSY:SWEEP GEN | 80009 | 6703010-01 |
| A4 | 670-3010-02 | B102648 | | CKT BOARD ASSY:SWEEP GEN | 80009 | 670-3010-02 |
| C4118 | 283-0068-00 | | | CAP.,FXD,CER DI:0.001UF,+100-0%,500V | 59660 | 871-533E103P |
| C4119 | 285-1093-00 | | | CAP.,FXD,PLSTC:0.027UF,0.1%,200V | 19396 | 51-17243 |
| C4128 | 283-0068-00 | | | CAP.,FXD,CER DI:0.01UF,+100-0%,500V | 59660 | 871-533E103P |
| C4134 | 283-0000-00 | | | CAP.,FXD,CER DI:0.001UF,+100-0%,500V | 59660 | 831610Y5U0102P |
| C4135 | 283-0000-00 | | | CAP.,FXD,CER DI:0.001UF,+100-0%,500V | 59660 | 831610Y5U0102P |
| C4312 | 285-1093-00 | | | CAP.,FXD,PLSTC:0.027UF,0.1%,200V | 19396 | 51-17243 |
| C4321 | 285-1093-00 | | | CAP.,FXD,PLSTC:0.027UF,0.1%,200V | 19396 | 51-17243 |
| C4328 | 285-0644-00 | | | CAP.,FXD,PLSTC:0.033UF,20%,600V | 56289 | 430P333X06 |
| CR4151 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR4156 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR4211 | 152-0429-00 | | | SEMICOND DEVICE:SILICON,5000V,10MA | 14099 | SA3282 |
| CR4311 | 152-0429-00 | | | SEMICOND DEVICE:SILICON,5000V,10MA | 14099 | SA3282 |
| CR4313 | 152-0429-00 | | | SEMICOND DEVICE:SILICON,5000V,10MA | 14099 | SA3282 |
| CR4323 | 152-0429-00 | | | SEMICOND DEVICE:SILICON,5000V,10MA | 14099 | SA3282 |
| 04145 | 151-0273-00 | B010100 | B020394 | TRANSISTOR:SILICON,NPN | 80009 | 151-0273-00 |
| Q4145 | 151-0347-00 | B020395 | B099999 | TRANSISTOR:SILICON,NPN | 56289 | 2N5551 |
| Q4145 | 151-0136-03 | B100000 | | TRANSISTOR:SILICON,NPN,SEL | 80009 | 151-0136-03 |
| 04149 | 151-0273-00 | B010100 | B020394 | TRANSISTOR:SILICON,NPN | 80009 | 151-0273-00 |
| Q4149 | 151-0347-00 | B020395 | B099999 | TRANSISTOR:SILICON,NPN | 56289 | 2N5551 |
| 04149 | 151-0136-03 | B100000 | | TRANSISTOR:SILICON,NPN,SEL | 80009 | 151-0136-03 |
| R4114 | 315-0106-00 | B010100 | B020384 | RES.,FXD,CMPSN:10M OHM,5%,0.25W | 01121 | CB1065 |
| R4114 | 315-0125-00 | B020385 | B099999 | RES.,FXD,CMPSN:1.2M OHM,5%,0.25W | 01121 | CB1255 |
| R4114 | 315-0625-00 | B100000 | | RES.,FXD,CMPSN:6.2M OHM,5%,0.25W | 01121 | CB6255 |
| R4122 | 315-0470-00 | | | RES.,FXD,CMPSN:47 OHM,5%,0.25W | 01121 | CB4705 |
| R4123 | 315-0470-00 | | | RES.,FXD,CMPSN:47 OHM,5%,0.25W | 01121 | CB4705 |
| R4126 | 315-0225-00 | B010100 | B020384 | RES.,FXD,CMPSN:2.2M OHM,5%,0.25W | 01121 | CB2255 |
| R4126 | 315-0155-00 | B020385 | B099999 | RES.,FXD,CMPSN:1.5M OHM,5%,0.25W | 01121 | CB1555 |
| R4126 | 315-0474-00 | B100000 | | RES.,FXD,CMPSN:470K OHM,5%,0.25W | 01121 | CB4745 |
| R4126 | -- ---- | | | (NOMINAL VALUE, SELECTED) | | |
| R4129 | 315-0475-00 | | | RES.,FXD,CMPSN:4.7M OHM,5%,0.25W | 01121 | CB4755 |
| R4141 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R4145 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R4146 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R4148 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R4221 | 315-0475-00 | | | RES.,FXD,CMPSN:4.7M OHM,5%,0.25W | 01121 | CB4755 |
| R4222 | 311-1257-00 | | | RES.,VAR, NONWIR:5M OHM,20%,0.50W | 32997 | 3386F-T04-505 |
| R4245 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| T4241 | 120-0975-00 | B010100 | B099999 | XFMR,PWR,SDN/SU:HIGH VOLTAGE POT CORE | 80009 | 120-0975-00 |
| T4241 | 120-0975-01 | B100000 | | TRANSFORMER,RF:HIGH VOLTAGE POT CORE | 80009 | 120-0975-01 |
| VR4117 | 152-0247-00 | | | SEMICOND DEVICE:ZENER,0.4W,150V,5% | 04713 | SZG275K1RL |

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| | | Eff | Dscont | | | |
| A5 | 6703513-00 | B010100 | B029999 | CKT BOARD ASSY:CHART RECORDER LOGIC | 80009 | 670-3513-00 |
| A5 | 670-3513-01 | B030000 | B102647 | CKT BOARD ASSY:CHART RECORDER LOGIC | 80009 | 6703513-01 |
| A5 | 670-3513-02 | B102648 | | CKT BOARD ASSY:CHART RECORDER LOGIC | 80009 | 670-3513-02 |
| C5116 | 283-0198-00 | | | CAP.,FXD,CER DI:0.22UF,20%,50V | 56289 | 1C10Z5U223M050B |
| C5117 | 283-0054-00 | | | CAP.,FXD,CER DI:150PF,5%,200V | 59660 | 855-535U2J0 151J |
| C5131 | 290-0524-00 | B010100 | B029999 | CAP.,FXD,ELCTLT:4.7UF,20%,10V | 90201 | TDC475M010EL |
| C5159 | 283-0203-00 | | | CAP.,FXD,CER DI:0.47UF,20%,50V | 72982 | 8131M058Z5U0474M |
| C5167 | 283-0004-00 | | | CAP.,FXD,CER DI:0.02UF, +80-20%,150V | 59821 | SDDH69J203Z |
| C5219 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273CI111 |
| C5249 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273C11 |
| C5253 | 283-0154-00 | | | CAP.,FXD,CER DI:22PF,5%,50V | 72982 | 8111B061COG220J |
| C5263 | 283-0110-00 | | | CAP.,FXD,CER DI:0.005UF, 80-20%,150V | 59660 | 855-547-E-502Z |
| C5266 | 283-0010-00 | | | CAP.,FXD,CER DI:0.05UF,+100-20%,50V | 56289 | 1C10Z5U503Z050B |
| C5276 | 283-0346-00 | | | CAP.,FXD,CER DI:0.47UF,+80-20%,100V | 72982 | 8131-M100F474Z |
| CR5162 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR5243 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR5244 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR5245 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V-150MA | 01295 | 1N4152R |
| CR5254 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| Q5112 | 151-1078-00 | B010100 | B029999 | TRANSISTOR:SILICON,JFE,N-CHANNEL | 17856 | J2133 |
| Q5112 | 151-1022-00 | B030000 | | TRANSISTOR:FET,N-CHAN,SI,F1782,T0-18 | 17856 | FN1234 |
| Q5114 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q5144 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q5173 | 151-0126-00 | | | TRANSISTOR:SILICON,NPN | 04713 | ST1046 |
| Q5179 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q5226 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q5229 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q5237 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q5239 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q5266 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q5273 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q5277 | 151-0260-00 | | | TRANSISTOR:SILICON,NPN | 80009 | 151-0260-00 |
| Q5279 | 151-0301-00 | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| R5112 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5116 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5118 | 316-0186-00 | | | RES.,FXD,CMPSN:18M OHM,10%,0.25W | 01121 | CB1861 |
| R5119 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5121 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5122 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5126 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5128 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5130 | 321-0644-00 | | | RES.,FXD,FILM:100K OHM,0.25%,0.125W | 91637 | MFF1816C10002C |
| R5131 | 315-0335-00 | | | RES.,FXD,CMPSN:3.3M OHM,5%,0.25W | 01121 | CB3355 |
| R5132 | 321-0756-03 | | | RES.,FXD,FILM:50K OHM,0.25%,0.125W | 91637 | MFF1816D50001C |
| R5134 | 321-0644-00 | | | RES.,FXD,FILM:100K OHM,0.25%,0.125W | 91637 | MFF1816C10002C |
| R5135 | 321-0756-03 | | | RES.,FXD,FILM:50K OHM,0.25%,0.125W | 91637 | MFF1816D50001C |
| R5136 | 321-0756-03 | | | RES.,FXD,FILM:50K OHM,0.25%,0.125W | 91637 | MFF1816D50001C |
| R5137 | 321-0756-03 | | | RES.,FXD,FILM:50K OHM,0.25%,0.125W | 91637 | MFF1816D50001C |
| R5138 | 321-0644-00 | | | RES.,FXD,FILM:100K OHM,0.25%,0.125W | 91637 | MFF1816C10002C |
| R5139 | 321-0644-00 | | | RES.,FXD,FILM:100K OHM,0.25%,0.125W | 91637 | MFF1816C10002C |
| R5141 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5148 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5155 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5158 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |

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| R5161 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5163 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5166 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5167 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5168 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5171 | 315-0333-00 | | | RES.,FXD,CMPSN:33K OHM,5%,0.25W | 01121 | CB3335 |
| R5177 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R5178 | 315-0102-00 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R5211 | 321-0318-02 | | | RES.,FXD,FILM:20K OHM,0.5%,0.125W | 91637 | CMF55116D20001D |
| R5216 | 321-0306-01 | | | RES.,FXD,FILM:15K OHM,0.5%,0.125W | 91637 | MFF1816G15001D |
| R5221 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5222 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5223 | 321-0345-00 | | | RES.,FXD,FILM:38.3K OHM,1%,0.125W | 91637 | MFF1816G38301F |
| R5225 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5229 | 315-0104-06 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5231 | 321-0756-03 | | | RES.,FXD,FILM:50K OHM,0.25%,0.125W | 91637 | MFF1816D50001C |
| R5232 | 321-0644-00 | | | RES.,FXD,FILM:100K OHM,0.25%,0.125W | 91637 | MFF1816C10002C |
| R5233 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R5234 | 321-0644-00 | | | RES.,FXD,FILM:100K OHM,0.25%,0.125W | 91637 | MFF1816C10002C |
| R5235 | 321-0644-00 | | | RES.,FXD,FILM:100K OHM,0.25%,0.125W | 91637 | MFF1816C10002C |
| R5236 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5237 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5246 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5247 | 315-0566-00 | | | RES.,FXD,CMPSN:56M OHM,5%,0.25W | 01121 | CB5665 |
| R5248 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5255 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5259 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5263 | 315-0105-00 | | | RES.,FXD,CMPSN:1M OHM,5%,0.25W | 01121 | CB1055 |
| R5266 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R5267 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5268 | 315-0472-00 | | | RES.,FXD,CMPSN:4.7K OHM,5%,0.25W | 01121 | CB4725 |
| R5269 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R5275 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| U5117 | 1560686-00 | | | MICROCIRCUIT,LI:OPNL AMPL,HIGH IMPEDANCE | 02735 | CA3130S |
| U5127 | 156-0525-03 | B010100 | B102647 | MICROCIRCUIT,DI-DUAL J-K MASTER SLAVE FF-SE | 80009 | 156-0525-03 |
| U5127 | 156-0525-03 | B102648 | | MICROCIRCUIT,DI:DUAL J-K MASTER SLAVE FF-FF | 80009 | 156-0525-03 |
| U5147 | 156-0523-01 | | | MICROCIRCUIT,DI:7 STAGE BINARY COUNTER,SCRN | 02735 | CD4024BFX |
| U5156 | 156-0350-00 | B010100 | B102647 | MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE | 80009 | 156-0350-00 |
| U5156 | 156-0350-02 | B102648 | | MICROCIRCUIT,DI:QUAD 2 INPUT NAND GATE,SEL | 80009 | 156-0350-02 |
| U5166 | 156-0350-00 | B010100 | B102647 | MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE | 80009 | 156-0350-00 |
| U5166 | 156-0350-02 | B102648 | | MICROCIRCUIT,DI:QUAD 2 INPUT NAND GATE,SEL | 80009 | 156-0350-02 |
| U5227 | 156-0067-00 | B010100 | B082049 | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U5227 | 156-0067-12 | B082050 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U5252 | 156-0524-02 | | | MICROCIRCUIT,DI:TRIPLE 3-INPUT NAND GATES | 80009 | 156-0524-02 |

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| A6 | 670-3520-00 | B010100 | B020394 | CKT BOARD ASSY:POWER | 80009 | 670-3520-00 |
| A6 | 6703520-01 | B020395 | B102647 | CKT BOARD ASSY:POWER | 80009 | 6703520-01 |
| A6 | 670-3520-02 | B102648 | | CKT BOARD ASSY:POWER | 80009 | 670-3520-02 |
| C6147 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 56289 | 2C20Z5U105Z025B |
| C6219 | 290-0114-00 | | | CAP.,FXD,ELCTLT:47UF,20%,6V | 56289 | 150D476X0006B2 |
| C6224 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 56289 | 2C20Z5U105Z025B |
| C6226 | 283-0177-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,25V | 56289 | 2C20Z5U105Z025B |
| C6228 | 290-0114-00 | | | CAP.,FXD,ELCTLT:47UF,20%,6V | 56289 | 150D476X0006B2 |
| C6233 | 290-0527-00 | | | CAP.,FXD,ELCTLT:15UF,20%,20V | 90201 | TDC156M020FL |
| C6243 | 290-0559-00 | | | CAP.,FXD,ELCTLT:22UF,20%,35V | 90201 | TDC226M035WLG |
| C6246 | 290-0137-00 | | | CAP.,FXD,ELCTLT: 100UF, + 75-15%,30V | 56289 | 1 09D107C7030T2 |
| C6323 | 290-0425-00 | | | CAP.,FXD,ELCTLT:100UF,20%,20V | 90201 | THF107M020P1G |
| C6326 | 290-0425-00 | | | CAP.,FXD,ELCTLT: 100UF,20%,20V | 90201 | THF107M020P1G |
| C6329 | 290-0425-00 | | | CAP.,FXD,ELCTLT:100UF,20%,20V | 90201 | THF107M020P1G |
| C6336 | 290-0425-00 | | | CAP.,FXD,ELCTLT:100UF,20%,20V | 90201 | THF107M020P1G |
| C6341 | 290-0137-00 | | | CAP.,FXD,ELCTLT:1 00UF, + 75-15%,30V | 56289 | 109D107C7030T2 |
| C6342 | 283-0142-00 | B020385 | | CAP.,FXD,CER DI:0.0027UF,5%,200V | 59860 | 875571YEE0272J |
| C6415 | 290-0701-00 | | | CAP.,FXD,ELCTLT:470UF,40%,16VDC | 90201 | TTX471U0161E1A3P |
| C6416 | 290-0134-00 | | | CAP.,FXD,ELCTLT22UF,20%,15V | 56289 | 150D226X0015B2 |
| C6426 | 290-0701-00 | | | CAP.,FXD,ELCTLT:470UF,40%,16VDC | 90201 | TTX471U0161E1A3P |
| C6429 | 290-0425-00 | | | CAP.,FXD,ELCTLT:100UF,20%,20V | 90201 | THF107M020PIG |
| C6443 | 290-0701-00 | | | CAP.,FXD,ELCTLT:470UF,40%,16VDC | 90201 | TTX471 U0161 EI A3P |
| C6444 | 283-0107-00 | | | CAP.,FXD,CER DI:51PF,5%,200V | 96733 | R3017 |
| C6447 | 283-0111-00 | | | CAP.,FXD,CER DI:0.1UF,20%,50V | 56289 | 273C11 |
| C6451 | 283-0047-00 | | | CAP.,FXD,CER DI:270PF,5%,500V | 59821 | 2DDH73L271J |
| C6455 | 283-0115-00 | B020395 | | CAP.,FXD,CER DI:47PF,5%,200V | 59660 | 805-519-COG0470J |
| C6515 | 283-0000-00 | | | CAP.,FXD,CER DI:0.001UF,+ 100-0%,500V | 59660 | 831610Y5U0102P |
| C6525 | 290-0425-00 | | | CAP.,FXD,ELCTLT:100UF,20%,20V | 90201 | THF107M020P1G |
| C6527 | 290-0164-00 | | | CAP.,FXD,ELCTLT:1UF,+50-10%,150V | 56289 | 56289 |
| C6529 | D105F150BA7 290-0658-00 | | | CAP.,FXD,ELCTLT:4UF,+50-10%,200V | 56289 | 600D405F200KD4 |
| C6551 | 283-0077-00 | | | CAP.,FXD,CER DI:330PF,5%,500V | 59660 | 831-500B331J |
| CR6139 | 152-0400-00 | | | SEMICOND DEVICE:SILICON,400V,1A | 80009 | 152-0400-00 |
| CR6157 | 152-0488-00 | | | SEMICOND DEVICE:SILICON,200V,1500MA | 04713 | SDA317 |
| CR6234 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6247 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6346 | 152-0400-00 | | | SEMICOND DEVICE:SILICON,400V,1A | 80009 | 152-0400-00 |
| CR6347 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6414 | 152-0400-00 | | | SEMICOND DEVICE:SILICON,400V,1A | 80009 | 152-0400-00 |
| CR6438 | 152-0400-00 | | | SEMICOND DEVICE:SILICON,400V,1A | 80009 | 152-0400-00 |
| CR6439 | 152-0400-00 | | | SEMICOND DEVICE:SILICON,400V,1A | 80009 | 152-0400-00 |
| CR6441 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6442 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6446 | 152-0400-00 | B010100 | B020394 | SEMICOND DEVICE:SILICON,400V,1A | 80009 | 152-0400-00 |
| CR6448 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6452 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6534 | 152-0400-00 | | | SEMICOND DEVICE:SILICON,400V,1A | 80009 | 152-0400-00 |
| CR6536 | 152-0586-00 | | | SEMICOND DEVICE:SILICON,600V,500MA | 14936 | RGP10J-011 |
| CR6537 | 152-0586-00 | | | SEMICOND DEVICE:SILICON,600V,600MA | 14936 | RGP10J-011 |
| CR6546 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| CR6551 | 152-0141-02 | | | SEMICOND DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| F6112 | 159-0128-00 | | | FUSE,CARTRIDGE:2A,125V,5 SEC | 75915 | 273002 |
| F6113 | 159-0128-00 | | | FUSE,CARTRIDGE:2A,125V,5 SEC | 75915 | 273002 |
| F6122 | 159-0128-00 | | | FUSE,CARTRIDGE:2A,125V,5 SEC | 75915 | 273002 |
| F6123 | 159-0128-00 | | | FUSE,CARTRIDGE:2A,125V,5 SEC | 75915 | 273002 |

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| L6344 | 108-0598-00 | | | | COIL,RF:200UH | 80009 | 108-0598-00 |
| L6423 | 108-0598-00 | | | | COIL,RF:200UH | 80009 | 108-0598-00 |
| L6428 | 108-0598-00 | | | | COIL,RF:200UH | 80009 | 108-0598-00 |
| L6532 | 108-0598-00 | | | | COIL,RF:200UH | 80009 | 108-0598-00 |
| L6538 | 108-0598-00 | | | | COIL,RF:200UH | 80009 | 108-0598-00 |
| Q6143 | 151-0508-00 | | | | TRANSISTOR:UJT,SI,2N6027,TO-98 | 03508 | X13T520 |
| Q6155 | 151-0506-00 | | | | SCR:SILICON | 03508 | C106B2X283 |
| Q6227 | 151-0302-00 | | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q6241 | 151-0188-00 | | | | TRANSISTOR:SILICON,PNP | 04713 | SPS6868K |
| Q6244 | 151-0188-00 | | | | TRANSISTOR:SILICON,PNP | 04713 | SPS6868K |
| Q6331 | 151-0302-00 | | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q6349 | 151-0390-00 | | | | TRANSISTOR:SILICON,NPN | 04713 | SPS3414 |
| Q6357 | 151-0302-00 | | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q6427 | 151-0301-00 | | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q6435 | 151-0352-00 | | | | TRANSISTOR:SILICON,NPN | 03508 | X44C282 |
| Q6445 | 151-0424-00 | | | | TRANSISTOR:SILICON,NPN | 04713 | SPS8246 |
| Q6458 | 151-0424-00 | | | | TRANSISTOR:SILICON,NPN | 04713 | SPS8246 |
| Q6547 | 151-0302-00 | | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q6548 | 151-0301-00 | | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q6549 | 151-0301-00 | | | | TRANSISTOR:SILICON,PNP | 27014 | 2N2907A |
| Q6552 | 151-0302-00 | | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| Q6557 | 151-0302-00 | | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| R6131 | 308-0463-00 | | | | RES.,FXD,WW:0.3 OHM,1%,3W | 91637 | RS2B-KR3000F |
| R6132 | 315-0102-00 | | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R6133 | 315-0362-00 | | | | RES.,FXD,CMPSN:3.6K OHM,5%,0.25W | 01121 | CB3625 |
| R6134 | 315-0272-00 | | | | RES.,FXD,CMPSN:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R6135 | 315-0154-00 | | | | RES.,FXD,CMPSN:150K OHM,5%,0.25W | 01121 | CB1545 |
| R6147 | 315-0272-00 | | | | RES.,FXD,CMPSN:2.7K OHM,5%,0.25W | 01121 | CB2725 |
| R6148 | 315-0101-00 | | | | RES.,FXD,CMPSN:100 OHM,5%,0.25W | 01121 | CB1015 |
| R6149 | 315-0362-00 | | | | RES.,FXD,CMPSN:3.6K OHM,5%,0.25W | 01121 | CB3625 |
| R6214 | 321-0289-00 | | | | RES.,FXD,FILM:10K OHM,1%,0.125W | 91637 | MFF1816G10001F |
| R6215 | 321-0260-00 | | | | RES.,FXD,FILM:4.99K OHM,1%,0.125W | 91637 | MFF1816G49900F |
| R6222 | 315-0821-00 | B010100 | B049999 | | RES.,FXD,CMPSN:820 OHM,5%,0.25W | 01121 | CB8215 |
| R6222 | 315-0181-00 | B050000 | | | RES.,FXD,CMPSN:180 OHM,5%,0.25W | 01121 | CB1815 |
| R6223 | 315-0202-00 | B010100 | B049999 | | RES.,FXD,CMPSN:2K OHM,5%,0.25W | 01121 | CB2025 |
| R6223 | 315-0821-00 | B050000 | B050649 | | RES.,FXD,CMPSN:820 OHM,5%,0.25W | 01121 | CB8215 |
| R6223 | 315-0431-00 | B050650 | | | RES.,FXD,CMPSN:430 OHM,5%,0.25W | 01121 | CB4315 |
| R6225 | 321-0289-00 | | | | RES.,FXD,FILM:10K OHM,1%,0.125W | 91637 | MFF1816G10001F |
| R6231 | 321-0289-00 | | | | RES.,FXD,FILM:10K OHM,1%,0.125W | 91637 | MFF1816G10001F |
| R6235 | 315-0391-00 | | | | RES.,FXD,CMPSN:390 OHM,5%,0.25W | 01121 | CB3915 |
| R6254 | 304-0391-00 | | | | RES.,FXD,CMPSN:390 OHM,10%,1W | 01121 | GB3911 |
| R6346 | 315-0101-00 | B010100 | B020394 | | RES.,FXD,CMPSN:100 OHM,5%,0.25W | 01121 | CB1015 |
| R6346 | 315-0471-00 | B020395 | | | RES.,FXD,CMPSN:470 OHM,5%,0.25W | 01121 | CB4715 |
| R6356 | 315-0753-00 | B010100 | B020394 | | RES.,FXD,CMPSN:75K OHM,5%,0.25W | 01121 | CB7535 |
| R6356 | 315-0563-00 | B020395 | | | RES.,FXD,CMPSN:56K OHM,5%,0.25W | 01121 | CB5635 |
| R6358 | 311-1268-00 | | | | RES.,VAR,NONWIR:10K OHM,10%,0.50W | 32997 | 3329P-L58-103 |
| R6413 | 321-0352-00 | B010100 | B020384 | | RES.,FXD,FILM:45.3K OHM,1%,0.125W | 91637 | MFF1816G45301F |
| R6413 | 321-0332-00 | B020385 | | | RES.,FXD,FILM:28K OHM,1%,0.125W | 91637 | MFF1816G28001F |
| R6424 | 315-0103-00 | | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1035 |
| R6426 | 315-0101-00 | | | | RES.,FXD,CMPSN:100 OHM,5%,0.25W | 01121 | CB1015 |
| R6444 | 307-0103-00 | | | | RES.,FXD,CMPSN:2.7 OHM,5%,0.25W | 01121 | CB27G5 |
| R6445 | 315-0104-00 | | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R6447 | 315-0101-00 | | | | RES.,FXD,CMPSN:100 OHM,5%,0.25W | 01121 | CB1015 |
| R6449 | 315-0513-00 | | | | RES.,FXD,CMPSN:51K OHM,5%,0.25W | 01121 | CB5135 |

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|---------|-------------|---------|------------------|------|---------------------------------------|-----------------|----------------|
| | Part No. | Eff | Dscont | Code | | mfr Part Number | |
| R6451 | 315-0104-00 | | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R6453 | 315-0513-00 | | | | RES.,FXD,CMPSN:51K OHM,5%,0.25W | 01121 | CB5135 |
| R6454 | 315-0433-00 | | | | RES.,FXD,CMPSN:43K OHM,5%,0.25W | 01121 | CB4335 |
| R6455 | 315-0473-00 | | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R6456 | 315-0222-00 | | | | RES.,FXD,CMPSN:2.2K OHM,5%,0.25W | 01121 | CB2225 |
| R6457 | 315-0104-00 | | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R6459 | 315-0204-00 | | | | RES.,FXD,CMPSN:200K OHM,5%,0.25W | 01121 | CB2045 |
| R6513 | 321-0346-00 | B010100 | B020384 | | RES.,FXD,FILM:39.2K OHM,1%,0.125W | 91637 | MFF1816G39201F |
| R6513 | 321-0332-00 | 8020385 | | | RES.,FXD,FILM:28K OHM,1%,0.125W | 91637 | MFF1816G28001F |
| R6514 | 311-1268-00 | | | | RES.,VAR, NONWIR:10K OHM,10%,0.50W | 32997 | 3329P-L58-103 |
| R6517 | 316-0156-00 | | | | RES.,FXD,CMPSN:15M OHM,10%,0.25W | 01121 | CB1561 |
| R6518 | 321-0260-00 | | | | RES.,FXD,FILM:4.99K OHM,1%,0.125W | 91637 | MFF1816G49900F |
| R6538 | 315-0153-00 | B010100 | B010155 | | RES.,FXD,CMPSN:15K OHM,5%,0.25W | 01121 | CB1535 |
| R6538 | 315-0433-00 | B010156 | | | RES.,FXD,CMPSN:43K OHM,5%,0.25W | 01121 | CB4335 |
| R6539 | 315-0102-00 | | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R6544 | 315-0243-00 | | | | RES.,FXD,CMPSN:24K OHM,5%,0.25W | 01121 | CB2435 |
| R6545 | 315-0473-00 | | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R6548 | 315-0104-00 | | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R6549 | 315-0154-00 | | | | RES.,FXD,CMPSN:150K OHM,5%,0.25W | 01121 | CB1545 |
| R6553 | 315-0223-00 | | | | RES.,FXD,CMPSN:22K OHM,5%,0.25W | 01121 | CB2235 |
| R6554 | 315-0223-00 | | | | RES.,FXD,CMPSN:22K OHM,5%,0.25W | 01121 | CB2235 |
| R6557 | 315-0224-00 | | | | RES.,FXD,CMPSN:220K OHM,5%,0.25W | 01121 | CB2245 |
| R6558 | 315-0103-00 | B010100 | B020394 | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R6558 | 315-0102-00 | B020395 | | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| T6535 | 120-0976-00 | | | | XFMR,FLYBACK:POT CORE | 80009 | 120-0976-00 |
| U6138 | 156-0067-00 | B010100 | B082049 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U6138 | 156-0067-12 | B082050 | | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U6222 | 156-0067-00 | 8010100 | B082049 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U6222 | 156-0067-12 | B082050 | | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U6236 | 156-0067-00 | B010100 | B082049 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U6236 | 156-0067-12 | B082050 | | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| U6515 | 156-0067-00 | B010100 | B082049 | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | MICROA741CP |
| U6515 | 156-0067-12 | B082050 | | | MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER | 01295 | UA741CJG |
| VR6134 | 152-0243-00 | | | | SEMICOND DEVICE:ZENER,0.4W,15V,5% | 14552 | TD3810983 |
| VR6235 | 152-0278-00 | | | | SEMICOND DEVICE:ZENER,0.4W,3V,5% | 04713 | SZG35009K20 |
| VR6252 | 152-0278-00 | | | | SEMICOND DEVICE:ZENER,0.4W,3V,5% | 04713 | SZG35009K20 |
| VR6253 | 152-0127-00 | | | | SEMICOND DEVICE:ZENER,0.4W,7.5V,5% | 04713 | SZG35009K2 |
| VR6318 | 152-0265-00 | | | | SEMICOND DEVICE:ZENER,0.4W,24V,5% | 04713 | SZG35009K8 |
| VR6417 | 152-0195-00 | | | | SEMICOND DEVICE:ZENER,0.4W,5.1V,5% | 04713 | SZ11755 |
| VR6419 | 152-0175-00 | | | | SEMICOND DEVICE:ZENER,0.4W,5.6V,5% | 04713 | SZG35008 |
| VR6427 | 152-0195-00 | | | | SEMICOND DEVICE:ZENER,0.4W,5.1V,5% | 04713 | SZ11755 |
| VR6459 | 152-0306-00 | | | | SEMICOND DEVICE:ZENER,0.4W,9.1V,5% | 15238 | Z5409 |

| Ckt No. | Tektronix | Serial/Model No. | | Name & Description | Mfr | |
|---------|-------------|------------------|---------|-----------------------------------|-------|-----------------|
| | Part No. | Eff | Dscont | | Code | mfr Part Number |
| A7 | 670-3865-00 | B010100 | B102647 | CKT BOARD ASSY:X-Y PLUG IN | 80009 | 670-3865-00 |
| A7 | 670-3865-01 | B102648 | | CKT BOARD ASSY:X-Y PLUG IN | 80009 | 670-3865-01 |
| C7132 | 283-0059-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,50V | 51642 | 400050Z5U105Z |
| C7232 | 283-0059-00 | | | CAP.,FXD,CER DI:1UF,+80-20%,50V | 51642 | 400050Z5U105Z |
| CR7247 | 152-0141-02 | | | SEMICONV DEVICE:SILICON,30V,150MA | 01295 | 1N4152R |
| Q7242 | 151-0302-00 | | | TRANSISTOR:SILICON,NPN | 07263 | S038487 |
| R7122 | 321-0301-00 | | | RES.,FXD,FILM:13.3K OHM,1%,0.125W | 91637 | MFF1816G13301F |
| R7129 | 321-0288-00 | | | RES.,FXD,FILM:9.76K OHM,1%,0.125W | 91637 | MFF1816G97600F |
| R7138 | 321-0335-00 | | | RES.,FXD,FILM:30.1K OHM,1%,0.125W | 91637 | CMF55116G30101F |
| R7146 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| R7224 | 315-0223-00 | | | RES.,FXD,CMPSN:22K OHM,5%,0.25W | 01121 | CB2235 |
| R7225 | 311-1559-00 | | | RES.,VAR,NONWIR:10K OHM,20%,0.50W | 73138 | 91-81-0 |
| R7234 | 315-0113-00 | | | RES.,FXD,CMPSN:11K OHM,5%,0.25W | 01121 | CB1135 |
| R7244 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R7245 | 315-0103-00 | | | RES.,FXD,CMPSN:10K OHM,5%,0.25W | 01121 | CB1035 |
| A9 | 670-6592-00 | B110000 | | CKT BOARD ASSY:POWER FUSE JACK | 80009 | 670-6592-00 |
| F9100 | 159-0124-00 | B110000 | | FUSE,WIRE LEAD:3A,125V | 75915 | 272003 |

REV SEP 1983

| Ckt No. | Tektronix | Serial/Model No. | | Name & Description | Mfr | |
|---------|-------------|------------------|---------|---|-------|------------------|
| | Part No. | Eff | Dscont | | Code | mfr Part Number |
| | | | | CHASSIS | | |
| BT0369 | 016-0595-00 | B010100 | B109999 | BATTERY SET: | 80009 | 016-0595-00 |
| BT0369 | 016-0595-01 | B110000 | | BATTERY SET: | 80009 | 016-0595-01 |
| C0380 | 283-0279-00 | | | CAP.,FXD,CER DI:0.001UF,20%,3000V | 59660 | 878-521-S-Y5S-10 |
| C0390 | 283-0279-00 | | | CAP.,FXD,CER DI:0.001UF,20%,3000V | 59660 | 878-521-S-Y5S-10 |
| CR0282 | 150-1040-01 | | | LAMP,LED:W/LEADS & DIODE HOLDER | 80009 | 150-1040-01 |
| F0401 | 159-0029-00 | B010100 | B059999 | FUSE,CARTRIDGE:3AG,0.3A,250V,SLOW-BLOW | 71400 | MDL3/10 |
| F0401 | 159-0032-00 | B060000 | | FUSE,CARTRIDGE:3AG,0.5A,250V,SLOW-BLOW | 71400 | MDL 1/2 |
| F0401 | 159-0054-00 | B010100 | B059999 | FUSE,CARTRIDGE:3AG,0.15A,250V,SLOW-BLOW | 71400 | MDL 15/100 |
| F0401 | | | | (OPTION 6 ONLY) | | |
| F0401 | 159-0029-01 | B060000 | | FUSE,CARTRIDGE:BUSSMAN ONLY | 71400 | MDL3/10 |
| F0401 | | | | (OPTION 6 ONLY) | | |
| F0491 | 159-0029-00 | B010100 | B059999 | FUSE,CARTRIDGE:3AG,0.3A,250V,SLOW-BLOW | 71400 | MDL3/10 |
| F0491 | 159-0032-00 | B060000 | | FUSE,CARTRIDGE:3AG,0.5A,250V,SLOW-BLOW | 71400 | MDL 1/2 |
| F0491 | 159-0054-00 | B010100 | B059999 | FUSE,CARTRIDGE:3AG,0.15A,250V,SLOW-BLOW | 71400 | MDL 15/100 |
| F0491 | | | | (OPTION 6 ONLY) | | |
| F0491 | 159-0029-01 | B060000 | | FUSE,CARTRIDGE:BUSSMAN ONLY | 71400 | MDL3/10 |
| F0491 | | | | (OPTION 6 ONLY) | | |
| F0491 | 159-0172-00 | B102860 | | FUSE,CARTRIDGE:TYPE C,13 AMP | S3629 | PCC-1089 |
| F0491 | | | | (OPTION 2 ONLY) | | |
| J0421 | 131-2010-00 | B040616 | | CONNECTOR,RCPT:BNC,FEMALE | 24931 | 28JR200-2 |
| L0234 | 108-0671-00 | | | COIL,TUBE DEFL:TRACE ROTATOR | 80009 | 108-0671-00 |
| M0171 | 149-0031-00 | B010100 | B049999 | METER,BTRY LVL:0-350UA,15%,0.50 DIA,SCALE | 24138 | P-202 |
| M0171 | 149-0044-05 | B050000 | | METER,BAT LEVEL:1MA,345 OHMS,0.5 DIA W/CONN | 80009 | 149-0044-05 |
| R0151 | 311-1806-00 | B010100 | B089999 | RES.,VAR,NONWIR:500 OHM,20%,1W | 12697 | 381S-CM40942 |
| R0151 | 311-2010-01 | B090000 | B113138 | RES.,VAR,WW:PNL,500 OHM,5%,1W,W/SW | 80009 | 311-2010-01 |
| R0151 | 311-2131-00 | B113139 | | RES.,VAR,NONWIR:PNL,500 OHM,5%,1W,W/4SPT | 80009 | 311-2131-00 |
| R0165 | 315-0102-00 | B010160 | | RES.,FXD,CMPSN:1K OHM,5%,0.25W | 01121 | CB1025 |
| R0251 | 311-0678-00 | | | RES.,VAR,NONWIR:2 X 50K OHM,10%,0.50W | 71590 | BA211-008 |
| R0252 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R0262 | 315-0104-00 | | | RES.,FXD,CMPSN:100K OHM,5%,0.25W | 01121 | CB1045 |
| R0263 | 311-0160-00 | | | RES.,VAR,NONWIR:50K OHM,100/,0.50W | 12697 | 381-CM30918 |
| R0271 | 311-1755-00 | B010100 | B039999 | RES.,VAR,WW:PNL,5K OHM,1.5W | 32997 | 3610S-502-502 |
| R0271 | 311-1755-02 | B040000 | | RES.,VAR,WW:PNL,5K OHM,5%,1.5W,W/KNOB | 80009 | 311-1755-02 |
| R0271 | 311-1800-00 | B010100 | B039999 | RES.,VAR,WW:PNL,5K OHM,5%,1.5W | 32997 | 3610S-514-502 |
| R0271 | | | | (OPTION 5 ONLY) | | |
| R0271 | 311-1800-02 | B040000 | | RES.,VAR,WW:PNL,5K OHM,5%,1.5W,W/KNOB | 80009 | 311-1800-02 |
| R0271 | | | | (OPTION 5 ONLY) | | |
| R0352 | 315-0473-00 | | | RES.,FXD,CMPSN:47K OHM,5%,0.25W | 01121 | CB4735 |
| R0432 | 311-0690-01 | B010100 | B030549 | RES.,VAR,NONWIR:5M OHM,0.50W | 0000M | OBD |
| R0432 | 311-1905-00 | B030550 | | RES.,VAR,NONWIR:PNL,5M OHM,20%,0.50W | 12697 | CM412712 |
| R0442 | 311-0690-01 | B010100 | B030549 | RES.,VAR,NONWIR:5M OHM,0.50W | 0000M | OBD |
| R0442 | 311-1906-00 | B030550 | | RES.,VAR,NONWIR:PNL,5M OHM,20%,0.25W | 12697 | CM41713 |
| R0472 | 311-0091-00 | | | RES.,VAR,NONWIR:1K OHM,10%,0.50W | 01121 | W-3083E |
| S0151 | 260-1923-00 | | | SWITCH,PUSH:4PST,0.4VA,28V | 01121 | 17M814 |
| S0165 | 260-0834-00 | | | SWITCH,TOGGLE:DPDT,5A,125VAC,0.25-40 THD | 09353 | U21-SHZQE |
| S0481 | 260-1727-00 | | | SWITCH,TOGGLE:DPDT,0.4VA AND 20V MAX | 09353 | 7215 SYZ(B)E |
| S1251 | 263-0013-05 | | | ACTR ASSY,PB:3 LATCHING,10 MM,6 CONTACT | 80009 | 263-0013-05 |
| S1222 | 263-1109-00 | | | SW CAM ACTR AS: | 80009 | 263-1109-00 |
| S2126 | 263-1108-00 | | | SW CAM ACTR AS: | 80009 | 263-1108-00 |
| T0389 | 120-0978-00 | | | XFMR,PWR,STPDN: | 80009 | 120-0978-00 |
| V0235 | 154-0667-00 | B010100 | B010209 | ELECTRON TUBE:CRT,P-31 | 80009 | 154-0667-00 |
| V0235 | 154-0667-02 | B010210 | | ELECTRON TUBE:CRT,P-31 | 80009 | 154-0667-02 |
| V0235 | 154-0667-03 | B030490 | | ELECTRON TUBE:CRT,P-7 | 80009 | 154-0667-03 |
| V0235 | | | | (OPTION 76 ONLY) | | |

SECTION 8 DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

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

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

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

Abbreviations are based on ANSI Y1.1-1972.

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

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

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

Component Values

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

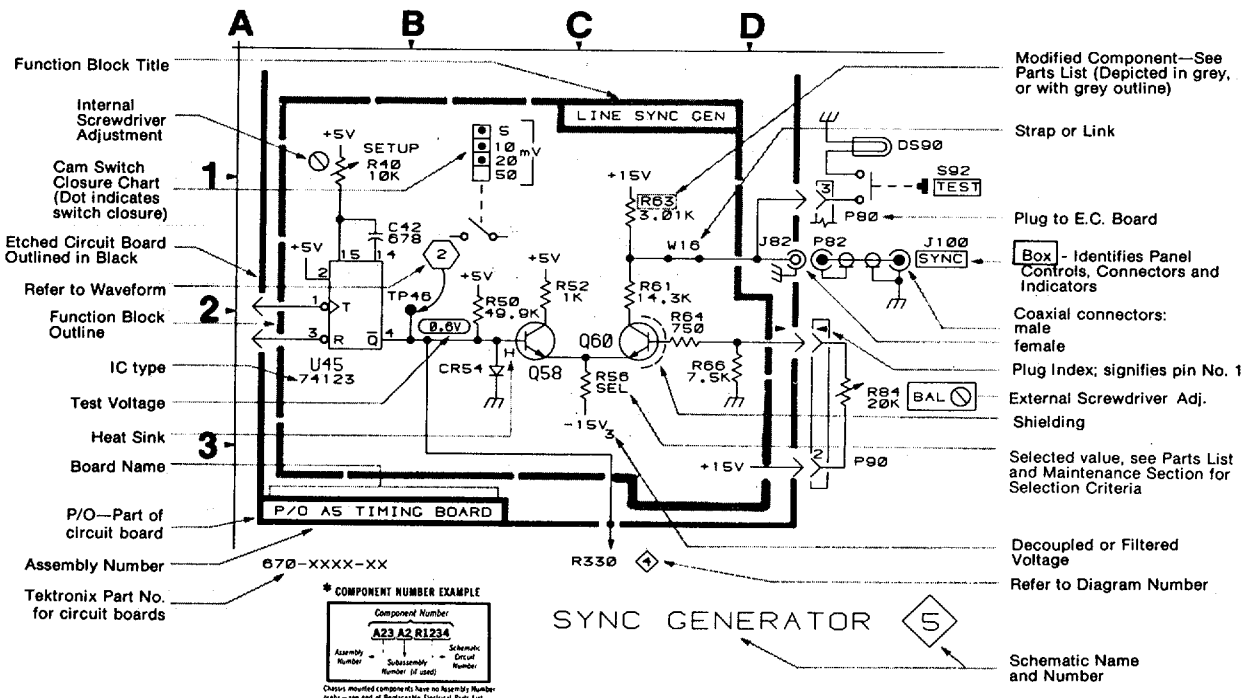
- Capacitors = Values one or greater are in picofarads (pF).
- Values less than one are in microfarads (μ F).
- Resistors = Ohms (Ω).

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

Assembly Numbers and Grid Coordinates

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

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



SECTION 9 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 |
| ACTR | NUMBER SIZE | ELEC | ELECTRICAL | INCAND | INCANDESCENT | SECT | SECTION |
| ADPTR | ACTUATOR | ELCTLT | ELECTROLYTIC | INSUL | INSULATOR | SEMICON | SEMICONDUCTOR |
| ALIGN | ADAPTER | ELEM | ELEMENT | INTL | INTERNAL | SHLD | SHIELD |
| AL | ALIGNMENT | EPL | ELECTRICAL PARTS LIST | PLHLD | LAMPHOLDER | SHLDR | SHOULDERED |
| ASSEM | ALUMINUM | EQPT | EQUIPMENT | MACH | MACHINE | SKT | SOCKET |
| ASSY | ASSEMBLED | EXT | EXTERNAL | MECH | MECHANICAL | SL | SLIDE |
| ATTEN | ASSEMBLY | FIL | FILLISTER HEAD | MTG | MOUNTING | SLFLKG | SELF-LOCKING |
| AWG | ATTENUATOR | FLEX | FLEXIBLE | NIP | NIPPLE | SLVG | SLEEVING |
| BD | AMERICAN WIRE GAGE | FLH | FLAT HEAD | NON WIRE | NOT WIRE WOUND | SPR | SPRING |
| BRKT | BOARD | FLTR | FILTER | OB | ORDER BY DESCRIPTION | SQ | SQUARE |
| BRS | BRACKET | FR | FRAME or FRONT | OD | OUTSIDE DIAMETER | SST | STAINLESS STEEL |
| BRZ | BRASS | FTSTNR | FASTENER | OVH | OVAL HEAD | STL | STEEL |
| BSHG | BRONZE | FT | FOOT | PH BRZ | PHOSPHOR BRONZE | SW | SWITCH |
| CAB | BUSHING | FXD | FIXED | PL | PLAIN or PLATE | T | TUBE |
| CAP | CABINET | GSKT | GASKET | PLSTC | PLASTIC | TERM | TERMINAL |
| CER | CAPACITOR | HDL | HANDLE | PN | PART NUMBER | THD | THREAD |
| CHAS | CERAMIC | HEX | HEXAGON | PNH | PAN HEAD | THK | THICK |
| CKT | CHASSIS | HEX HD | HEXAGONAL HEAD | PWR | POWER | TNSN | TENSION |
| COMP | CIRCUIT | HEX SOC | HEXAGONAL SOCKET | RCPT | RECEPTACLE | TPG | TAPPING |
| CONN | COMPOSITION | HLCPS | HELICAL COMPRESSION | RES | RESISTOR | TRH | TRUSS HEAD |
| COV | CONNECTOR | HLEXT | HELICAL EXTENSION | RGD | RIGID | V | VOLTAGE |
| CPLG | COVER | HV | HIGH VOLTAGE | RLF | RELIEF | VAR | VARIABLE |
| CRT | COUPLING | IC | INTEGRATED CIRCUIT | RTNR | RETAINER | W | WITH |
| DEG | CATHODE RAY TUBE | ID | INSIDE DIAMETER | SCH | SOCKET HEAD | WSHR | WASHER |
| DWR | DEGREE | IDENT | IDENTIFICATION | SCOPE | OSCILLOSCOPE | XFMR | TRANSFORMER |
| | DRAWER | IMPLR | IMPELLER | SCR | SCREW | XSTR | TRANSISTOR |

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip |
|-----------|---|---------------------------------------|-----------------------------|
| 0000M | SONY/TEKTRONIX CORPORATION | P O BOX 14, HANEDA AIRPORT | TOKYO 149, JAPAN |
| 000AZ | AIR OIL PROD. CORPORATION | 2400 E BURNSIDE | PORTLAND, OR 97214 |
| 000BK | STAUFFER SUPPLY | 105 SE TAYLOR | PORTLAND, OR 97214 |
| 000CY | NORTHWEST FASTENER SALES, | INC.7923 SW CIRRUS DRIVE | BEAVERTON, OR 97005 |
| 000EX | O'HARA METAL PRODUCT COMPANY | 542 BRANNAN STREET | SAN FRANCISCO, CA 94107 |
| 000FV | WESTERN SINTERING CO INC. | 2620 STEVENS DRIVE | RICHLAND, WA 99352 |
| 00779 | AMP, INC. | P.O. BOX 3608 | HARRISBURG, PA 17105 |
| 05276 | ITT, POMONA ELECTRONICS DIVISION | P O BOX 2767, 1500 E 9TH ST. | POMONA, CA 91766 |
| 05574 | VIKING INDUSTRIES, INC. | 21001 NORDHOFF STREET | CHATSWORTH, CA 91311 |
| 06090 | RAYCHEM CORPORATION | 300 CONSTITUTION DRIVE | MENLO PARK, CA 94025 |
| 06540 | AMATOM ELECTRONIC HARDWARE, DIV. OF MITE CORP. | 446 BLAKE ST. | NEW HAVEN, CT 06515 |
| 07322 | MINNESOTA RUBBER CO. | 3630 WOODDALE AVENUE | MINNEAPOLIS, MN 55416 |
| 07707 | USM CORP., USM FASTENER DIV. | 510 RIVER RD. | SHELTON, CT 06484 |
| 08261 | SPECTRA-STRIP CORP | 7100 LAMPSON AVE. | GARDEN GROVE, CA 92642 |
| 08530 | RELIANCE MICA CORP. | 342-39TH ST. | BROOKLYN, NY 11232 |
| 09353 | C AND K COMPONENTS, INC. | 103 MORSE STREET | WATERTOWN, MA 02172 |
| 12327 | FREEWAY CORPORATION | 9301 ALLEN DRIVE | CLEVELAND, OH 44125 |
| 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 |
| 22599 | ESNA, DIV. OF AMERACE CORPORATION | 16150 STAGG STREET | VAN NUYS, CA 91409 |
| 22670 | G.M. NAMEPLATE, INC. | 2040 15TH AVENUE WEST | SEATTLE, WA 98119 |
| 24655 | GENERAL RADIO CO. | 300 BAKER AVE. | CONCORD, MA 01742 |
| 24931 | SPECIALITY CONNECTOR CO., INC. | 2620 ENDRESS PLACE | GREENWOOD, IN 46142 |
| 52152 | MINNESOTA MINING AND MFG CO. | INDUSTRIAL SPECIALTIES DIV. 3M CENTER | ST. PAUL, MN 55144 |
| 59730 | THOMAS AND BETTS COMPANY | 36 BUTLER ST. | ELIZABETH, NJ 07207 |
| 70903 | BELDEN CORP. | 2000 S BATAVIA AVENUE | GENEVA, IL 60134 |
| 71126 | BRONSON, HOMER D., CO. | 250 MAIN ST., P. O. BOX 98 | BEACON FALLS, CT 06403 |
| 71400 | BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO. | 2536 W. UNIVERSITY ST. | ST. LOUIS, MO 63107 |
| 71468 | ITT CANNON ELECTRIC | 666 E. DYER RD. | SANTA ANA, CA 92702 |
| 71785 | TRW, CINCH CONNECTORS | 1501 MORSE AVENUE | ELK GROVE VILLAGE, IL 60007 |
| 72228 | CONTINENTAL SCREW CO., DIV. OF AMTEL, INC. | 459 MT. PLEASANT | NEW BEDFORD, MA 02742 |
| 73743 | FISCHER SPECIAL MFG. CO. | 446 MORGAN ST. | CINCINNATI, OH 45206 |
| 73803 | TEXAS INSTRUMENTS, INC., METALLURGICAL MATERIALS DIV. | 34 FOREST STREET | ATTLEBORO, MA 02703 |
| 74445 | HOLO-KROME CO. | 31 BROOK ST. WEST | HARTFORD, CT 06110 |
| 74970 | JOHNSON, E. F., CO. | 299 10TH AVE. S. W. | WASECA, MN 56093 |
| 75915 | LITTELFUSE, INC. | 800 E. NORTHWEST HWY | DES PLAINES, IL 60016 |
| 77250 | PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP. | 5700 W. ROOSEVELT RD. | CHICAGO, IL 60650 |
| 78189 | ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION | ST. CHARLES ROAD | ELGIN, IL 60120 |
| 78584 | STEWART STAMPING CORP. | 630 CENTRAL PARK AVE. | YONKERS, NY 10704 |
| 79136 | WALDES, KOHINOOR, INC. | 47-16 AUSTEL PLACE | LONG ISLAND CITY, NY 11101 |
| 79807 | WROUGHT WASHER MFG. CO. | 2100 S. O BAY ST. | MILWAUKEE, WI 53207 |
| 80009 | TEKTRONIX, INC. | P O BOX 500 | BEAVERTON, OR 97077 |
| 83309 | ELECTRICAL SPECIALITY CO., SUBSIDIARY OF BELDEN CORP. | 213 E. HARRIS AVE. SOUTH | SAN FRANCISCO, CA 94080 |
| 83330 | SMITH, HERMAN H., INC. | 812 SNEDIKER AVE. | BROOKLYN, NY 11207 |
| 83385 | CENTRAL SCREW CO. | 2530 CRESCENT DR. | BROADVIEW, IL 60153 |
| 83553 | ASSOCIATED SPRING CORP., SEABOARD DIV. | 15001 S BROADWAY, P O BOX 231 | GARDENA, CA 90248 |
| 85471 | BOYD, A. B., CO. | 2527 GRANT AVENUE | SAN LEANDRO, CA 94579 |
| 86928 | SEASTROM MFG. COMPANY, INC. | 701 SONORA AVENUE | GLENDALE, CA 91201 |
| 87308 | N. L. INDUSTRIES, INC., SOUTHERN SCREW DIV. | P. O. BOX 1360 | STATESVILLE, NC 28677 |
| 89663 | REESE, J. RAMSEY, INC. | 71 MURRAY STREET | NEW YORK, NY 10007 |
| 91737 | ITT CANNON GREMAR, INC. | 922 S. LYON ST. | SANTA ANA, CA 92705 |
| 91836 | KINGS ELECTRONICS CO., INC. | 40 MARBLEDALE ROAD | TUCKAHOE, NY 10707 |
| 93410 | ESSEX INTERNATIONAL, INC., CONTROLS DIV. LEXINGTON PLANT | P. O. BOX 1007 | MANSFIELD, OH 44903 |
| 97464 | INDUSTRIAL RETAINING RING CO. | 57 CORDIER ST. | IRVINGTON, NJ 07111 |
| 97539 | APM-HEXSEAL CORP. | 44 HONECK ST. | ENGLEWOOD, NJ 07631 |
| S3109 | C/O PANEL COMPONENTS CORP. | P.O. BOX 6626 | SANTA ROSA, CA 95406 |

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

| Mfr. Code | Manufacturer | Address | City, State, Zip |
|-----------|--------------|------------|------------------|
| T1063 | SCHOofs INC. | P O BOX 67 | MORAGA, CA 94556 |

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| Fig. & Index No. | Tektronix Part No. | Serial/Model No. | | Qty | Name & Description | Mfr | |
|------------------|--------------------|------------------|---------|-----|--|-------|-----------------|
| | | Eff | Dscont | | | Code | Mfr Part Number |
| 1- | 437-0190-00 | | | 1 | CAB.,TDR ACCESS: | 80009 | 437-0190-00 |
| | 105-0684-00 | B010100 | B092239 | 2 | LATCH ASSEMBLY: | 80009 | 105-0684-00 |
| | 105-0684-01 | B092240 | | 2 | LATCH ASSEMBLY: ***** (ATTACHING PARTS)***** | 80009 | 105-0684-01 |
| -1 | 211-0510-00 | | | 4 | SCREW,MACHINE:6-32 X 0.375,PNH,STL,CD PL ***** (END ATTACHING PARTS)***** LATCH ASSEMBLY INCLUDES: | 83385 | OBD |
| -2 | 367-0212-00 | B010100 | B092239 | 2 | HANDLE,LATCH:2.108 L,AL | 80009 | 367-0212-00 |
| | 367-0212-01 | B092240 | | 2 | HANDLE,LATCH:MOLDING ***** (ATTACHING PARTS)***** | 80009 | 367-0212-01 |
| -3 | 214-2350-00 | | | 2 | PIN,STR,HDLS:0.125 DIA X 2.0 INCH LONG | 000BK | OBD |
| -4 | 214-2357-00 | | | 2 | PIN,SPRING:0.375" L X 0.125 OD,STL *****END ATTACHING PARTS)***** | 22599 | 52-028-125-0375 |
| -5 | 351-0463-00 | B010100 | B092239 | 2 | GUIDE,SHAFT: | 80009 | 351-0463-00 |
| | 351-0463-01 | B092240 | | 2 | GUIDE,SHAFT:STEEL ***** (ATTACHING PARTS)***** | 80009 | 351-0463-01 |
| -6 | 214-0110-00 | | | 2 | PIN,SPRING:0.25 L X 0.066 OD,STL,CD PL ***** (END ATTACHING PARTS)***** | 22599 | 52-012-062-0250 |
| -7 | 214-2352-00 | | | 2 | SPRING,HLCPS:1.0" L X 0.24" OD,MUSIC WIR | 83553 | C0240-042-100M |
| -8 | 354-0324-00 | | | 2 | RING,RETAINING:E SHAPE,0.102 ID X 0.270 | 79136 | 5133-14-MD |
| -9 | 384-1385-00 | | | 2 | EXTENSION SHAFT:2.274" L X 0.188 OD,STL ***** (ATTACHING PARTS)***** | 80009 | 384-1385-00 |
| -10 | 214-2351-00 | | | 2 | PIN,SPRING:0.375" L X 0.101" OD,STL ***** (END ATTACHING PARTS)***** | 22599 | 52-022-094-0375 |
| -11 | 105-0686-00 | | | 2 | LATCH,COVER ***** (ATTACHING PARTS)***** | 80009 | 105-0686-00 |
| -12 | 214-2349-00 | | | 2 | PIN,STR,HDLS:0.125 DIA X 1.0 INCH LONG,S ***** (END ATTACHING PARTS)***** | 000BK | OBD |
| -13 | 361-0762-00 | | | 2 | SPACER,SLEEVE:0.128 ID X 0.15" L,BRASS | 80009 | 361-0762-00 |
| -14 | 214-2345-00 | | | 2 | SPR,HLCL,TRSN:0.665 INCH L X 0.245 OD,SS | 80009 | 214-2345-00 |
| -15 | 214-2351-00 | B010100 | B092220 | 4 | PIN,SPRING:0.375" L X 0.101" OD,STL | 22599 | 52-022-094-0375 |
| -16 | 426-1271-00 | B010100 | B092220 | 2 | FRAME,LATCH: | 80009 | 426-1271-00 |
| | 426-1271-02 | B092221 | | 2 | FRAME,LATCH: | 80009 | 426-1271-02 |
| -17 | 214-0787-00 | | | 1 | STEM,LATCH:1.110 X 0.185" WHITE PLSTC | 80009 | 214-0787-00 |
| -18 | 204-0282-00 | | | 1 | BODY,LATCH:1.0 X 1.0 X 0.54",BLACK PLS | 80009 | 204-0282-00 |
| -19 | 214-2389-00 | | | 2 | PIN,ACTUATOR:POWER SWITCH ***** (ATTACHING PARTS)***** | 80009 | 214-2389-00 |
| -20 | 211-0008-00 | | | 2 | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -21 | 200-1778-00 | | | | DOOR,ACCESS:FRONT COVER ***** (ATTACHING PARTS)***** | 80009 | 200-1778-00 |
| -22 | 211-0101-00 | | | 2 | SCREW,MACHINE:4-40 X 0.25,100 DEG,FLH STL | 83385 | OBD |
| -23 | 210-0586-00 | | | 2 | NUT,PL,ASSEM WA:4-40 X 0.25,STL ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -24 | 214-0001-00 | | | 1 | HINGE,BUTT:1.5 X 1.0,BRS ***** (ATTACHING PARTS)***** | 71126 | B78 |
| -25 | 211-0102-00 | | | 2 | SCREW,MACHINE:4-40 X 0.500",FLH,STL ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -26 | 386-3216-00 | | | 1 | SUPPORT,HINGE:ACCESS DOOR | 80009 | 386-3216-00 |
| -27 | 105-0652-00 | | | 1 | STRIKE,CATCH:ACCESS DOOR ***** (ATTACHING PARTS)***** | 80009 | 105-0652-00 |
| -28 | 211-0102-00 | | | 2 | SCREW,MACHINEi4-40 X0.500",FLH,STL ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -29 | 200-1759-00 | | | 1 | COVER,TDR UNIT:FRONT | 80009 | 200-1759-00 |
| -30 | 200-1805-00 | | | 2 | COV,HDL LATCH: ***** (ATTACHING PARTS)***** | 80009 | 200-1805-00 |
| -31 | 213-0739-00 | | | 4 | SCREW,MACHINE:10-32 X 0.375 INCH,HEX HD,S ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -32 | 210-1231-00 | | | 2 | WASHER,FLAT:0.203 ID X 0.875 OD,STL | 86928 | 5712-82-60-C2 |
| -33 | 386-3303-01 | | | 2 | PLATE,SECURING:HANDLE,STEEL | 80009 | 386-3303-01 |
| -34 | 107-0035-00 | | | 4 | DISC,FRICITION:0.38 ID X 1.865 OD | 80009 | 107-0035-00 |
| -35 | 334-2467-00 | | | 1 | PLATE,IDENT: | 80009 | 334-2467-00 |
| -36 | 367-0204-01 | | | 1 | HANDLE,CARRYING:W/HARDWARE | 80009 | 367-0204-01 |

| Fig. & Index No, | Tektronix Part No. | Serial/Model No. | | Qty | 1 2 3 4 5 Name & Description | Mfr | |
|------------------------|-----------------------|------------------|---------|-----|---|-------|-----------------|
| | | Eff | Dscont | | | Code | Mfr Part Number |
| 1-37 | 437-0188-00 | | | 1 | CAB.,TDR UNIT: | 80009 | 437-0188-00 |
| -38 | 348-0419-00 | | | 2 | FOOT,CABINET:FRONT ***** (ATTACHING PARTS) ***** | 80009 | 348-0419-00 |
| -39 | 211-0507-00 | | | 4 | SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -40 | 213-0451-00 | B010100 | B102826 | 4 | SCR,EXT,RLV BOD:FOOT RETAINING | 80009 | 213-0451-00 |
| | 213-0451-01 | B102827 | | 4 | SCREW,EXT,RLV:FOOT,RETAINING ***** (ATTACHING PARTS) ***** | 80009 | 213-0451-01 |
| -41 | 354-0175-00 | | | 4 | RING,RETAINING:TYPE EXT,U/O 0.188 ID SFT ***** (END ATTACHING PARTS) ***** | 79136 | 5133-18-MI |
| | 334-2666-00 | B010100 | B102569 | 1 | MARKER,IDENT:MKD 110V | 80009 | 334-2666-00 |
| | 334-2666-01 | B102570 | | 1 | MARKER,IDENT:MKD 115VAC | 22670 | OBD |
| | 334-2667-00 | B010100 | B102569 | 1 | MARKER,IDENT:MARKED 230V (OPTION 6 ONLY) | 80009 | 334-2667-00 |
| | 334-2667-01 | B102570 | | 1 | MARKER,IDENT:MARKED 230VAC (OPTION 6 ONLY) | 80009 | 334-2667-01 |

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| Fig. & Index No, | Tektronix Part No. | Serial/Model No. | | Qty | 1 2 3 4 5 Name & Description | Mfr Code | Mfr Part Number |
|------------------|--------------------|------------------|---------|-----|---|----------|------------------|
| | | Eff | Dscont | | | | |
| 2-1 | 366-0494-00 | | | 2 | KNOB:GRAY WITH SETSCREW | 80009 | 3866-0494-00 |
| | 213-0153-00 | | | 2 | SETSCREW:5-40 X 0.125,STL BK OXD,HEX | 000CY | OBD |
| -2 | 366-1319-02 | | | 1 | KNOB:GY,0.79 ID,0.28 OD,0.32 H | 80009 | 366-1319-02 |
| | 213-0075-00 | | | 1 | SETSCREW:4-40 X 0.094,STL BK OXD,HEX | 000BK | OBD |
| -3 | 366-1059-00 | | | 1 | PUSH BUTTON:GRAY | 80009 | 366-1059-00 |
| -4 | 366-1334-00 | | | 2 | KNOB:GRAY | 80009 | 366-1344-00 |
| | 213-015300 | | | 2 | SETSCREW:5-40 X 0.125,STL BK OXD,HEX | 000CY | OBD |
| -5 | 366-1190-00 | | | 1 | KNOB:GRAY | 80009 | 366-1190-00 |
| | 213-015300 | | | 2 | SETSCREW:5-40 X 0.125,STL BK OXD,HEX | 000CY | OBD |
| -6 | 366-1031-00 | | | 1 | KNOB:RED | 80009 | 366-1031-00 |
| | 213-0153-00 | | | 1 | SETSCREW:5-40 X 0.125,STL BK OXD,HEX | 000CY | OBD |
| -7 | 366-1408-00 | | | 1 | KNOB:GRAY | 80009 | 366-1408-00 |
| | 213-0153-00 | | | 2 | SETSCREW:5-40 X 0.125,STL BK OXD,HEX | 000CY | OBD |
| -8 | 366-1620-11 | | | 1 | PUSH BUTTON:GRAY-SOLID POL | 80009 | 366-1620-11 |
| -9 | 366-1620-10 | | | 1 | PUSH BUTTON:SIL GY,SOLID PTFE | 80009 | 366-1620-10 |
| -10 | 3686-1620-08 | | | 1 | PUSH BUTTON:SIL GY,OTHER | 80009 | 366-1620-08 |
| -11 | 366-1620-02 | | | 1 | PUSH BUTTON:GRAY-NOISE FILTER | 80009 | 366-1620-02 |
| -12 | 426-0681-00 | | | 4 | FR,PUSH BUTTON:GRAY PLASTIC | 80009 | 426-0681-00 |
| -13 | 366-1269-00 | B010100 | B039999 | 1 | KNOB:GY,1.041 OD X 0.7 H,ABS | 80009 | 366-1269-00 |
| | 3866-1269-05 | B040000 | | 1 | SHELL,KNOB:GY,1.041 OD X 0.7 H,PC W/LE | 80009 | 366-1269-05 |
| -14 | 384-1159-01 | | | 1 | EXTENSION SHAFT:4.5 INCH LONG W/KNOB | 80009 | 384-1159-01 |
| -15 | 35-0216-00 | | | 1 | BUSHING,PLASTIC:0.257 ID X 0.412 INCH OD | 80009 | 358-0216-00 |
| -16 | | | | | RESISTOR,VAR:(SEE R0472 REPL) | | |
| -17 | 210-0046-00 | | | 1 | WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS | 78189 | 1214-05-00-0541C |
| -18 | 129-0290-00 | | | 1 | POST,ELEC-MECH:0.635 INCH LONG,HEX ***** (ATTACHING PARTS)***** | 80009 | 129-0290-00 |
| -19 | 35-0342-00 | | | 1 | BSHG,MACH.THD:0.25 X 32 X 0.352 INCH LONG ***** (END ATTACHING PARTS)***** | 80009 | 358-0342-00 |
| -20 | | | | | SWITCH,TOGGLE:(SEE S0481 REPL) ***** (ATTACHING PARTS)***** | | |
| -21 | 200-1744-00 | | | 1 | CAP.,TOGGLE SW:SEAL,25-40 THD | 97539 | N5040 |
| -22 | 211-0583-00 | | | 1 | SCREW,MACHINE:0.25-32 X 0.312 INCH,BRS ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -23 | 162-0593-00 | B010100 | B081319 | IN | INS SLV,ELEC:0.5 INCH DIA,BLUE HEAT SHRI | 06090 | 1004040 |
| | 162-0031-00 | B081320 | | AR | INSUL SLVG,ELEC:HEAT SHRINK,0.54 ID | 93410 | FL25090 |
| -24 | 352-0362-00 | | | 2 | FUSEHOLDER: W/MOUNTING HARDWARE ***** (ATTACHING PARTS)***** | 75915 | 345603 |
| | 220-0859-00 | B071082 | | 2 | NUT,PLAIN,HEX:5-28 THD X 0.688 HEX,STL ***** (END ATTACHING PARTS)***** | 80009 | 220-0859-00 |
| -25 | 210-1245-00 | | | 1 | WASHER,FLAT:0.375 ID X 0.562 OD,STL | 85471 | OBD |
| -26 | 210-1242-00 | | | 2 | WASHER,FLAT:0.51 ID X 0.688 OD,AL | 86928 | 5712-113-90 |
| -27 | | | | 1 | RES.,VAR,WW:(SEE R1051 REPL) ***** (ATTACHING PARTS)***** | | |
| -28 | 210-0583-00 | B010100 | 8113138 | 2 | NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS | 73743 | 2X20317-402 |
| -29 | 210-0940-00 | B010100 | 8089999 | 1 | WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL | 79807 | OBD |
| | 220-0484-00 | 8090000 | 6113138 | 1 | NUT,PLAIN,HEX.:0.2542 X 0.375 INCH AL ***** (END ATTACHING PARTS)***** RESISTOR ASSY INCLUDES: RESISTOR,VAR:(SEE R0151 REPL) | 80009 | 220-0484-00 |
| | 210-0583-00 | | | 2 | NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS | 73743 | 2X20317-402 |
| | 220-0484-00 | | | 1 | NUT,PLAIN,HEX.:0.25-32 X 0.375 INCH AL | 80009 | 220-0484-00 |
| | | | | 1 | SWITCH,PUSH:(SEE S0151 REPL) | | |
| -30 | | | | 1 | RESISTOR,VAR:(SEE R0251 REPL) ***** (ATTACHING PARTS)***** | | |
| -31 | 210-0583-00 | | | 2 | NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS | 73743 | 2X20317-402 |
| -32 | 210-0940-00 | | | 1 | WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL ***** (END ATTACHING PARTS)***** | 79807 | OBD |
| -33 | | | | 1 | RESISTOR,VAR:(SEE R0263 REPL) | | |
| -34 | 210-0223-00 | | | 1 | TERMINAL,LUG:0.25 INCH DIA,SE | 86928 | A313136 |
| -35 | 129-0290-00 | | | 1 | POST,ELEC-MECH:0.635 INCH LONG,HEX ***** (ATTACHING PARTS)***** | 80009 | 129-0290-00 |
| -36 | 358-0342-00 | | | 1 | BSHG.MACH.THD:0.25 X 32 X 0.352 INCH LONG ***** (END ATTACHING PARTS)***** | 80009 | 358-0342-00 |
| -37 | 200-1341-00 | | | 2 | COVER,INS,HV:MOLDE BLACK | 80009 | 200-1341-00 |

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Dscont Qty | 1 2 3 4 5 | Name & Description | Mfr Code | Mfr Part Number |
|------------------|--------------------|----------------------|------------|-----------|---|----------|------------------|
| 2-38 | | | 1 | | RESISTOR,VAR:(SEE R0432 REPL) ***** (ATTACHING PARTS)***** | | |
| -39 | 210-0583-00 | | 1 | | NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS | 73743 | 2X20317-402 |
| -40 | 210-0940-00 | | 1 | | WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL ***** (END ATTACHING PARTS)***** | 79807 | OBD |
| -41 | | | | | RESISTOR,VAR:(SEE R0442 REPL) ***** (ATTACHING PARTS)***** | | |
| -42 | 210-0583-00 | | 1 | | NUT,PLAIN,HEX:0.2532 X 0.312 INCH,BRS | 73743 | 2X20317-402 |
| -43 | 210-0940-00 | | 1 | | WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL ***** (END ATTACHING PARTS)***** | 79807 | OBD |
| -44 | 354-0563-00 | B040000 | 1 | | PACKING,PREFMD:0.65 ID X 0.74 OD | 000AZ | 5-64 N506-65 |
| -45 | 210-1085-00 | | 1 | | RESISTOR,VAR:(SEE R0271 REPL) | | |
| -46 | 210-0845-00 | | 1 | | WASHER,FLAT:0.375 ID X 0.75 INCH OD,STL | 12327 | OBD |
| -47 | 333-1991-03 | B010100 | 1 | B102694 | WASHER,FLAT:0.500 ID X 0.625 INCH OD,ST | 89663 | 634-R |
| | 333-1991-05 | B102695 | 1 | | PANEL,FRONT: | 80009 | 333-1991-03 |
| | 333-2119-02 | B010100 | 1 | B102694 | PANEL,FRONT: | 80009 | 333-1991-05 |
| | | | | | (OPTION 5 ONLY) | | |
| | 333-2119-04 | B102695 | 1 | | PANEL,FRONT: | 80009 | 333-2119-04 |
| | | | | | (OPTION 5 ONLY) | | |
| -48 | 348-0421-00 | B010100 | 1 | B060959 | SEAL,INDICATOR:BATTERY LEVEL | 80009 | 348-0421-00 |
| | | B060960 | 1 | | (REPLACEABLE WITH FRONT PANEL ASSY) | | |
| -49 | 210-1246-00 | | 2 | | WASHER,FLAT:0.5 ID X 0.688 OD,STL | 80009 | 210-1246-00 |
| | 211-0160-00 | B102695 | 1 | | SCREW MACHINE:0-80 X 0.188,FILH,SST,SLOT | 83385 | OBD |
| -50 | 348-0409-03 | | 1 | | SEAL,PB: 3 BUTTON | 80009 | 348-0409-03 |
| -51 | 348-0409-01 | | 1 | | SEAL,PB: 1 BUTTON | 80009 | 348-0409-01 |
| -52 | 348-0422-00 | | 1 | | SEAL,SWITCH:POWER | 80009 | 348-0422-00 |
| -53 | | | 1 | | METER,ELEC FREQO:(SEE M0171 REPL) | | |
| -54 | 352-0243-00 | | 1 | | HOLDER,INDICATR:BATTERY LEVEL,PLASTIC | 80009 | 352-0243-00 |
| -55 | 348-0477-00 | | 2 | | SEAL,RBR STRIP:0.94 X 28.0 INCH LONG | 85471 | OBD |
| -56 | 348-0342-01 | B010100 | 1 | B010209 | PAD,CUSHIONING:REAR CRT W/PLATE ***** (ATTACHING PARTS)***** | 80009 | 348-0342-01 |
| -57 | 211-0513-00 | B010100 | 2 | B010209 | SCREW,MACHINE:6-32 X 0.625 INCH,PNH STL ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -58 | 214-1304-00 | B010100 | 2 | B010209 | SPRING,HLCPS:0.30 OD X 1.25 INCH LONG | 80009 | 214-1304-00 |
| -59 | 361-0109-00 | B010100 | 2 | B010209 | NUT,PLAIN,HEX:0.641 INCH LONG,W/0.375 HEX ***** (ATTACHING PARTS)***** | 80009 | 361-0109-00 |
| -60 | 211-0507-00 | B010100 | 2 | B010209 | SCREW,MACHINE: 6-32 X 0.312 INCH,PNH STL | 83385 | OBD |
| -61 | 210-0006-00 | B010100 | 2 | B010209 | WASHER,LOCK:#6 INTL,0.018 THK,STL CD PL ***** (END ATTACHING PARTS)***** | 78189 | 1206-00-00-0541C |
| -62 | 213-0738-00 | B010210 | 1 | | SCREW,ADJUSTING:1.188 INCH LONG | 80009 | 213-0738-00 |
| -63 | 220-0415-00 | B010210 | 1 | | NUT,PLAIN,HEX.:0.312-32 X 0.013" THK,BRS | 73743 | 2X-28046-402 |
| -64 | 129-0602-00 | B010210 | 1 | | POST,ELEC-MECH:1.14" L,0.438 HEX BRASS ***** (ATTACHING PARTS)***** | 80009 | 129-0602-00 |
| -65 | 212-0507-00 | B010210 | 1 | | SCREW,MACHINE:10-342 X 0.375 INCH,PNH STL | 83385 | OBD |
| -66 | 210-0009-00 | B010210 | 1 | | WASHER,LOCK:EXT,0.1931D X 0.40" OD,STL ***** (END ATTACHING PARTS)***** | 78189 | 1110-00 |
| -67 | 129-0562-00 | B010210 | 1 | | POST,RETAINER:0.892 INCH LONG X 0.375 HEX ***** (ATTACHING PARTS)***** | 80009 | 129-0562-00 |
| -68 | 211-0198-00 | B010210 | 1 | | SCREW,MACHINE:4-40 X 0.438 PNH,STL,POZ | 77250 | OBD |
| -69 | 210-0003-00 | | 1 | | WASHER,LOCK:EXT,0.123 ID X 0.245" OD,ST ***** (END ATTACHING PARTS)***** | 78189 | 1104-00-00-0541C |
| -70 | 386-3520-00 | B010210 | 1 | | SUPPORT,CRT:REAR ***** (ATTACHING PARTS)***** | 80009 | 386-3520-00 |
| -71 | 210-0586-00 | B010210 | 1 | | NUT,PL,ASSEM WA:4-40 X 0.25,STL | 83385 | OBD |
| -72 | 211-0033-00 | B010210 | 5 | | SCR,ASSEM WSHR:4-40 X 0.312 PNH,STL,CD PL ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -73 | 386-3153-00 | | 1 | | SUPPORT,CRT SH:REAR ***** (ATTACHING PARTS)***** | 80009 | 386-3153-00 |
| -74 | 210-0586-00 | | 3 | | NUT,PL,ASSEM WA:4-40 X 0.25,STL | 83385 | OBD |
| -75 | 211-0008-00 | | 6 | | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS)***** | 83385 | OBD |
| -76 | 136-0644-00 | | 1 | | SOCKET ASSY:CRT | 80009 | 136-0644-00 |
| -77 | 386-1316-00 | | 1 | | SUPPORT,CRT:REAR | 80009 | 386-1316-00 |
| -78 | 136-0266-01 | | 1 | | SKT,PL-IN ELEK:ELCTR N TUBE,12 CONT,W/LEAD | 0000M | OBD |
| -79 | 131-0707-00 | | 55 | | CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD | 22526 | 47439 |
| | 131-0708-00 | | 2 | | CONTACT,ELEC:0.48"L,28-32 AWG WIRE | 22526 | 47437 |
| | 131-0621-00 | | 4 | | CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD | 22526 | 46231 |

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. | | 1 | 2 | 3 | 4 | 5 | Name & Description | Mfr | |
|------------------|--------------------|------------------|------------|----|---|---|---|---|--|-------|-----------------|
| | | Eff | Dscont Qty | | | | | | | Code | Mfr Part Number |
| 2-80 | 352-0171-03 | | | 1 | | | | | CONN BODY,PL,EL:1 WIRE ORANGE | 80009 | 352-0171-03 |
| | 352-0171-08 | | | 1 | | | | | CONN BODY,PL,EL:1 WIRE GRAY | 80009 | 352-0171-08 |
| | 352-0171-09 | | | 1 | | | | | CONN BODY,PL,EL:1 WIRE WHITE | 80009 | 352-0171-09 |
| -81 | 352-0169-01 | | | 1 | | | | | HLDR TERM CONN:2 WIRE BROWN | 80009 | 352-0169-01 |
| | 352-0169-02 | | | 1 | | | | | CONN BODY,PL,EL:2 WIRE RED | 80009 | 352-0169-02 |
| -82 | 352-0162-03 | | | 1 | | | | | CONN BODY,PL,EL:4 WIRE-ORANGE | 80009 | 352-0162-03 |
| | 352-0162-07 | | | 1 | | | | | CONN BODY,PL,EL:4 WIRE VIOLET | 80009 | 352-0162-07 |
| -83 | 352-0163-04 | | | 1 | | | | | CONN BODY,PL,EL:5 WIRE YELLOW | 80009 | 352-0163-04 |
| | 352-0163-05 | | | 1 | | | | | CONN BODY,PL,EL:5 WIRE GREEN | 80009 | 352-0163-05 |
| -84 | 352-0165-08 | | | 1 | | | | | CONN BODY,PL,EL:7 WIRE GRAY | 80009 | 352-0165-08 |
| | 352-0165-09 | | | 1 | | | | | CONN BODY,PL,EL:7 WIRE WHITE | 80009 | 352-0165-09 |
| -85 | 352-0166-05 | | | 1 | | | | | CONN BODY,PL,EL:8 WIRE GREEN | 80009 | 352-0166-05 |
| | 352-0166-06 | | | 1 | | | | | CONN BODY,PL,EL:8 WIRE BLUE | 80009 | 352-0166-06 |
| -86 | 352-0168-09 | | | 1 | | | | | CONN BODY,PL,EL:10 WIRE WHITE | 80009 | 352-0168-09 |
| -87 | 352-0200-02 | | | 1 | | | | | CONN BODY,PL EL:4 WIRE RED | 80009 | 352-0200-02 |
| -88 | 386-3113-00 | | | 1 | | | | | SUPPORT,CRT:REAR | 80009 | 386-3113-00 |
| -89 | 348-0239-00 | | | 1 | | | | | GROMMET,PLASTIC:DK GRAY,U-SHAPE,0.27 ID | 80009 | 348-0239-00 |
| -90 | 348-0067-00 | | | 1 | | | | | GROMMET,PLASTIC:0.312 INCH DIA | 80009 | 348-0067-00 |
| -91 | 337-2085-00 | | | 1 | | | | | SHIELD,CRT: | 80009 | 337-2085-00 |
| -92 | 386-3112-00 | | | 1 | | | | | SUPPORT,CRT:FRONT | 80009 | 386-3112-00 |
| -93 | 343-0610-00 | | | 1 | | | | | RETAINER,SHLD:IMPLOSION | 80009 | 343-0610-00 |
| -94 | 337-2206-00 | | | 1 | | | | | SHLD,IMPLOSION:CRT,CLEAR | 80009 | 337-2206-00 |
| -95 | 407-1589-00 | | | 1 | | | | | BRACKET,ANGLE:PLUG IN GUIDE,ALUMINUM ***** (ATTACHING PARTS) ***** | 80009 | 407-1589-00 |
| -96 | 211-0084-00 | | | 2 | | | | | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -97 | 337-2137-00 | | | 1 | | | | | SHIELD,ELEC:PULSER SAMPLER,BOTTOM ***** (ATTACHING PARTS) ***** | 80009 | 337-2137-00 |
| -98 | 211-0136-00 | | | 12 | | | | | SCREW,MACHINE:2-56 X 0.094 INCH,PNH STL ***** (END ATTACHING PARTS) ***** | 73743 | OBD |
| -99 | 337-2138-00 | | | 1 | | | | | SHIELD,ELEC:PULSER SAMPLER,TOP (MOUNTED ON COMPONENT SIDE OF CKT BD) ***** (ATTACHING PARTS) ***** | 80009 | 337-2138-00 |
| -100 | 211-0136-00 | | | 12 | | | | | SCREW,MACHINE:2-56 X 0.094 INCH,PNH STL ***** (END ATTACHING PARTS) ***** | 73743 | OBD |
| -101 | 381-0359-00 | | | 1 | | | | | BAR,SUPPORT:PULSE SAMPLER,TOP,AL ***** (ATTACHING PARTS) ***** | 80009 | 381-0359-00 |
| -102 | 213-0202-00 | | | 9 | | | | | SCREW,MACHINE:2-56 X 0.625 INCH,FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -103 | 337-2133-00 | | | 1 | | | | | SHIELD,ELEC:50 OHM STRIP LINE,BOTTOM ***** (ATTACHING PARTS) ***** | 80009 | 337-2133-00 |
| -104 | 211-0159-00 | | | 6 | | | | | SCREW,MACHINE:2-56 X 0.375 INCH,PNH STL | 87308 | OBD |
| -105 | 211-0100-00 | B010100 | B040622 | 1 | | | | | SCREW,MACHINE:2-56 X 0.750 INCH,PNH,STL | 83385 | OBD |
| | 213-0202-00 | B040623 | | 1 | | | | | SCREW,MACHINE:2-56 X 0.625 INCH,FLH STL | 83385 | OBD |
| -106 | 213-0202-00 | | | 5 | | | | | SCREW,MACHINE:2-56 X 0.625 INCH,FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -107 | 381-0358-00 | | | 1 | | | | | BAR,SUPPORT:PULSE SAMPLER,BOTTOM,AL ***** (ATTACHING PARTS) ***** | 80009 | 381-0358-00 |
| -108 | 211-0030-00 | | | 2 | | | | | SCREW,MACHINE:2-56 X 0.25"82 DEG,FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -109 | 337-2134-00 | | | 1 | | | | | SHIELD,ELEC-50 OHM STRIP LINE, TOP ***** (ATTACHING PARTS) ***** | 80009 | 337-2134-00 |
| -110 | 211-0008-00 | | | 4 | | | | | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -111 | 210-1251-00 | | | 1 | | | | | WASHER,FLAT:0.5 ID X 0.688 OD,SPONGE | 80009 | 210-1251-00 |
| -112 | 129-0554-00 | B010100 | B113859 | 1 | | | | | SPACER,POST:0.975" L W/4-40 THD,PLSTC | 80009 | 129-0554-00 |
| | 129-0554-01 | B113860 | | 1 | | | | | SPACER,POST:0.975L W/0.094 ID ***** (ATTACHING PARTS) ***** | 80009 | 129-0554-01 |
| -113 | 211-0008-00 | B010100 | B113859 | 2 | | | | | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL | 83385 | OBD |
| | 213-0912-00 | B113860 | | 2 | | | | | SCREW,TPGTF:4-20 X 0.25,PNH,STL,CD,PL ***** (ATTACHING PARTS) ***** | 72228 | OBD |

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Model No. Dscont Qty | 1 2 3 4 5 | Name & Description | Mfr Code | Mfr Part Number |
|------------------|--------------------|----------------------|----------------------|-----------|---|----------|------------------|
| 2-114 | 384-1101-00 | | | 4 | EXTENSION SHAFT:4.14 INCH LONG | 80009 | 384-1101-00 |
| | 672-0487-00 | | | 1 | CKT BOARD ASSY:MAIN | 80009 | 672-0487-00 |
| | 672-0570-00 | | | 1 | CKT BOARD ASSY:MAIN-VERTICAL | 80009 | 672-0570-00 |
| | | | | - | (OPTION 5 ONLY) | | |
| | | | | | ***** (ATTACHING PARTS) ***** | | |
| -115 | 377-0451-00 | | | 2 | INSERT SFT SEAL:0.625 OD X 0.407,0.562-18 | 80009 | 377-0451-00 |
| -116 | 354-0555-00 | | | 2 | PACKING,PREFMD:0.25 ID X 0.375 INCH OD | 07322 | 8010-559AN |
| -117 | 211-0116-00 | | | 1 | SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS | 83385 | OBD |
| -118 | 213-0088-00 | | | 1 | SCR,TPG,THD CTG:4-24 X 0.25 INCH,PNH STL | 83385 | OBD |
| | | | | | ***** (END ATTACHING PARTS) ***** | | |
| | | | | - | CKT BOARD ASSY INCLUDES: | | |
| -119 | | | | 1 | CKT BOARD ASSY:MAIN(SEE A1 REPL) | | |
| | | | | | ***** (ATTACHING PARTS) ***** | | |
| | 346-0160-00 | B060986 | | 1 | STRAP,GROUNDING:0.625 L | 80009 | 346-0160-00 |
| -120 | 211-0147-00 | | | 10 | SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL | 83385 | OBD |
| -121 | 210-0003-00 | | | 10 | WASHER,LOCK:EXT,0.123 ID X 0.245" OD,ST | 78189 | 1104-00-00-0541C |
| | | | | | ***** (END ATTACHING PARTS) ***** | | |
| | | | | - | CKT BOARD ASSY INCLUDES: | | |
| -122 | 337-2157-00 | | | 2 | SHIELD,ELEC:PULSER SAMPLER | 80009 | 337-2157-00 |
| -123 | 337-2158-00 | | | 2 | SHIELD,ELEC:STROBE/PREAMPL | 80009 | 337-2158-00 |
| -124 | 337-2135-00 | | | 1 | SHIELD,ELEC:PULSER,SAMPLER,REAR | 80009 | 337-2135-00 |
| -125 | 131-1097-00 | B010100 | B040615 | 1 | CONNECTOR,RCPT.: BNC,FEMALE,CKT BOARD MT | 24931 | 28JR220-2 |
| | 131-2010-00 | B040616 | | 1 | CONNECTOR,RCPT.: BNC,FEMALE | 24931 | 28JR200-2 |
| | 200-2069-00 | B040616 | | 1 | CAP.,PROTECTIVE: BNC,RECEPTACLE | 24931 | 28PC110-2 |
| -126 | 131-0604-00 | | | 13 | CONTACT,ELEC: CKT BD SW,SPR,CU BE | 80009 | 131-0604-00 |
| -127 | 200-0687-01 | | | 6 | COV,TRANSISTOR.: 0.438 DIA X 0.47 INCH H | 80009 | 200-0687-01 |
| -128 | 136-0235-00 | | | 6 | SOCKET,PLUG-IN: 6 CONTACT,ROUND | 71785 | 133-96-12-062 |
| -129 | 343-0497-00 | | | 1 | CLIP,SWITCH: REAR | 80009 | 343-0497-00 |
| | | | | | ***** (ATTACHING PARTS) ***** | | |
| -130 | 210-3033-00 | | | 6 | EYELET,METALLIC: 0.59 OD X 0.156 INCH LON | 07707 | SE-25 |
| | | | | | ***** (END ATTACHING PARTS) ***** | | |
| -131 | 343-0496-00 | | | 1 | CLIP,SWITCH: FRONT | 80009 | 343-0496-00 |
| | | | | | ***** (ATTACHING PARTS) ***** | | |
| -132 | 210-3033-00 | | | 6 | EYELET,METALLIC: 0.59 OD X 0.156 INCH LON | 07707 | SE-25 |
| | | | | | ***** (END ATTACHING PARTS) ***** | | |
| -133 | 136-0514-00 | B010100 | B102647 | 1 | SKT,PL-IN ELEC: MICROCIRCUIT,8 DIP | 73803 | CS9002-8 |
| -134 | 131-0608-00 | | | 38 | TERMINAL,PIN: 0.365 L X 0.025 PH BRZ GOLD | 22526 | 47357 |
| -135 | 214-0579-00 | | | 13 | TERM,TEST POINT: BRS CD PL | 80009 | 214-0579-00 |
| -136 | 136-0252-04 | B010100 | B102647 | 94 | SOCKET,PIN TERM: U/W 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| -137 | 136-0260-02 | B010100 | B102647 | 1 | SKT,PL-IN ELEK :MICROCIRCUIT,16 DIP,LOW C | 71785 | 133-51-92-008 |
| -138 | 136-0269-02 | B010100 | B102647 | 2 | SKT,PL-IN ELEK: MICROCIRCUIT,14 DIP,LOW C | 73803 | CS9002-14 |
| -139 | 214-0259-00 | | | 1 | SPRING,HLCPS: 0.118 OD X 0.312 L,CLOSED | 80009 | 214-0259-00 |
| -140 | 210-0676-00 | | | 1 | EYELET,METALLIC:0.089 OD X 0.281 L,BRS | 83385 | OBD |
| -141 | 380-0103-00 | | | 1 | HSG,HELICAL SPR: BRS ALBALOY PL | 80009 | 380-0103-00 |
| -142 | | | | 1 | SWITCH,PB ASSY: (SEE S1251 REPL) | | |
| | | | | 1 | SW CAM ACTR AS: (SEE S1222 REPL) | | |
| | | | | | ***** (ATTACHING PARTS) ***** | | |
| -143 | 211-0147-00 | | | 6 | SCREW,MACHINE: 4-40 X 0.25 INCH,PNH STL | 83385 | OBD |
| -144 | 210-0003-00 | | | 6 | WASHER,LOCK: EXT,0.123 ID X 0.245" OD,ST | 78189 | 1104-00-00-0541C |
| | | | | | ***** (END ATTACHING PARTS) ***** | | |
| | | | | | ACTUATOR ASSY INCLUDES: | | |
| -145 | 131-0963-00 | | | 1 | CONTACT,ELEC: GROUNDING | 000EX | OBD |
| -146 | 210-0406-00 | | | 3 | NUT,PLAIN,HEX.: 4-40 X 0 188 INCH,BRS | 73743 | 12161-50 |
| -147 | 214-1139-02 | | | 2 | SPRING,FLAT: GREEN COLORED | 80009 | 214-1139-02 |
| -148 | 214-1127-00 | | | 2 | ROLLER,DETENT: 0.125 DIA X 0.125,SST | 80009 | 214-1127-00 |
| -149 | 401-0081-02 | | | 1 | BEARING,CAM SW: FRONT | 80009 | 401-0081-02 |
| | | | | | ***** (ATTACHING PARTS) ***** | | |
| -150 | 354-0391-00 | | | 1 | RING,RETAINING: 0.395"FREE ID X 0.025" S | 97464 | 3100-43-CD |
| | | | | | ***** (END ATTACHING PARTS) ***** | | |
| -151 | 105-0647-00 | | | 1 | ACTUATOR,CAM SW: FEED/DIV | 80009 | 105-0647-00 |
| -152 | 210-0406-00 | | | 4 | NUT,PLAIN,HEX.: 4-40 X 0.188 INCH,BRS | 73743 | 12161-50 |

| Fig. & Index | Tektronix No. | Part No. | Serial/Model No. | | 1 2 3 4 5 | Name & Description | Mfr | |
|-----------------|------------------|----------|------------------|------------|-----------|---|-------|------------------|
| | | | Eff | Dscont Qty | | | Code | Mfr Part Number |
| 2-153 | 401-0115-00 | | | | 1 | BEARING,CAM SW:CENTER | 80009 | 401-0115-00 |
| -154 | 105-0648-00 | | | | 1 | ACTUATOR,CAM SW:X.1-X1 ***** (ATTACHING PARTS) ***** | 80009 | 105-648-00 |
| -155 | 354-0391-00 | | | | 1 | RING,RETAINING:0.395"FREE ID X 0.025" S ***** (END ATTACHING PARTS) ***** | 97464 | 3100-43-CD |
| -156 | 210-0406-00 | | | | 4 | NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS | 73743 | 12161-50 |
| -157 | 214-1139-02 | | | | 2 | SPRING,FLAT:GREEN COLORED | 80009 | 214-1139-02 |
| -158 | 214-1127-00 | | | | 2 | ROLLER,DETENT:0.125 DIA X 0.125,SST | 80009 | 214-1127-00 |
| -159 | 401-0081-02 | | | | 1 | BEARING,CAM SW:FRONT | 80009 | 401-0081-02 |
| | | | | | 1 | SW CAM ACTR AS:(SEE S2126 REPL) ***** (ATTACHING PARTS) ***** | | |
| -160 | 211-0147-00 | | | | 4 | SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL | 83385 | OBD |
| -161 | 210-0003-00 | | | | 4 | WASHER,LOCK:EXT,0.123 ID X 0.245" OD,ST ***** (END ATTACHING PARTS) ***** * ACTUATOR ASSY INCLUDES: | 78189 | 1104-00-00-0541C |
| -162 | 131-0963-00 | | | | 2 | CONTACT,ELEC:GROUNDING | 000EX | OBD |
| -163 | 210-0406-00 | | | | 2 | NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS | 73743 | 12161-50 |
| -164 | 214-1139-02 | | | | 2 | SPRING,FLAT:GREEN COLORED | 80009 | 214-1139-02 |
| -165 | 214-1127-00 | | | | 2 | ROLLER,DETENT:0.125 DIA X 0.125,SST | 80009 | 214-1127-00 |
| -166 | 401-0081-02 | | | | 1 | BEARING,CAM SW:FRONT ***** (ATTACHING PARTS) ***** | 80009 | 401-0081-02 |
| -167 | 354-0391-00 | | | | 1 | RING,RETAINING:0.395"FREE ID X 0.025" S ***** (END ATTACHING PARTS) ***** | 97464 | 3100-43-CD |
| -168 | 105-0646-00 | | | | 1 | ACTUATOR,CAM SW:REFLECTION/DIV | 80009 | 105-0646-00 |
| -169 | 210-0406-00 | | | | 4 | NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS | 73743 | 12161-50 |
| -170 | 401-0115-00 | | | | 1 | BEARING,CAM SW:CENTER | 80009 | 401-0115-00 |
| -171 | | | | | 1 | CKT BOARD ASSY:VERT AMPL/SLOW RAMP (SEE A2 REPL) | | |
| -172 | 131-0604-00 | | | | 7 | CONTACT,ELEC:CKT BD SW,SPR,CU BE | 80009 | 131-0604-00 |
| -173 | 136-0269-02 | B010100 | B102647 | | 1 | SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW C | 73803 | CS9002-14 |
| -174 | 136-0252-04 | B010100 | 8102647 | | 36 | SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| -175 | 214-0579-00 | | | | 6 | TERM,TEST POINT:BRS CD PL | 80009 | 214-0579-00 |
| -176 | 131-0608-00 | | | | 34 | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD | 22526 | 47357 |
| -177 | 361-0384-00 | | | | 2 | SPACER,PB SW:0.133 INCH LONG | 80009 | 361-0384-00 |
| -178 | | | | | 1 | SWITCH,PUSH:(SEE S2254 REPL) | | |
| -179 | 136-Q514-00 | B010100 | B102647 | | 3 | SKT,PL-IN ELEK:MICROCIRCUIT,8 DIP | 73803 | CS9002-8 |

Fig. &

| Index | Tektronix Part No. | Serial/Model No. Eff | Dscont Qty | 1 2 3 4 5 | Name & Description | Mfr Code | Mfr Part Number |
|-------|--------------------|----------------------|------------|-----------|---|----------|-----------------|
| 3-1 | 337-2194-00 | | | 1 | SHIELD,ELEC:EMI, TOP | 80009 | 337-2194-00 |
| -2 | 342-0309-00 | | | 1 | INSULATOR,FILM:EMI, TOP, PLASTIC | 80009 | 342-0309-00 |
| -3 | 337-2193-00 | | | 1 | SHIELD,ELEC:EMI,BOTTOM | 80009 | 337-2193-00 |
| -4 | 342-0310-00 | | | 1 | INSULATOR,FILM:EMI,BOTTOM; PLASTIC | 80009 | 342-0310-00 |
| -5 | 131-1726-00 | | | 3 | JACK,TIP:BLACK,W/HARDWARE | 83330 | 256-103 |
| -6 | 131-1726-01 | | | 3 | JACK,TIP:RED,W/HARDWARE | 83330 | 21293-RED |
| -7 | 366-1368-00 | | | 1 | KNOB:PLUG-IN, SECURING | 80009 | 366-1368-00 |
| | 213-0076-00 | | | 1 | SETSCREW:2-56 X 0.125 INCH, HEX.SOC S | 74445 | OBD |
| -8 | 384-1349-00 | | | 2 | PIN,STR,THD:0.125 DIA X 6.417" LONG ***** (ATTACHING PARTS) ***** | 80009 | 384-1349-00 |
| -9 | 354-0163-00 | | | 2 | RING,RETAINING:TRUARC,CAD PLATE | 79136 | 5133-12MD |
| -10 | 210-1011-00 | | | 2 | WASHER, NONMETAL:0.13 ID X 0.375" OD, PLSTC | 83309 | OBD |
| -11 | 354-0538-00 | | | 2 | PACKING, PREFMD:0.119 ID X 0.125" OD, NPRN | 07322 | 8006-366Y |
| -12 | 210-0803-00 | | | 2 | WASHER, FLAT:0.15 ID X 0.032 THK, STL CD ***** (END ATTACHING PARTS) ***** | 12327 | OBD |
| -13 | 333-2021-00 | | | 1 | PANEL, FRONT: | 80009 | 333-2021-00 |
| -14 | 386-3229-00 | B010100 | B050909 | 1 | SUBPANEL, FRONT: | 80009 | 386-3229-00 |
| | 3863229-03 | B050910 | | 1 | SUBPANEL, FRONT: ***** (ATTACHING PARTS) ***** | 80009 | 386-3229-03 |
| -15 | 211-0101-00 | | | 4 | SCREW, MACHINE:4-40 X 0.25, 100 DEG, FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -16 | | | | 1 | CKT BOARD ASSY:X-Y PLUG-IN(SEE A7 REPL) ***** (ATTACHING PARTS) ***** | | |
| -17 | 211-0116-00 | | | 4 | SCR, ASSEM WSHR:4-40 X 0.312 INCH, PNH BRS ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| | | | | | CKT BOARD ASSY INCLUDES: | | |
| -18 | 131-0608-00 | | | 3 | TERMINAL, PIN:0.365 L X 0.025 PH BRZ GOLD | 22526 | 47357 |
| -19 | 131-0993-00 | | | 1 | BUS, CONDUCTOR:2 WIRE BLACK | 00779 | 850100-01 |
| -20 | 136-0220-00 | B010100 | B102647 | 1 | SKT, PL-IN ELEK:TRANSISTOR 3 CONTACT, PCB M | 71785 | 133-23-11-034 |
| -21 | 407-1633-00 | | | 1 | BRACKET, FR SECT:ALUMINUM ***** (ATTACHING PARTS) ***** | 80009 | 407-1633-00 |
| -22 | 211-0101-00 | | | 2 | SCREW, MACHINE:4-40 X 0.25, 100 DEG, FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -23 | 220-0547-01 | | | 4 | NUT, BLOCK:0.38 X 0.26 X 0.282 (2)4-40 ***** (ATTACHING PARTS) ***** | 000FW | OBD |
| -24 | 211-0101-00 | | | 4 | SCREW, MACHINE:4-40 X 0.25, 100 DEG, FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -25 | 426-1204-00 | | | 2 | FRAME SECTION:LEFT AND RIGHT | 80009 | 426-1204-00 |
| -26 | 426-1187-04 | B010100 | B102694 | 1 | FRAME PNL,CAB.:FRONT | 80009 | 426-1187-04 |
| | 426-1187-01 | B102695 | | 1 | FRAME PNL,CAB.:FRONT ***** (ATTACHING PARTS) ***** | 80009 | 426-1187-01 |
| -27 | 213-0718-00 | | | 1 | SCR, TPG, THD FOR:6-20 X 0.625 INCH, OVH STL | 83385 | OBD |
| -28 | 213-0227-00 | | | 5 | SCR, TPG, THD FOR:6-32 X 0.50 DEG, FLH ST ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| | 337-2206-00 | B010100 | B112954 | 1 | SHLD, IMPLOSION:CRT, CLEAR | 80009 | 337-2206-00 |
| | 337-2206-02 | B112955 | | 1 | SHLD, IMPLOSION:CRT | 80009 | 337-2206-02 |
| -29 | | | | 1 | CKT BOARD ASSY:OUTPUT AMPL(SEE A3 REPL) ***** (ATTACHING PARTS) ***** | | |
| -30 | 213-0088-00 | | | 4 | SCR, TPG; THD CTG:4-24 X 0.25 INCH, PNH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| | | | | | CKT BOARD ASSY INCLUDES: | | |
| -31 | 136-0252-04 | B010100 | B102647 | 27 | SOCKET, PIN TERM:U/W 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| -32 | 136-0269-02 | B010100 | B102647 | 2 | SKT, PL-IN ELEK:MICROCIRCUIT, 14 DIP, LOW CL | 73803 | CS9002-14 |
| -33 | 131-0608-00 | | | 22 | TERMINAL, PIN:0.365 L X 0.025 PH BRZ GOLD | 22526 | 47357 |
| | 131-0589-00 | | | 5 | TERMINAL, PIN:0.46 L X 0.025 SQ | 22526 | 48283-029 |
| -34 | 346-0127-00 | B010100 | B114407 | 2 | STRAP, TIE DOWN:4.0" L X 0.091" WIDE | 59730 | TY53M |
| | 343-0775-00 | B114408 | | 1 | CLIP, SPR TNSN: | 52152 | 3484-1000 |
| -35 | 214-1756-00 | | | 1 | ACTUATOR, SWITCH:POWER | 80009 | 214-1756-00 |
| -36 | 260-0834-00 | | | 1 | SWITCH, TOGGLE:DPDT, 5A, 125VAC, 0.25-40 THD | 09353 | U21-SHZQE |

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. | | Qty | Name & Description | Mfr | |
|---------------------|-----------------------|------------------|---------|-----|---|-------|------------------|
| | | Eff | Dscont | | | Code | Mfr Part Number |
| 3-37 | 210-0269-00 | B010160 | | 1 | TERMINAL,LUG:NON LOCKING,0.257" MTG HOLE | 78584 | 905-020 |
| -38 | 407-1590-00 | | | 1 | BRACKET,ANGLE:POWER SWITCH,ALUMINUM ***** (ATTACHING PARTS) ***** | 80009 | 407-1590-00 |
| -39 | 211-0101-00 | | | 2 | SCREW,MACHINE:4-40 X 0.25,100 DEG,FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| 40 | 351-0436-00 | | | 1 | GUIDE,PL-IN UNI:UPPER RIGHT ***** (ATTACHING PARTS) ***** | 80009 | 351-0436-00 |
| -41 | 213-0192-00 | | | 1 | SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH STL ***** (END ATTACHING PARTS) ***** | 87308 | OBD |
| -42 | | | | 1 | CKT BOARD ASSY:CHART REC LOGIC - (SEE A5 REPL) ***** (ATTACHING PARTS) ***** | | |
| -43 | 211-0008-00 | | | 4 | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS) ***** CKT BOARD ASSY INCLUDES: | 83385 | OBD |
| -44 | 131-0589-00 | | | 16 | TERMINAL,PIN:0.46 L X 0.025 SQ | 22526 | 48283-029 |
| -45 | 136-0514-00 | B010100 | B102647 | 1 | SKT,PL-IN ELEC:MICROCIRCUIT,8 DIP | 73803 | CS9002-8 |
| -46 | 136-0269-02 | B010100 | B102647 | 4 | SKT,PL-IN ELEC:MICROCIRCUIT,14 DIP,LOW CL | 73803 | CS9002-14 |
| -47 | 136-0252-04 | B010100 | B102647 | 47 | SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| -48 | 136-0263-04 | | | 10 | SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN | 22526 | 75377-001 |
| -49 | 136-0260-02 | B010100 | B102647 | 1 | SKT,PL-IN ELEC:MICROCIRCUIT,16 DIP,LOW CL | 71785 | 133-51-92-008 |
| -50 | 214-0579-00 | | | 7 | TERM,TEST POINT:BRS CD PL | 80009 | 214-0579-00 |
| -51 | 220-0729-00 | | | 1 | NUT BLOCK:0.25 X 0.471 INCH LONG ***** (ATTACHING PARTS) ***** | 80009 | 220-0729-00 |
| -52 | 211-0101-00 | | | 1 | SCREW,MACHINE:4-40 X 0.25,100 DEG,FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -53 | 351-0435-00 | | | 1 | GUIDE,PL-IN:LOVER LEFT ***** (ATTACHING PARTS) ***** | 80009 | 351-0435-00 |
| -54 | 213-0192-00 | | | 1 | SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH STL ***** (ATTACHING PARTS) ***** | 87308 | OBD |
| -55 | 131-1165-00 | | | 1 | CONNECTOR,RCPT,:15 PIN FEMALE,FLOATING ***** (ATTACHING PARTS) ***** | 71468 | DAF-15S |
| -56 | 211-0034-00 | | | 2 | SCREW,MACHINE:2-56 X 0.50 INCH,PNH | 83385 | OBD |
| -57 | 361-0742-00 | | | 3 | SPACER,SLEEVE:0.094 ID X 0.2 INCH LONG ***** (END ATTACHING PARTS) ***** | 80009 | 361-0742-00 |
| -58 | 134-0014-00 | | | 2 | PLUG,TIP:MALE ***** (END ATTACHING PARTS) ***** | 74970 | 023-0026-001 |
| -59 | 210-0457-00 | | | 2 | NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL | 83385 | OBD |
| -60 | 210-0202-00 | | | 2 | TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED | 78189 | 2104-06-00-2520N |
| -61 | 210-0975-00 | | | 2 | WSHR,SHOULDERED:0.14 ID X 0.247" OD,PLSTC | 80009 | 210-0975-00 |
| -62 | 210-0933-00 | | | 2 | WASHER,NONMETAL:0.625 DIA,0.002 MICA ***** (ATTACHING PARTS) ***** | 08530 | OBD |
| -63 | 343-0089-00 | | | 1 | CLAMP,LOOP:LARGE | 80009 | 343-0089-00 |
| -64 | 343-0213-00 | | | 1 | CLAMP,LOOP:0.2 ID,PLASTIC | 80009 | 343-0213-00 |
| -65 | 348-0064-00 | | | 1 | GROMMET,PLASTIC:0.625 INCH DIA | 80009 | 348-0064-00 |
| -66 | 348-0417-00 | | | 1 | GROMMET,PLASTIC:0.75 INCH DIA | 80009 | 348-0417-00 |
| -67 | | | | 1 | CKT BOARD ASSY:POWER(SEE A6 REPL) ***** (ATTACHING PARTS) ***** | | |
| -68 | 211-0008-00 | | | 4 | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS) ***** CKT BOARD ASSY INCLUDES: | 83385 | OBD |
| -69 | 136-0514-00 | B010100 | B102647 | 4 | SKT,PL-IN ELEC:MICROCIRCUIT,8 DIP | 73803 | CS9002-8 |
| -70 | 136-0252-04 | B010100 | B102647 | 42 | SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| | 136-0352-00 | | | 8 | CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN | 00779 | 50462-7 |
| -71 | 131-0589-00 | | | 5 | TERMINAL,PIN:0.46 L X 0.025 SQ | 22526 | 48283-029 |
| -72 | 131-0608-00 | | | 21 | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD | 22526 | 47357 |
| | 131-0590-00 | | | 2 | CONTACT,ELEC:0.71 INCH LONG | 22526 | 47351 |
| -73 | 214-0579-00 | | | 7 | TERM,TEST POINT:BRS CD PL | 80009 | 214-0579-00 |
| -74 | | | | 1 | CKT BOARD ASSY:SWEEP GEN(SEE A4 REPL) ***** (ATTACHING PARTS) ***** | | |
| -75 | 211-0116-00 | | | 4 | SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS ***** (END ATTACHING PARTS) ***** | 83385 | OBD |

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. | | 1 | 2 | 3 | 4 | 5 | Name & Description | Mfr | |
|------------------|--------------------|------------------|------------|----|---|---|---|---|--|-------|------------------|
| | | Eff | Dscont Qty | | | | | | | Code | Mfr Part Number |
| 3- | | | | - | | | | | CKT BOARD ASSY INCLUDES: | | |
| -76 | 136-0252-04 | | | 6 | | | | | SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS | 22526 | 75060-007 |
| -77 | 131-0589-00 | | | 7 | | | | | TERMINAL,PIN:0.46 L X 0.025 SQ | 22526 | 48283-029 |
| -78 | 131-0608-00 | | | 5 | | | | | TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD | 22526 | 47357 |
| -79 | 214-0579-00 | | | 2 | | | | | TERM,TEST POINT:BRS CD PL | 80009 | 214-0579-00 |
| -80 | 129-0541-00 | | | 1 | | | | | POST,ELEC-MECH:1.53" L W/4-40 THD,NYLON | 80009 | 129-0541-00 |
| -81 | | | | 1 | | | | | XFMR,PWR,STPDN:(SEE T0389 REPL) ***** (ATTACHING PARTS) ***** | | |
| -82 | 210-0457-00 | | | 1 | | | | | NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL | 83385 | OBD |
| -83 | 210-0202-00 | | | 1 | | | | | TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED | 78189 | 2104-06-00-2520N |
| -84 | 211-0529-00 | | | 1 | | | | | SCREW,MACHINE:6-32 X 1.25 INCHES,PNH STL | 83385 | OBD |
| -85 | 211-0628-00 | | | 3 | | | | | SCREW,MACHINE:6-32 X 1.125 INCH,PNH,STL | 83385 | OBD |
| -86 | 210-1133-00 | | | 4 | | | | | WASHER,FLAT:0.142 ID X 0.058 THK,FBR ***** (ATTACHING PARTS) ***** | 80009 | 210-1133-00 |
| -87 | 358-0329-00 | | | 10 | | | | | BSHG,FEED THRU:FUSEHOLDER TERM,DELTRIN | 80009 | 358-0329-00 |
| -88 | 131-0513-03 | | | 10 | | | | | TERM,FEEDTHRU:0.89 L X 0.025 SQ EA END | 00779 | 1-86074-3 |
| -89 | 131-1360-00 | | | 1 | | | | | CONN,RCPT,ELEC:CKT BD,10/20 CONTACT ***** (ATTACHING PARTS) ***** | 05574 | 600201-3197 |
| -90 | 210-0406-00 | | | 2 | | | | | NUT,PLAIN,HEX:4-40 X 0.188 INCH,BRS | 73743 | 12161-50 |
| -91 | 210-0201-00 | | | 2 | | | | | TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL | 86928 | OBD |
| -92 | 211-0014-00 | | | 2 | | | | | SCREW,MACHINE:4-40 X 0.50 INCH,PNH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -93 | 220-0547-01 | | | 1 | | | | | NUT,BLOCK:0.38 X 0.26 X 0.282 (2)4-40 ***** (ATTACHING PARTS) ***** | 000FW | OBD |
| -94 | 211-0008-00 | | | 1 | | | | | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| | 334-2501-00 | B010100 | B060749 | 1 | | | | | MARKER,IDENT:MKD CAUTION 48 TO 410HZ | 80009 | 334-2501-00 |
| | 334-2501-00 | B060750 | | 1 | | | | | MARKER,IDENT:MKD CAUTION 48 TO 410HZ | 80009 | 334-2501-00 |
| -95 | 441-1262-00 | | | 1 | | | | | CHAS,TDR UNIT:MAIN ***** (ATTACHING PARTS) ***** | 80009 | 441-1262-00 |
| -96 | 211-0008-00 | | | 8 | | | | | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -97 | 256-0570-00 | | | 1 | | | | | DEHYDRATING AGT:SILICA GEL,2.75 DIA X 0.75 ***** (ATTACHING PARTS) ***** | T1063 | X1009 |
| -98 | 211-0513-00 | | | 1 | | | | | SCREW,MACHINE:6-32 X 0.625 INCH,PNH STL | 83385 | OBD |
| -99 | 210-0055-00 | | | 1 | | | | | WASHER,LOCK:SPLIT,0.145 ID X 0.253 OD,S | 83385 | OBD |
| -100 | 407-1694-00 | | | 1 | | | | | BRACKET,RTNR:ALUMINUM ***** (END ATTACHING PARTS) ***** | 80009 | 407-1694-00 |
| -101 | 129-0562-00 | | | 1 | | | | | POST,RETAINER:0.892 INCH LONG X 0.375 HEX ***** (ATTACHING PARTS) ***** | 80009 | 129-0562-00 |
| -102 | 211-0097-00 | B010100 | B010209 | 1 | | | | | SCREW,MACHINE:4-40 X 0.312 INCH,PNH STL | 83385 | OBD |
| | 211-0033-00 | B010210 | | 1 | | | | | SCR,ASSEM WSHR:4-40 X 0.312 PNH,STL,CD PL | 83385 | OBD |
| -103 | 210-0003-00 | B010100 | B010209 | 1 | | | | | WASHER,LOCK:EXT,0.123 ID X 0.245" OD,ST ***** (END ATTACHING PARTS) ***** | 78189 | 1104-00-00-0541C |
| -104 | 131-1084-01 | | | 1 | | | | | CONNECTOR,RCPT,:3 BLADE,6A,250V,W/0.203 ID ***** (ATTACHING PARTS) ***** | 80009 | 131-1084-01 |
| -105 | 210-0586-00 | | | 2 | | | | | NUT,PL,ASSEM WA:4-40 X 0.25,STL | 83385 | OBD |
| -106 | 211-0012-00 | | | 2 | | | | | SCREW,MACHINE:4-40 X 0.375,PNH STL CD PL | 83385 | OBD |
| -107 | 210-0994-00 | | | 2 | | | | | WASHER,FLAT:0.125 ID X 0.25" OD,STL | 86928 | 5702-201-20 |
| -108 | 361-0764-00 | | | 2 | | | | | SPACER,SLEEVE:0.135 INCH L X 0.432 ID,BRS ***** (END ATTACHING PARTS) ***** | 80009 | 361-0764-00 |
| -109 | 220-0547-01 | | | 3 | | | | | NUT,BLOCK:0.38 X 0.26 X 0.282 (2)4-40 ***** (ATTACHING PARTS) ***** | 000FW | OBD |
| -110 | 211-0101-00 | | | 3 | | | | | SCREW,MACHINE:440 X 0.25,100 DEG,FLH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -111 | 210-0201-00 | | | 1 | | | | | TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL ***** (ATTACHING PARTS) ***** | 86928 | OBD |
| -112 | 210-0457-00 | B010100 | B079999 | 1 | | | | | NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL | 83385 | OBD |
| | 210-0407-00 | B080000 | | 1 | | | | | NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS | 73743 | 3038-0228-402 |
| -113 | 211-0507-00 | | | 1 | | | | | SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |

| Fig. & Index No, | Tektronix Part No. | Serial/Model No. | | Qty | 1 2 3 4 5 Name & Description | Mfr | |
|---------------------|-----------------------|------------------|---------|-----|---|-------|-----------------|
| | | Eff | Dscont | | | Code | Mfr Part Number |
| 3-114 | 386-3154-00 | B010100 | B010209 | 1 | PANEL,REAR: | 80009 | 386-3154-00 |
| | 386-3154-01 | B010210 | | 1 | PANEL,REAR: | 80009 | 386-3154-01 |
| | | | | | ***** (ATTACHING PARTS) ***** | | |
| -115 | 213-0192-00 | | | 1 | SCR,TPG,THD FOR:6-32 X 0.50 INCH,PNH S | 87308 | OBD |
| | | | | | ***** (END ATTACHING PARTS) ***** | | |
| -116 | 426-1184-00 | | | 1 | FRAME SECT,TDR:LEFT | 80009 | 426-1184-00 |
| -117 | 426-1185-00 | | | 1 | FRAME SECT,TDR:CENTER | 80009 | 426-1185-00 |
| -118 | 426-1186-00 | | | 1 | FRAME SECT,TDR:RIGHT | 80009 | 426-1186-00 |
| | 198-2257-00 | | | 1 | WIRE SET,ELEC: | 80009 | 198-2257-00 |
| | | | | 1 | COIL,TUBE DEFLE:(SEE L0234 REPL) | | |
| -119 | 131-0707-00 | | | 42 | CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD | 22526 | 47439 |
| | 131-0708-00 | | | 2 | CONTACT,ELEC:0.48'L,28-32 AWG WIRE | 22526 | 47437 |
| | | | | 1 | METER,ELEC FREQ:(SEE M0171 REPL) | | |
| -120 | 175-0825-00 | | | FT | WIRE,ELECTRICAL:2 WIRE RIBBON | 80009 | 175-0825-00 |
| -121 | 175-0826-00 | | | FT | WIRE,ELECTRICAL:3 WIRE RIBBON | 80009 | 175-0826-00 |
| -122 | 175-0829-00 | | | FT | WIRE,ELECTRICAL:6 WIRE RIBBON | 08261 | SS-0626-710610C |
| -123 | 175-0830-00 | | | FT | WIRE,ELECTRICAL:7 WIRE RIBBON | 08261 | SS-0726-710610C |
| -124 | 352-0161-01 | | | 1 | CONN BODY,PL,EL:3 WIRE BROWN | 80009 | 352-0161-01 |
| | 352-0161-05 | | | 2 | CONN BODY,PL,EL:3 WIRE GREEN | 80009 | 352-0161-05 |
| -125 | 352-0164-02 | | | 1 | CONN BODY,PL,EL:6 WIRE RED | 80009 | 352-0164-02 |
| | 352-0164-07 | | | 1 | HLDR,TERM CONN:6 WIRE VIOLET | 80009 | 352-0164-07 |
| -126 | 352-0165-03 | | | 1 | CONN BODY,PL,EL:7 WIRE ORANGE | 80009 | 352-0165-03 |
| | 352-0165-05 | | | 2 | CONN BODY,PL,EL: 7 WIRE GREEN | 80009 | 352-0165-05 |
| | 352-0165-06 | | | 1 | CONN BODY,PL,EL: 7 WIRE BLUE | 80009 | 352-0165-06 |
| -127 | 352-0169-02 | | | 1 | CONN BODY,PL,EL: 2 WIRE RED | 80009 | 352-0169-00 |
| | 352-0169-04 | | | 2 | CONN BODY,PL,EL: 2 WIRE YELLOW | 80009 | 352-0169-04 |
| | 198-2386-00 | | | 1 | WIRE SET,ELEC: | 80009 | 198-2386-00 |
| | 131-0621-00 | | | 3 | CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD | 22526 | 46231 |
| | 131-0707-00 | | | 7 | CONNECTOR,TERM 22-26 AWG,BRS & CU BE GOLD | 22526 | 47439 |
| | 352-0161-01 | | | 1 | CONN BODY,PL,EL:3 WIRE BROWN | 80009 | 352-0161-01 |
| | 352-0161-09 | | | 1 | CONN BODY,PL,EL:3 WIRE WHITE | 80009 | 352-0161-09 |
| -128 | 352-0171-04 | | | 1 | CONN BODY,PL,EL:1 WIRE YELLOW | 80009 | 352-0171-04 |
| -129 | 352-0199-03 | | | 1 | CONN BODY,PL,EL:3 WIRE ORANGE | 80009 | 352-0199-03 |
| | 198-2940-00 | | | 1 | WIRE SET,ELEC: | 80009 | 198-294000 |
| | 131-0707-00 | | | 9 | CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD | 22526 | 47439 |
| | 175-0830-00 | | | FT | WIRE,ELECTRICAL:7 WIRE RIBBON | 08261 | SS-0726-710610C |
| | 352-0165-04 | | | 1 | CONN BODY,PL,EL:7 WIRE YELLOW | 80009 | 352-016504 |
| | 352-0169-01 | | | 1 | HLDR TERM CONN:2 WIRE,BROWN | 80009 | 352-0169-01 |
| -130 | 179-2178-00 | B010100 | B060959 | 1 | WIRING HARNESS,;FRONT PANEL | 80009 | 179-2178-00 |
| | 179-2178-01 | B060960 | B113799 | 1 | WIRING HARNESS,;FRONT PANEL | 80009 | 179-2178-01 |
| | 179-2178-02 | B113800 | | 1 | WIRING HARNESS,;FRONT PANEL | 80009 | 179-2178-01 |
| | 131-0707-00 | | | 35 | CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD | 22526 | 47439 |
| | 352-0169-03 | | | 1 | CONN BODY,PL,EL:2 WIRE ORANGE | 80009 | 352-0169-03 |
| | 352-0169-06 | | | 1 | CONN BODY,PL,EL:2 WIRE BLUE | 80009 | 352-0169-06 |
| | 352-0161-01 | | | 1 | CONN BODY,PL,EL:3 WIRE BROWN | 80009 | 352-0161-01 |
| | 352-0161-02 | | | 2 | CONN BODY,PL,EL:3 WIRE RED | 80009 | 352-0161-02 |
| | 352-0161-06 | | | 1 | CONN BODY,PL,EL:3 WIRE BLUE | 80009 | 352-0161-06 |
| | 352-0161-07 | | | 1 | CONN BODY,PL,EL:3 WIRE VIOLET | 80009 | 352-0161-07 |
| | 352-0165-03 | | | 1 | CONN BODY,PL,EL: 7 WIRE ORANGE | 80009 | 352-0165-03 |
| | 352-0165-07 | | | 1 | CONN BODY,PL,EL:7 WIRE VIOLET | 80009 | 352-0165-07 |
| | 179-2349-00 | B010100 | B102647 | 1 | WIRING HARNESS,;AC | 80009 | 179-2349-00 |
| | 175-2492-00 | B102648 | | 1 | CA ASSY,SP,ELEC 4,22 AWG,17.0 L | 80009 | 175-2492-00 |
| | 195-0389-00 | B102648 | | 1 | LEAD,ELECTRICAL:18 AWG,4.0 L,5-4 | 80009 | 195-0389-00 |

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Model No. Dscont | Qty | 1 2 3 4 5 Name & Description | Mfr Code | Mfr Part Number |
|------------------|--------------------|----------------------|------------------|-----|---|----------|-----------------|
| 4- | 016-0595-00 | B010100 | B109999 | 1 | BATTERY SET: | 80009 | 016-0595-00 |
| | 016-0595-01 | B110000 | | 1 | BATTERY SET: ***** (ATTACHING PARTS) **** | 80009 | 016-0595-01 |
| -1 | 214-1573-00 | | | 2 | THUMBSCREW:6-32 X 0.656 INCH LONG,SST | 06540 | 6130-SS-0632 |
| -2 | 210-1160-00 | | | 2 | WASHER,FLAT:0.129 ID X 0.031 THK,TEFLON ***** (END ATTACHING PARTS) ***** | 86928 | 5612-32-31 |
| -3 | 333-1990-00 | | | 1 | BATTERY PACK ASSY INCLUDES: PANEL,FRONT: ***** (ATTACHING PARTS) ***** | 80009 | 333-1990-00 |
| -4 | 211-0198-00 | | | 4 | SCREW,MACHINE:4-40 X 0.438 PNH,STL,POZ | 77250 | OBD |
| -5 | 213-0267-00 | | | 2 | SCREW,MACHINE:4-24 X 0.375 INCH,PNH STL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -6 | 348-0432-00 | | | 1 | GASKET: FRONT PANEL | 80009 | 348-0432-00 |
| -7 | 337-2762-00 | | | 1 | SHIELD,FUSE:ALUMINUM ***** (ATTACHING PARTS) ***** | 80009 | 337-2762-00 |
| -8 | 211-0008-00 | | | 4 | SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL ***** (END ATTACHING PARTS) ***** | 83385 | OBD |
| -9 | 343-0349-01 | | | 2 | CLAMP,BTRY RTNG:W/HOLES ***** (ATTACHING PARTS) ***** | 80009 | 343-0349-01 |
| -10 | 210-0406-00 | | | 4 | NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS | 73743 | 12161-50 |
| -11 | 211-0194-00 | | | 4 | SCREW,MACHINE:4-40 X 47.5MM,PNH,ST ***** (END ATTACHING PARTS) ***** | 0000M | 211-0194-00 |
| -12 | 361-0776-00 | | | 4 | SPACER,SLEEVE:1.248 L X 0.118 ID,NYLON | 80009 | 361-0776-00 |
| -13 | 214-2344-00 | | | 1 | HEAT SINK,ELEC:BATTERY SUPPLY,LOWER,AL | 80009 | 214-2344-00 |
| -14 | | | | 1 | CKT BOARD ASSY:POWER FUSE JACK (SEE A9 REPL) | | |
| -15 | 136-0352-00 | | | 4 | CONTACT,ELEC:FOR 0.02 INCH DIAMETER PIN | 00779 | 50462-7 |
| -16 | 386-2435-00 | | | 2 | PLATE,METALLIC:W/TAPS | 0000M | 386-2435-00 |
| -17 | 146-0018-01 | | | 1 | BATTERY SET:10.8V,1.5AH,9 C CELLS | 19209 | 41B002K33G1 |
| -18 | 214-2343-00 | | | 1 | HEAT SINK,ELEC:BATTERY SUPPLY,UPPER,AL | 80009 | 214-2343-00 |

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SCHEMATICS, ACCESSORIES, AND FIGURES

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APPENDIX A

MAINTENANCE ALLOCATION CHART

Information pertaining to Maintenance Allocation Chart (MAC) will be furnished at a later date.

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By Order of the Secretary of the Army:

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

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

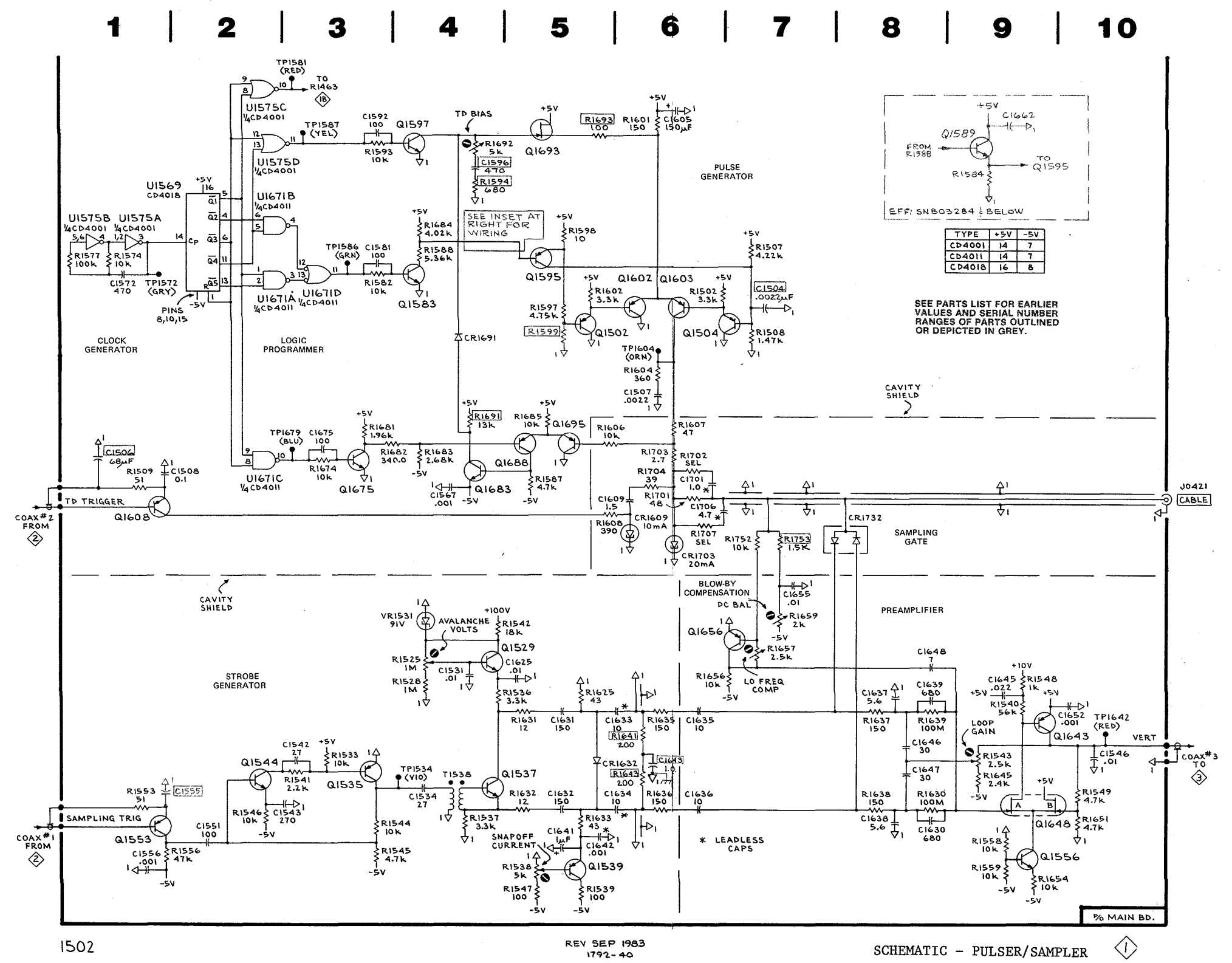
Distribution:

To be distributed in accordance with DA Form 12-32, Operator, Organizational, Direct Support and General Support Maintenance requirements for the PATRIOT Air Defense Guided Missile System.

| CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|--------|----------|
| C1155 | F12 | Q1504 | C6 | R1542 | F4 |
| C1161 | F12 | Q1529 | F4 | R1543 | G9 |
| C1237 | E15 | Q1535 | G3 | R1544 | H3 |
| C1313 | C13 | Q1537 | G4 | R1545 | H3 |
| C1325 | E14 | Q1539 | H5 | R1546 | G2 |
| C1332 | F15 | Q1544 | G2 | R1547 | H5 |
| C1341 | E17 | Q1553 | H1 | R1548 | F9 |
| C1345 | H17 | Q1556 | H9 | R1549 | G10 |
| C1435 | F13 | Q1583 | C4 | R1553 | G1 |
| C1464 | D12 | Q1589 | A9 | R1556 | H1 |
| C1504 | C7 | Q1595 | B5 | R1558 | H9 |
| C1507 | D8 | Q1597 | A4 | R1559 | H9 |
| C1508 | D1 | Q1602 | C6 | R1574 | B1 |
| C1531 | F4 | Q1608 | E1 | R1577 | B1 |
| C1534 | G4 | Q1643 | G9 | R1582 | C3 |
| C1542 | G3 | Q1648 | G9 | R1584 | B9 |
| C1543 | G3 | Q1656 | F7 | R1587 | D5 |
| C1546 | G10 | Q1675 | D3 | R1588 | B4 |
| C1551 | H2 | Q1683 | D4 | R1593 | A3 |
| C1555 | G2 | Q1688 | D5 | R1594 | B4 |
| C1556 | H1 | Q1693 | A5 | R1597 | C5 |
| C1566 | F11 | Q1695 | D5 | R1598 | B5 |
| C1567 | E4 | | | R1599 | C5 |
| C1572 | C1 | R0151 | H18 | R1601 | A6 |
| C1581 | B3 | R0271 | C15 | R1602 | C5 |
| C1592 | A3 | R0472 | F20 | R1604 | C6 |
| C1596 | B4 | R1129 | H15 | R1606 | D5 |
| C1605 | A6 | R1132 | H15 | R1607 | D6 |
| C1609 | E6 | R1135 | H15 | R1608 | E5 |
| C1625 | F5 | R1138 | H17 | R1625 | F5 |
| C1630 | H8 | R1144 | F19 | R1630 | G8 |
| C1631 | G5 | R1146 | F19 | R1631 | G5 |
| C1632 | G5 | R1148 | F19 | R1632 | G5 |
| C1633 | G6 | R1152 | E18 | R1633 | H5 |
| C1634 | G6 | R1216 | B16 | R1635 | G6 |
| C1635 | G6 | R1217 | B16 | R1636 | G6 |
| C1636 | G6 | R1218 | B17 | R1637 | G8 |
| C1637 | F8 | R1219 | B17 | R1638 | G8 |
| C1638 | H8 | R1226 | B18 | R1639 | G8 |
| C1639 | F8 | R1227 | B18 | R1641 | G6 |
| C1641 | H5 | R1235 | H17 | R1643 | G6 |
| C1642 | H5 | R1239 | E17 | R1645 | G9 |
| C1643 | G6 | R1312 | C14 | R1651 | H10 |
| C1645 | F9 | R1315 | C13 | R1654 | H9 |
| C1646 | G8 | R1318 | D14 | R1656 | F7 |
| C1647 | G8 | R1319 | C13 | R1657 | F7 |
| C1648 | F8 | R1323 | B19 | R1659 | F7 |
| C1652 | G10 | R1324 | B20 | R1674 | D3 |
| C1655 | E7 | R1326 | C13 | R1681 | D3 |
| C1661 | F11 | R1333 | E16 | R1682 | D3 |
| C1662 | B9 | R1335 | F15 | R1683 | D4 |
| C1675 | D3 | R1338 | F13 | R1684 | B4 |
| C1701 | D6 | R1341 | F16 | R1685 | D5 |
| C1706 | E6 | R1342 | E17 | R1691 | D4 |
| | | R1352 | F12 | R1692 | A4 |
| CR1359 | D13 | R1353 | E12 | R1693 | A5 |
| CR1609 | E6 | R1354 | E12 | R1701 | E6 |
| CR1632 | G5 | R1355 | D13 | R1702 | D6 |
| CR1691 | C4 | R1358 | D13 | R1703 | D6 |
| CR1703 | E6 | R1422 | F16 | R1704 | D6 |
| CR1732 | E8 | R1431 | E16 | R1707 | E6 |
| | | R1432 | F14 | R1752 | E7 |
| | | R1434 | F13 | R1753 | E7 |
| | | R1435 | F13 | | |
| Q1317 | C13 | R1437 | F16 | S0151 | D14 |
| Q1325 | E17 | R1441 | F13 | S1222 | A17 |
| Q1328 | D17 | R1442 | H16 | S1251 | F18 |
| Q1329 | D16 | R1443 | H16 | | |
| Q1336 | E16 | R1444 | H16 | | |
| Q1337 | F14 | R1445 | G16 | | |
| Q1338 | F13 | R1462 | D12 | T1538 | G4 |
| Q1339 | F13 | R1463 | D12 | | |
| Q1347 | C16 | R1502 | C6 | U1344 | E19 |
| Q1348 | G16 | R1507 | B7 | U1569 | B2 |
| Q1355 | D13 | R1508 | C7 | U1575 | B1,B2 |
| Q1357 | E12 | R1509 | D1 | U1671 | B2,D2 |
| Q1358 | E12 | R1525 | F4 | VR1531 | F4 |
| Q1413 | C14 | R1528 | F4 | | |
| Q1425 | E16 | R1533 | G3 | | |
| Q1431 | E16 | R1536 | F4 | | |
| Q1443 | G16 | R1537 | F4 | | |
| Q1444 | G17 | R1538 | H5 | | |
| Q1447 | G16 | R1539 | H5 | | |
| Q1448 | G16 | R1540 | G9 | | |
| Q1502 | C5 | R1541 | G3 | | |

NOTE: THIS GRID LOCATOR APPLIES TO BOTH DIAGRAMS 1 AND 2

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SCHEMATIC-PULSER/SAMPLER

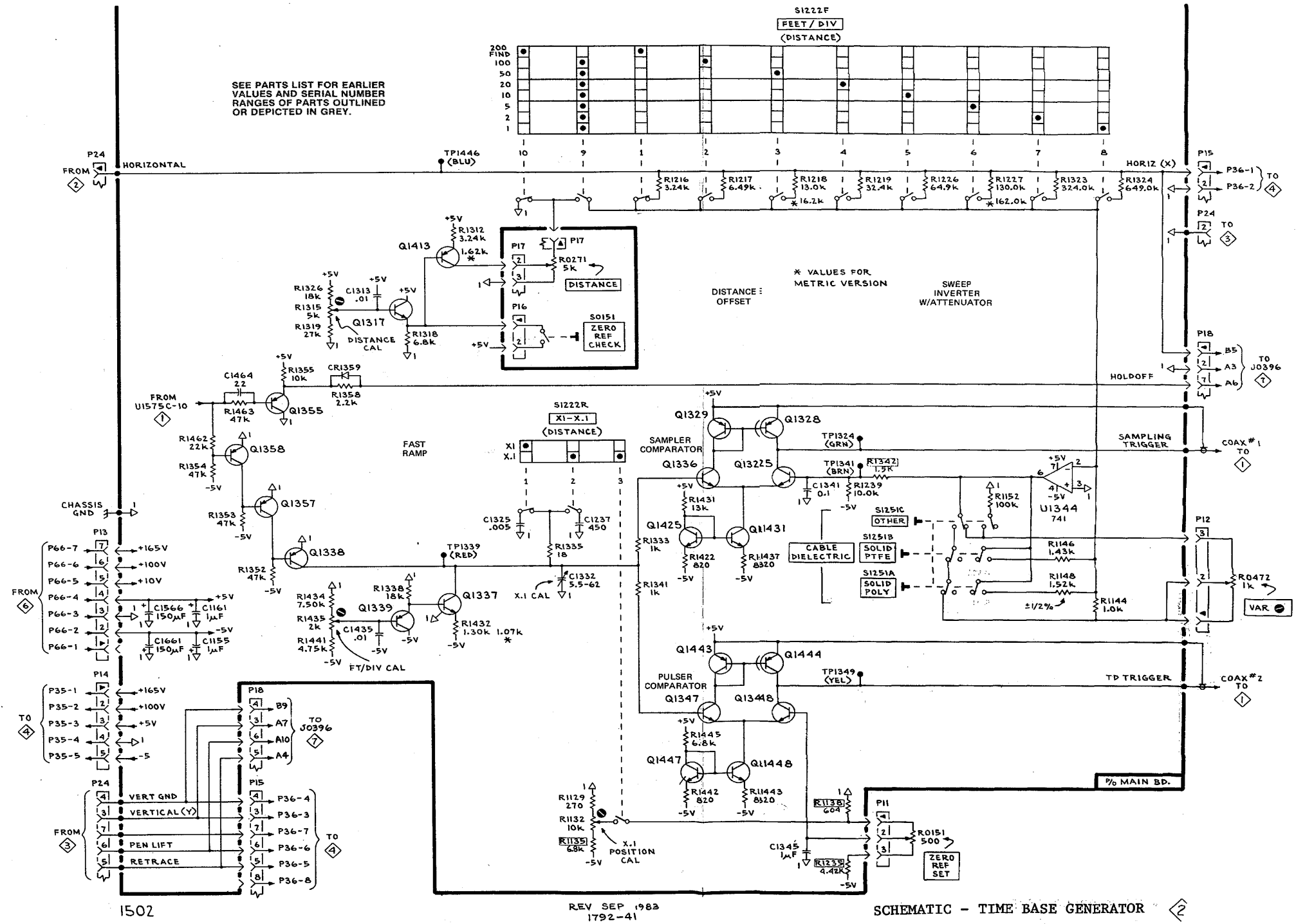
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| CKT NO | GRID LOC | CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|--------|----------|
| C1155 | F12 | Q1504 | C6 | R1542 | F4 |
| C1161 | F12 | Q1529 | F4 | R1543 | G9 |
| C1237 | E15 | Q1535 | G3 | R1544 | H3 |
| C1313 | C13 | Q1537 | G4 | R1545 | H3 |
| C1325 | E14 | Q1539 | H5 | R1546 | G2 |
| C1332 | F15 | Q1544 | G2 | R1547 | H5 |
| C1341 | E17 | Q1553 | H1 | R1548 | F9 |
| C1345 | H17 | Q1556 | H9 | R1549 | G10 |
| C1435 | F13 | Q1583 | C4 | R1553 | G1 |
| C1464 | D12 | Q1589 | A9 | R1556 | H1 |
| C1504 | C7 | Q1595 | B5 | R1558 | H9 |
| C1506 | D1 | Q1597 | A4 | R1559 | H9 |
| C1507 | D6 | Q1602 | C6 | R1574 | B1 |
| C1508 | D2 | Q1603 | C6 | R1577 | B1 |
| C1531 | F4 | Q1608 | E1 | R1582 | C3 |
| C1534 | G4 | Q1643 | G9 | R1584 | B9 |
| C1542 | G3 | Q1648 | G9 | R1587 | D5 |
| C1543 | G3 | Q1656 | F7 | R1588 | B4 |
| C1546 | G10 | Q1675 | D3 | R1593 | A3 |
| C1551 | H2 | Q1683 | D4 | R1594 | B4 |
| C1555 | G2 | Q1688 | D5 | R1597 | C5 |
| C1556 | H1 | Q1693 | A5 | R1598 | B5 |
| C1566 | F11 | Q1695 | D5 | R1599 | C5 |
| C1587 | E4 | | | R1601 | A6 |
| C1572 | C1 | R0151 | H18 | R1602 | C5 |
| C1581 | B3 | R0271 | C15 | R1604 | C6 |
| C1592 | A3 | R0472 | F20 | R1606 | D5 |
| C1596 | B4 | R1129 | H15 | R1607 | D6 |
| C1605 | A6 | R1132 | H15 | R1608 | E5 |
| C1609 | E6 | R1135 | H15 | R1637 | G8 |
| C1625 | F8 | R1138 | H17 | R1639 | G8 |
| C1630 | H8 | R1144 | F19 | R1641 | G6 |
| C1631 | G5 | R1146 | F19 | R1643 | G9 |
| C1632 | G5 | R1148 | F19 | R1651 | H10 |
| C1633 | G6 | R1152 | E18 | R1654 | H9 |
| C1634 | G6 | R1216 | B16 | R1656 | F7 |
| C1635 | G6 | R1217 | B16 | R1657 | F7 |
| C1636 | G6 | R1218 | B17 | R1659 | F7 |
| C1637 | F8 | R1219 | B17 | R1674 | D3 |
| C1638 | H8 | R1226 | B18 | R1681 | D3 |
| C1639 | F8 | R1227 | B18 | R1682 | D3 |
| C1641 | H5 | R1235 | H17 | R1683 | D4 |
| C1642 | H5 | R1239 | E17 | R1684 | B4 |
| C1643 | G6 | R1312 | C14 | R1685 | D5 |
| C1645 | F9 | R1315 | C13 | R1691 | D4 |
| C1646 | G8 | R1318 | D14 | R1692 | A4 |
| C1647 | G8 | R1319 | C13 | R1693 | A5 |
| C1648 | F8 | R1323 | B19 | R1701 | E6 |
| C1652 | G10 | R1324 | B20 | R1702 | D6 |
| C1655 | E7 | R1326 | C13 | R1703 | D6 |
| C1661 | F11 | R1333 | E16 | R1704 | D6 |
| C1662 | B9 | R1335 | F15 | R1707 | E6 |
| C1675 | D3 | R1338 | F13 | R1752 | E7 |
| C1701 | D6 | R1341 | F16 | R1753 | E7 |
| C1706 | E6 | R1342 | E17 | | |
| CR1359 | D13 | R1352 | F12 | S0151 | D14 |
| CR1609 | E6 | R1353 | E12 | S1222 | A17 |
| CR1632 | G5 | R1355 | E12 | S1251 | F18 |
| CR1691 | C4 | R1358 | D13 | | |
| CR1703 | E6 | R1422 | F16 | T1538 | G4 |
| CR1732 | E8 | R1431 | E16 | | |
| Q1317 | C13 | R1432 | F14 | U1344 | E19 |
| Q1325 | E17 | R1434 | F13 | U1569 | B2 |
| Q1328 | D17 | R1435 | F13 | U1575 | B1,B2 |
| Q1329 | D16 | R1437 | F16 | U1671 | B2,D2 |
| Q1336 | E16 | R1441 | H16 | | |
| Q1337 | F14 | R1442 | H16 | | |
| Q1338 | F13 | R1443 | H16 | | |
| Q1339 | F13 | R1444 | G16 | | |
| Q1347 | G16 | R1445 | G16 | | |
| Q1348 | G16 | R1462 | D12 | | |
| Q1355 | D13 | R1463 | D12 | | |
| Q1357 | E12 | R1502 | C6 | | |
| Q1358 | E12 | R1507 | B7 | | |
| Q1413 | C14 | R1508 | C7 | | |
| Q1425 | E16 | R1509 | D1 | | |
| Q1431 | E16 | R1525 | F4 | | |
| Q1443 | G16 | R1528 | F4 | | |
| Q1444 | G17 | R1533 | G3 | | |
| Q1447 | G16 | R1536 | F4 | | |
| Q1448 | G16 | R1537 | H4 | | |
| Q1502 | C5 | R1538 | H5 | | |
| | | R1539 | H5 | | |
| | | R1540 | G9 | | |
| | | R1541 | G3 | | |

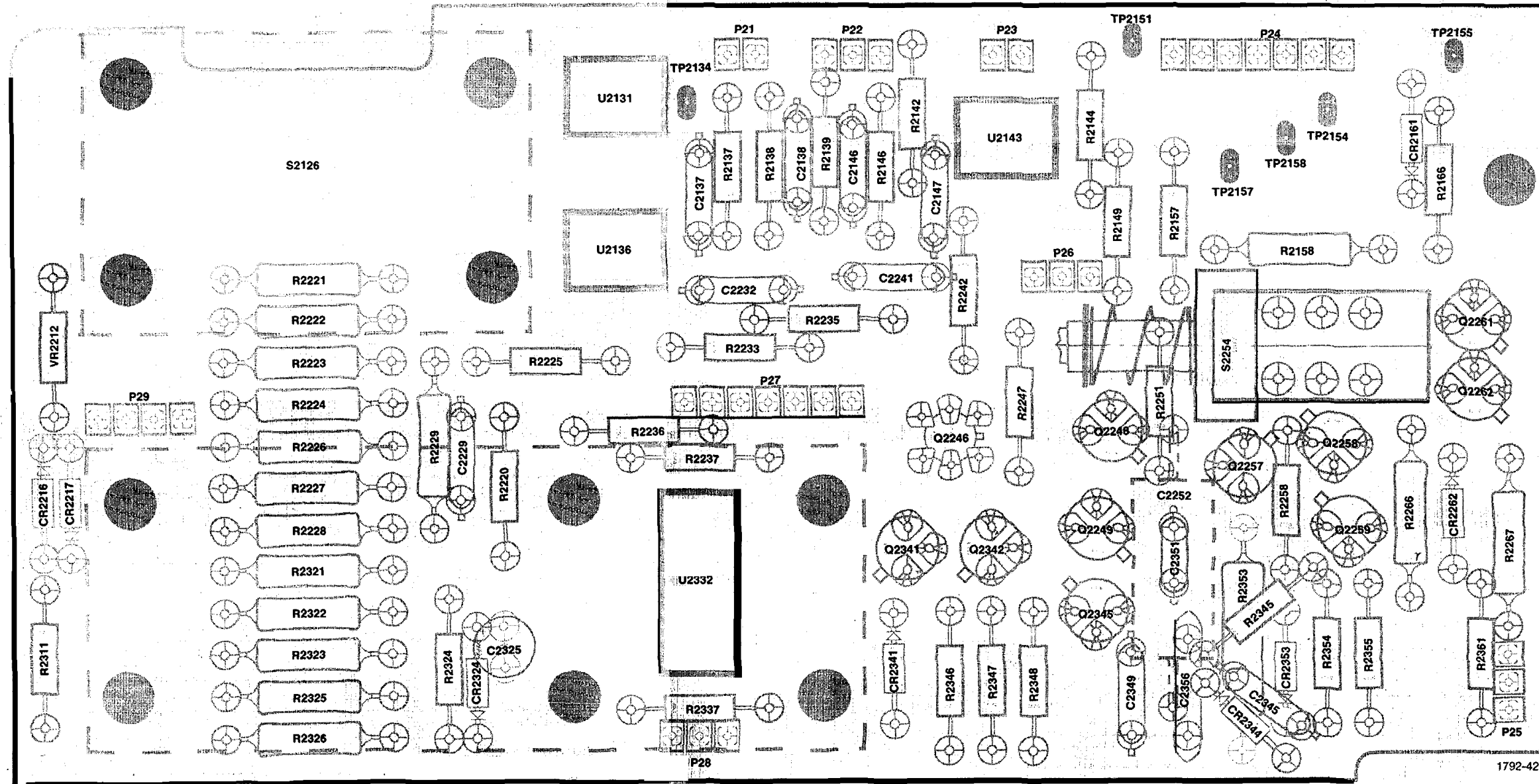
NOTE: THIS GRID LOCATOR APPLIES TO BOTH DIAGRAMS
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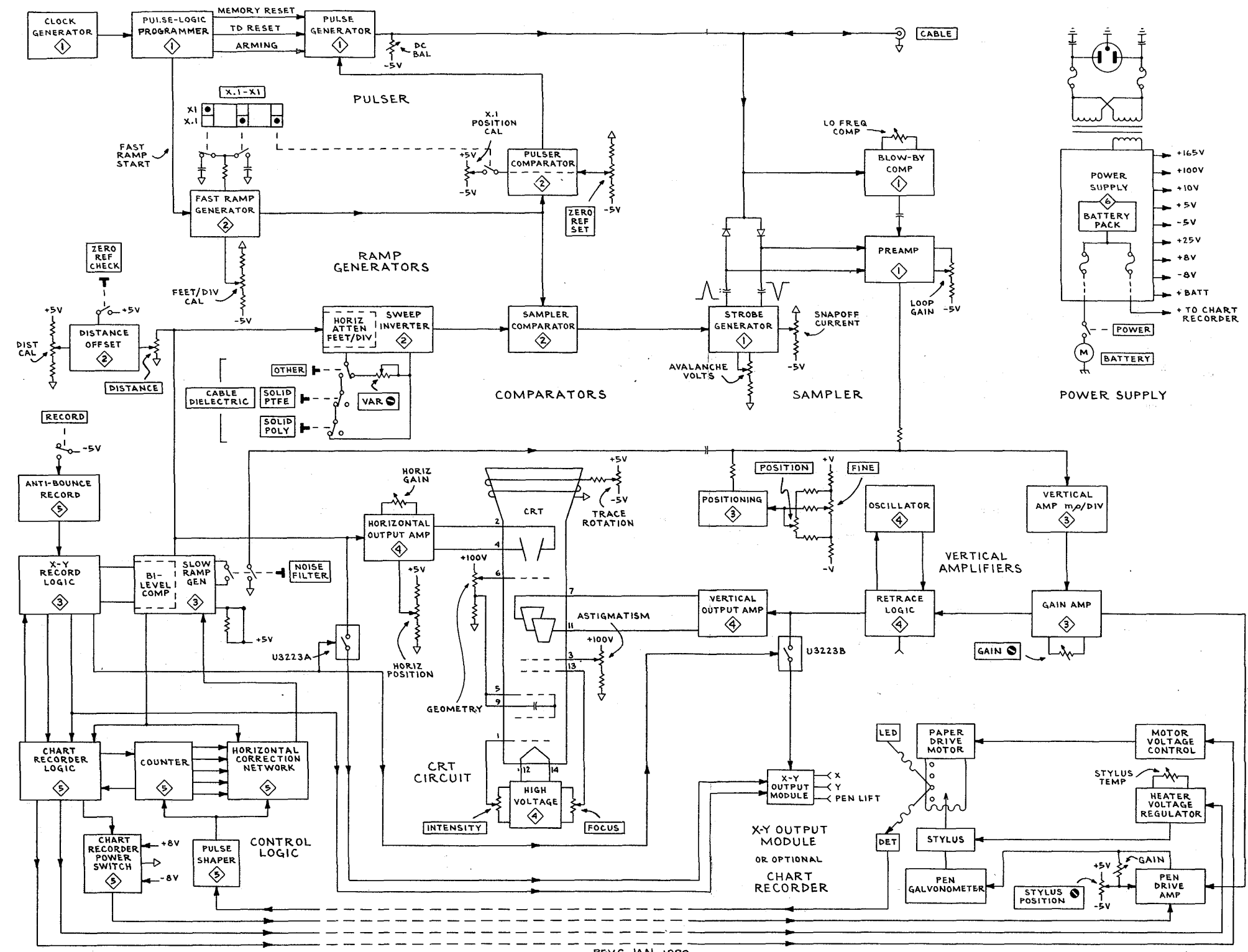


SCHEMATIC-TIME BASE GENERATOR



Vertical Amplifier/Slow Ramp Board

SCHEMATIC-VERT AMPL/SLOW RAMP COMPONENTS



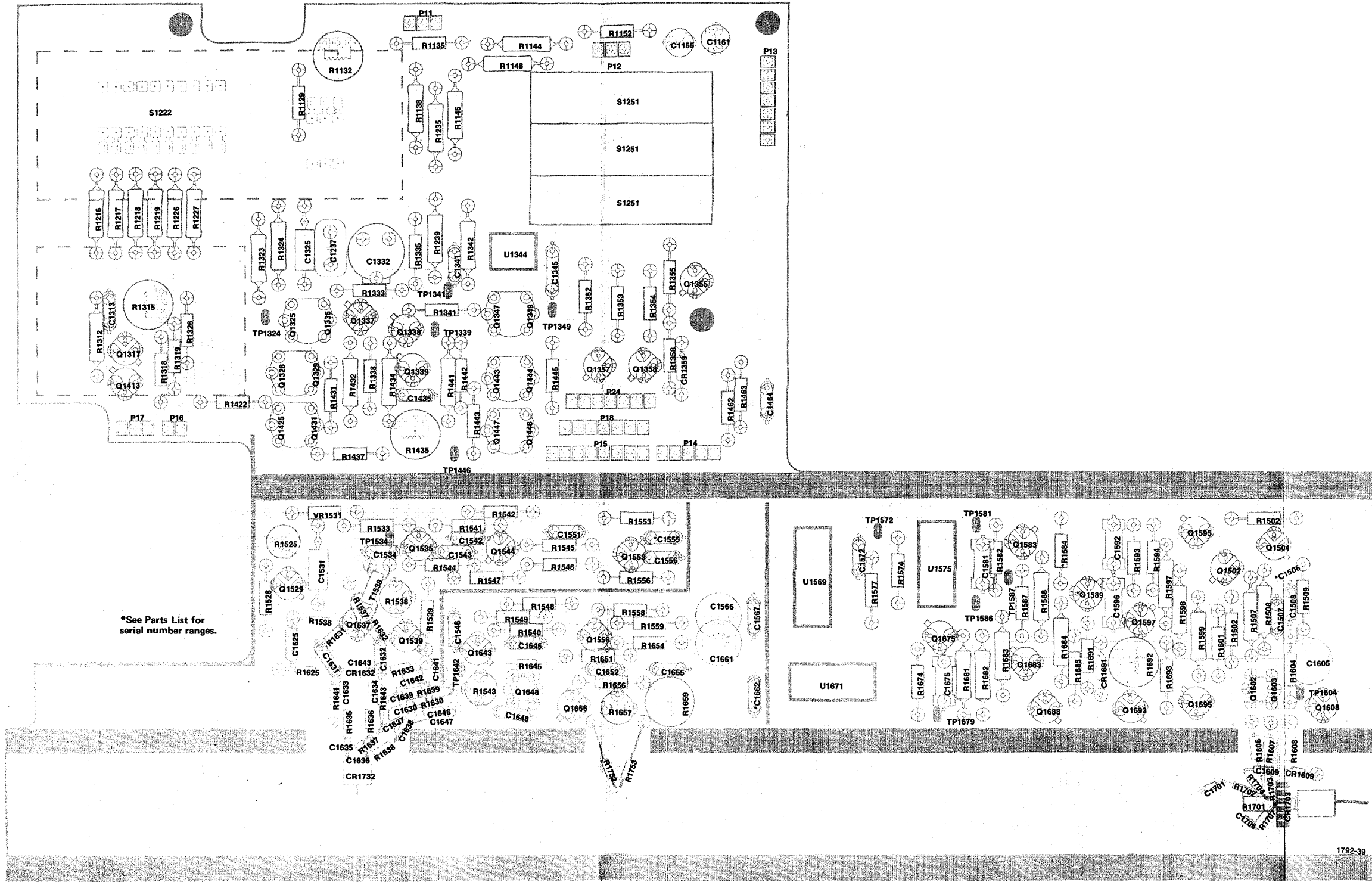
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SCHMATIC-BLOCK DIAGRAM

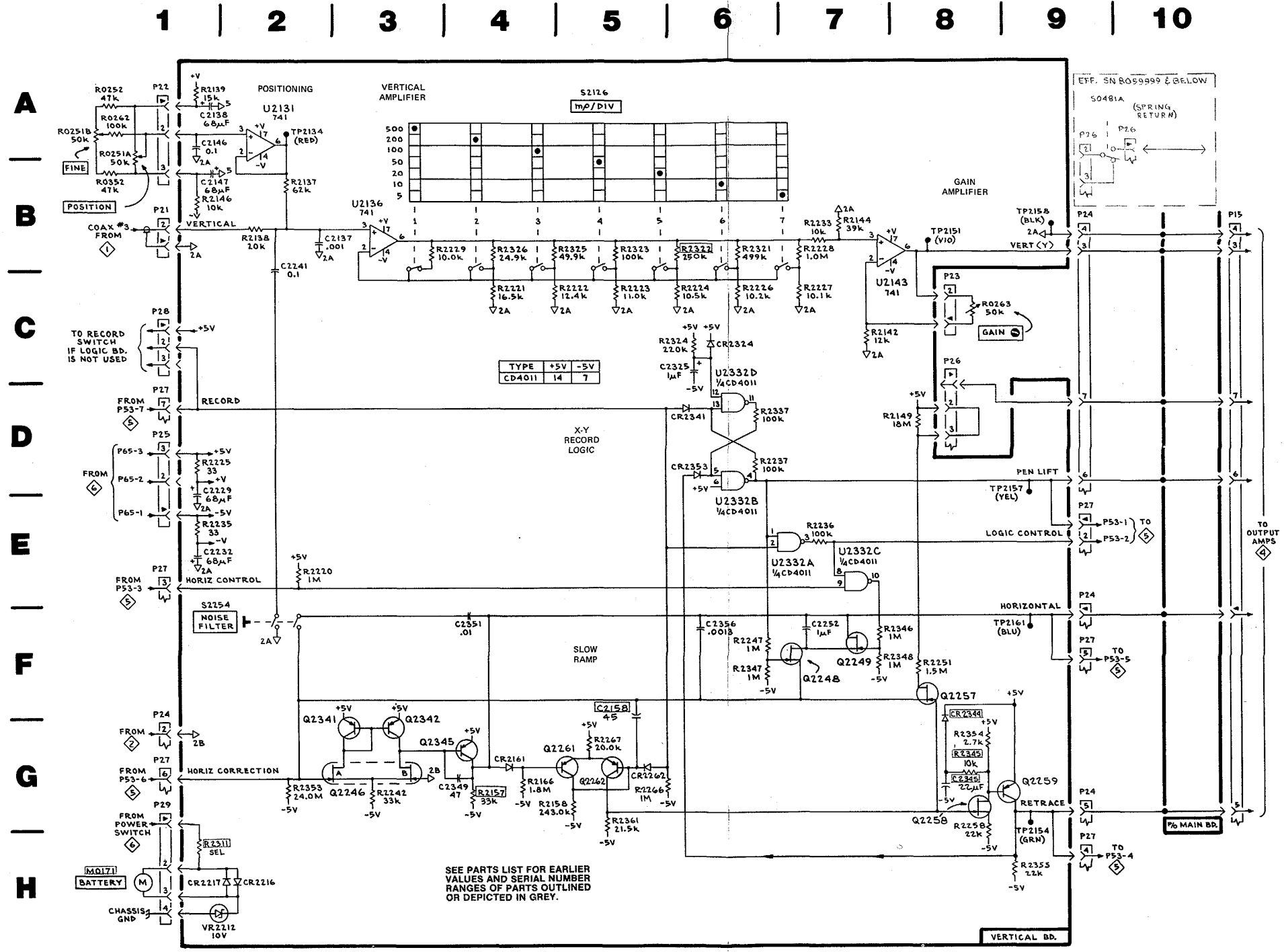
SCHMATIC - BLOCK DIAGRAM

1502 BLOCK DIAGRAM

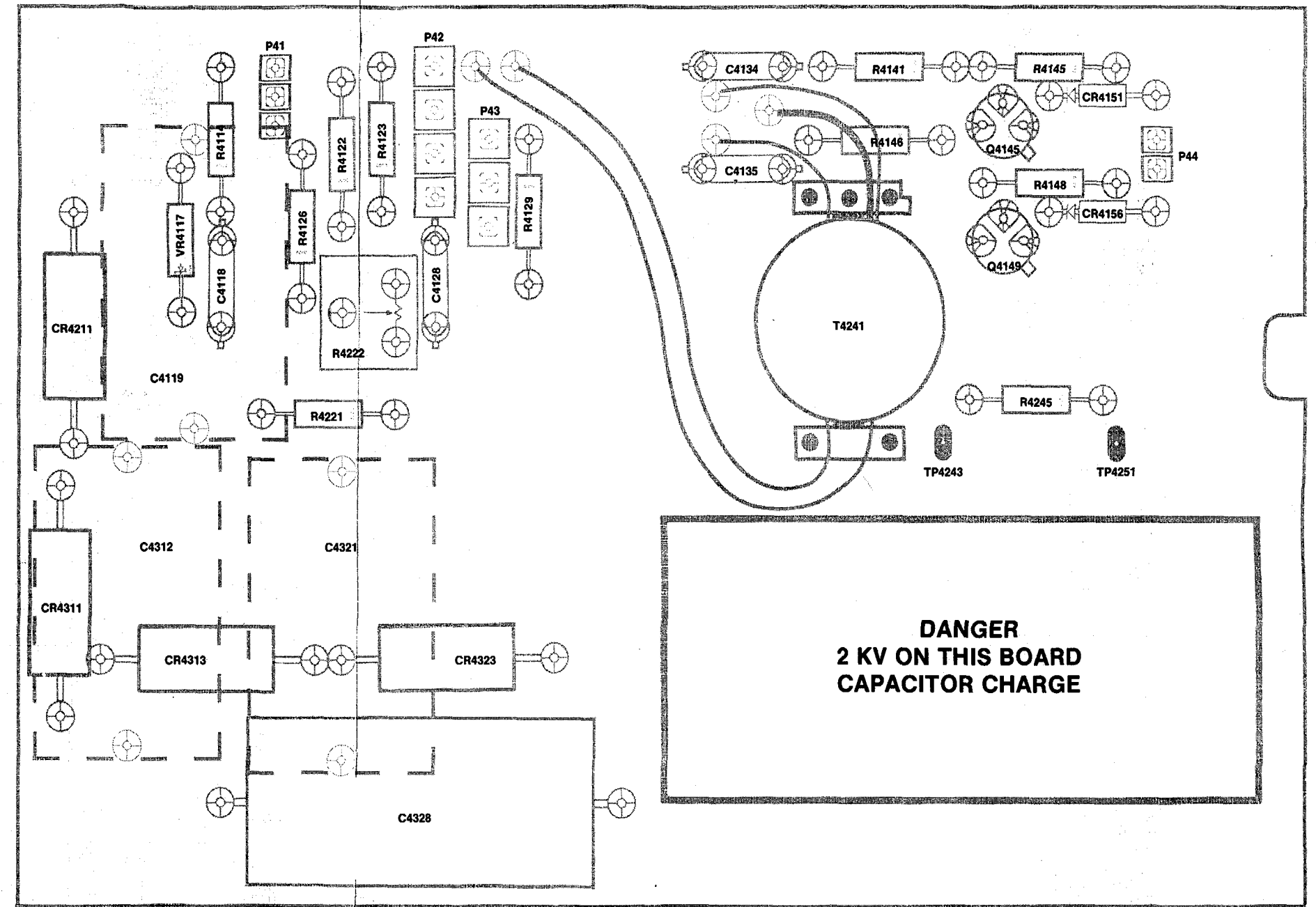
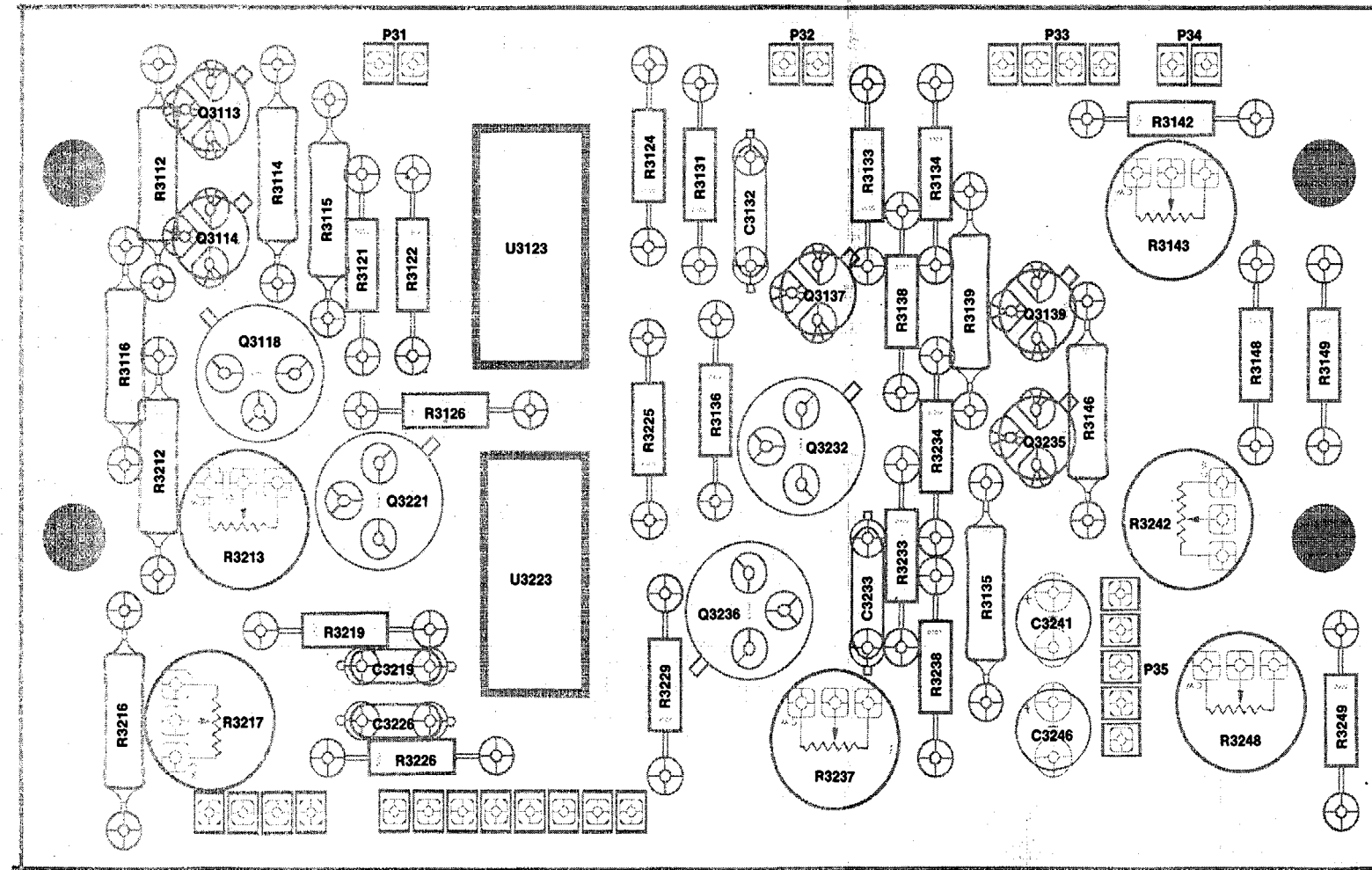


SCHEMATIC-MAIN BOARD COMPONENTS

| CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|
| C2137 | B3 | R2311 | H2 |
| C2138 | A2 | R2321 | B6 |
| C2146 | A2 | R2322 | B6 |
| C2147 | B2 | R2323 | B5 |
| C2158 | G5 | R2324 | C6 |
| C2229 | E2 | R2325 | B5 |
| C2232 | E2 | R2326 | B4 |
| C2241 | C2 | R2337 | D7 |
| C2252 | F7 | R2345 | G8 |
| C2325 | C6 | R2346 | F8 |
| C2345 | G8 | R2347 | F7 |
| C2349 | G4 | R2348 | F8 |
| C2351 | F4 | R2353 | G2 |
| C2352 | F7 | R2354 | G9 |
| C2356 | F6 | R2355 | H9 |
| | | R2361 | G5 |
| CR2161 | G4 | S0481A | D8 |
| CR2216 | H2 | S2126 | A5 |
| CR2217 | H2 | S2254 | F2 |
| CR2262 | G6 | | |
| CR2324 | C6 | | |
| CR2341 | D6 | | |
| CR2344 | F8 | U2131 | A2 |
| CR2345 | G8 | U2136 | B3 |
| CR2353 | D6 | U2143 | B8 |
| | | U2332 | D6,E7 |
| M0171 | H1 | VR2212 | H2 |
| Q2246A | G6 | | |
| Q2246B | G6 | | |
| Q2248 | F7 | | |
| Q2249 | F7 | | |
| Q2257 | F8 | | |
| Q2258 | G8 | | |
| Q2259 | G9 | | |
| Q2261 | G5 | | |
| Q2262 | G5 | | |
| Q2341 | G3 | | |
| Q2342 | G3 | | |
| Q2345 | G4 | | |
| R0251A | A1 | | |
| R0251B | A1 | | |
| R0252 | A1 | | |
| R0262 | A1 | | |
| R0263 | C9 | | |
| R0352 | B1 | | |
| R2137 | B2 | | |
| R2138 | B2 | | |
| R2139 | A2 | | |
| R2142 | C8 | | |
| R2144 | B7 | | |
| R2146 | B2 | | |
| R2149 | D8 | | |
| R2157 | G4 | | |
| R2158 | G5 | | |
| R2166 | G4 | | |
| R2220 | E3 | | |
| R2221 | C4 | | |
| R2222 | C3 | | |
| R2223 | C5 | | |
| R2224 | C6 | | |
| R2225 | D2 | | |
| R2226 | C7 | | |
| R2227 | C7 | | |
| R2228 | B7 | | |
| R2229 | B4 | | |
| R2233 | B7 | | |
| R2235 | E2 | | |
| R2236 | E7 | | |
| R2237 | D7 | | |
| R2242 | G3 | | |
| R2247 | F7 | | |
| R2251 | F8 | | |
| R2258 | H9 | | |
| R2266 | G5 | | |
| R2267 | G5 | | |

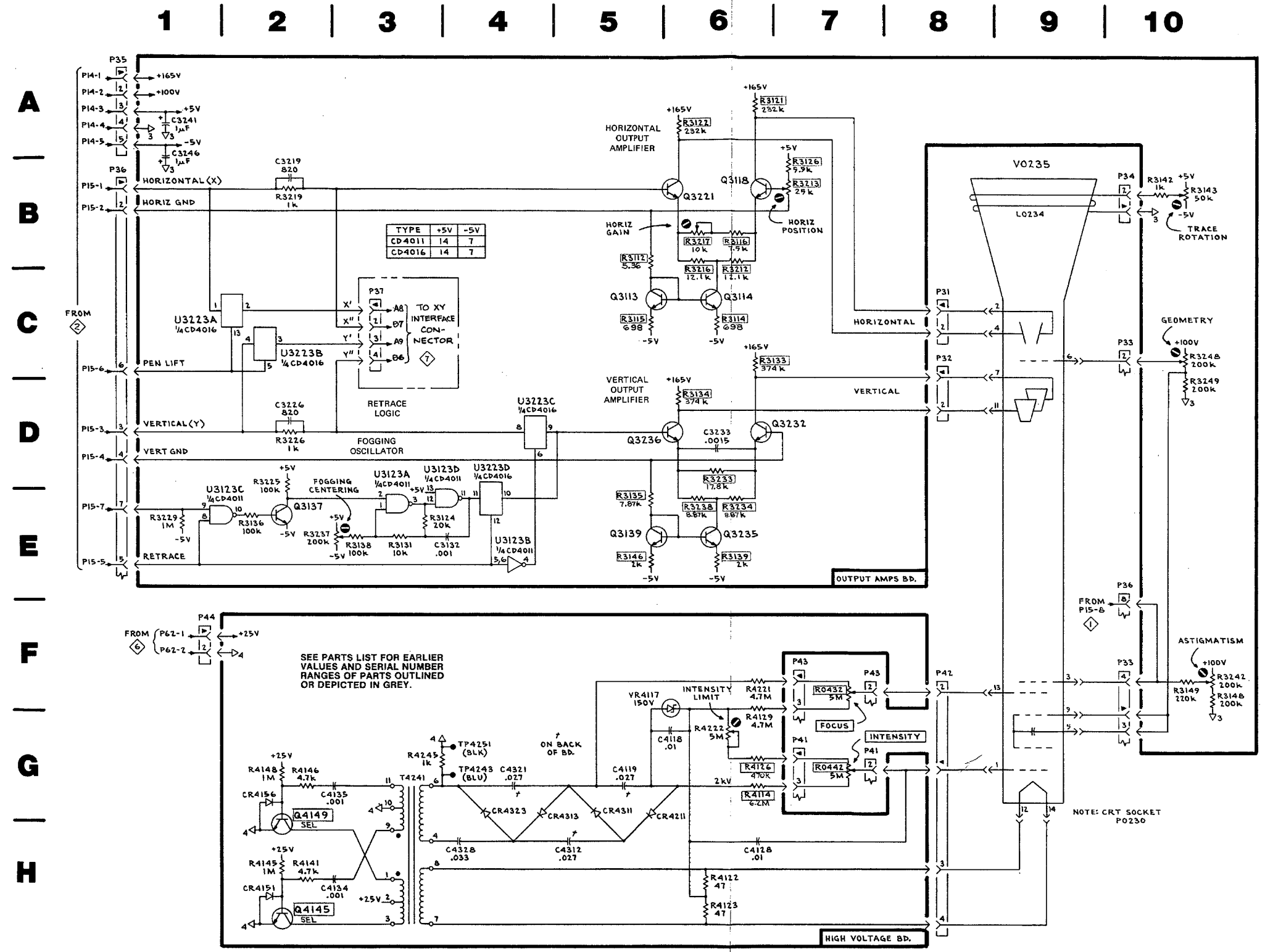


SCHEMATIC-VERTICAL AMP/SLOW RAMP

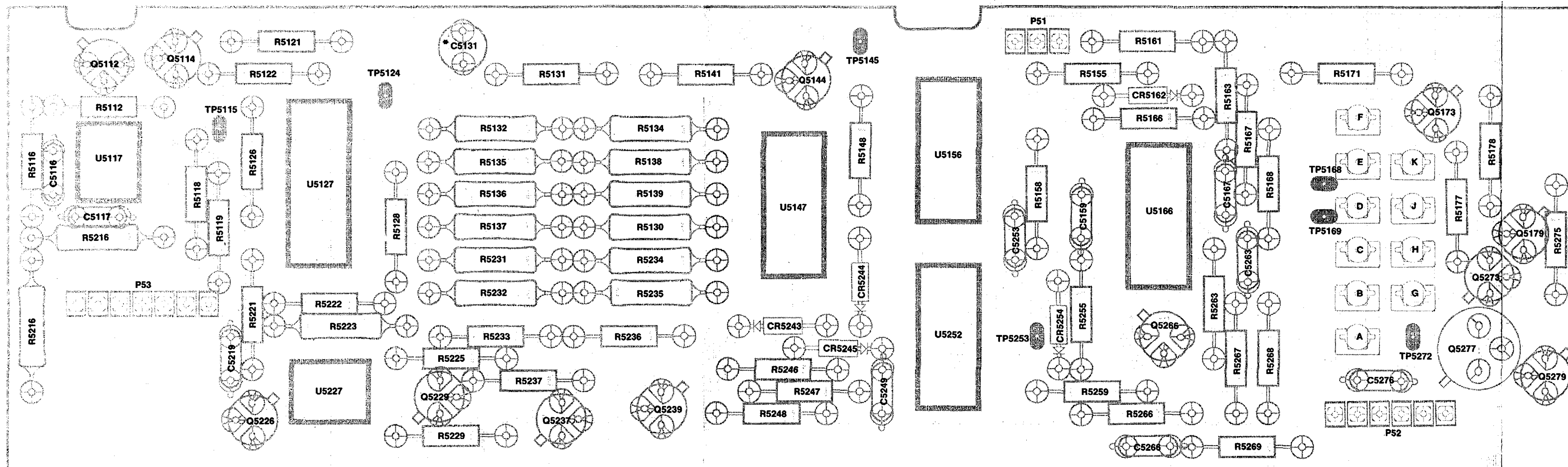


SCHMATIC-OUTPUT AMPL & HIGH VOLTAGE COMPONENTS

| CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|
| C3132 | E2 | R4114 | G6 |
| C3219 | B2 | R4122 | H6 |
| C3226 | D2 | R4123 | H6 |
| C3233 | D6 | R4126 | G6 |
| C3241 | A1 | R4129 | G6 |
| C3246 | A1 | R4141 | H2 |
| | | R4145 | H2 |
| C4118 | G5 | R4146 | G2 |
| C4119 | G5 | R4148 | G2 |
| C4128 | H6 | R4221 | F6 |
| C4134 | H2 | R4222 | G6 |
| C4135 | G2 | R4245 | G3 |
| C4312 | H4 | | |
| C4321 | G4 | T4241 | G3 |
| C4328 | H3 | | |
| CR4151 | H2 | U3123 | E1,E3 |
| CR4156 | G2 | U3223 | C1,D4 |
| CR4211 | G5 | | |
| CR4311 | G5 | V0235 | B9 |
| CR4313 | G4 | | |
| CR4323 | G4 | VR4117 | F5 |
| L0234 | B9 | | |
| P0230 | G9 | | |
| Q3113 | C5 | | |
| Q3114 | C6 | | |
| Q3118 | B6 | | |
| Q3137 | E2 | | |
| Q3139 | E5 | | |
| Q3221 | B6 | | |
| Q3232 | D6 | | |
| Q3235 | E6 | | |
| Q3236 | D6 | | |
| Q4145 | H2 | | |
| Q4149 | G2 | | |
| R0432 | F7 | | |
| R0442 | G7 | | |
| R3112 | B5 | | |
| R3114 | C6 | | |
| R3115 | C5 | | |
| R3116 | B6 | | |
| R3121 | A6 | | |
| R3122 | A6 | | |
| R3124 | E3 | | |
| R3126 | B7 | | |
| R3131 | E3 | | |
| R3133 | C6 | | |
| R3134 | D6 | | |
| R3135 | E5 | | |
| R3136 | E2 | | |
| R3138 | E3 | | |
| R3139 | E6 | | |
| R3142 | B10 | | |
| R3143 | B10 | | |
| R3146 | E5 | | |
| R3148 | F10 | | |
| R3149 | F10 | | |
| R3212 | B6 | | |
| R3213 | B7 | | |
| R3216 | B6 | | |
| R3217 | B6 | | |
| R3219 | B2 | | |
| R3225 | D2 | | |
| R3226 | D1 | | |
| R3229 | E1 | | |
| R3233 | D6 | | |
| R3234 | E6 | | |
| R3237 | E2 | | |
| R3238 | E6 | | |
| R3242 | F10 | | |
| R3248 | C10 | | |
| R3249 | C10 | | |



SCHEMATIC-OUTPUT AMPLIFIERS & HIGH VOLTAGE
10-11



*See Parts List for serial number ranges.

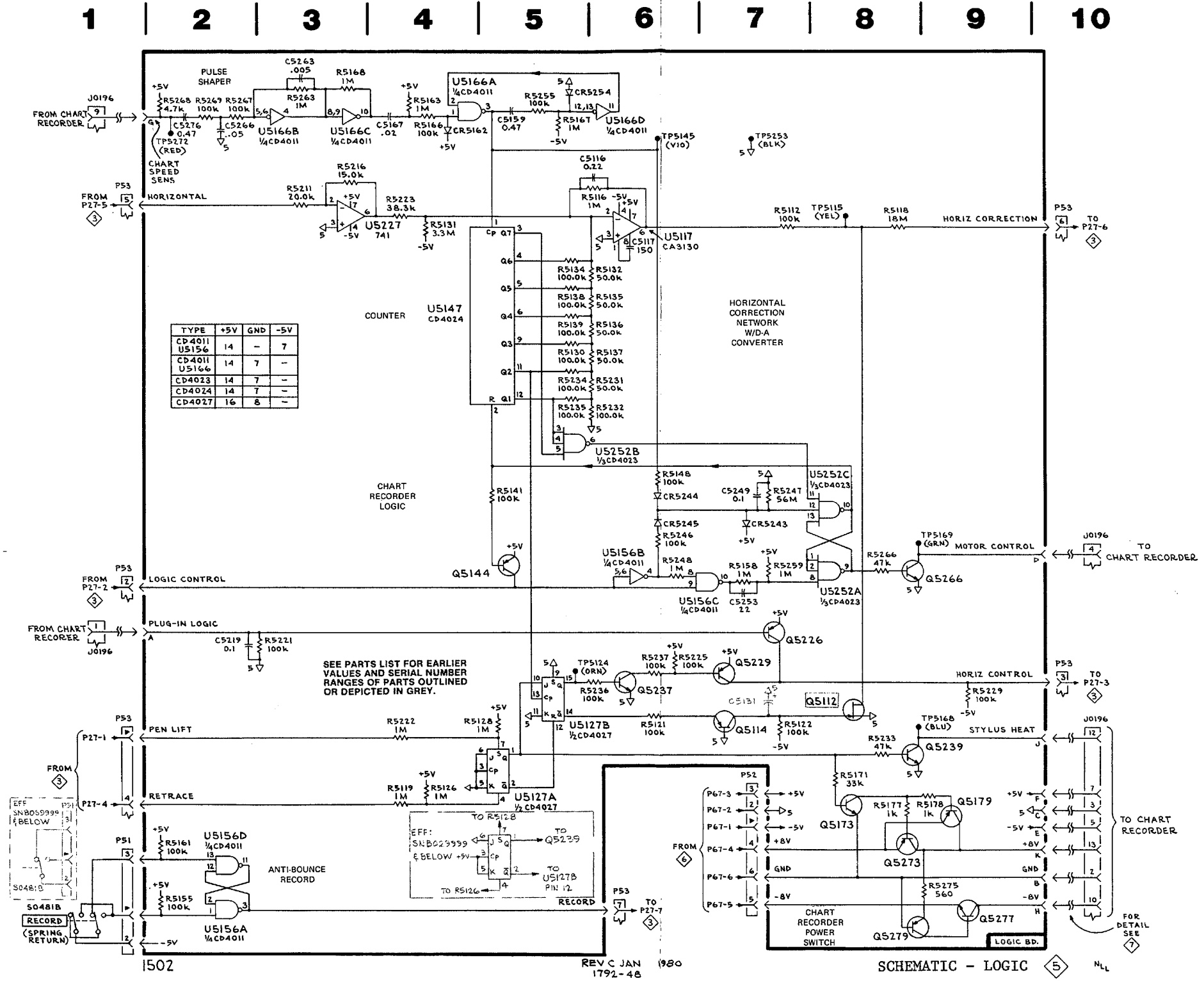
1792-47

Logic Board

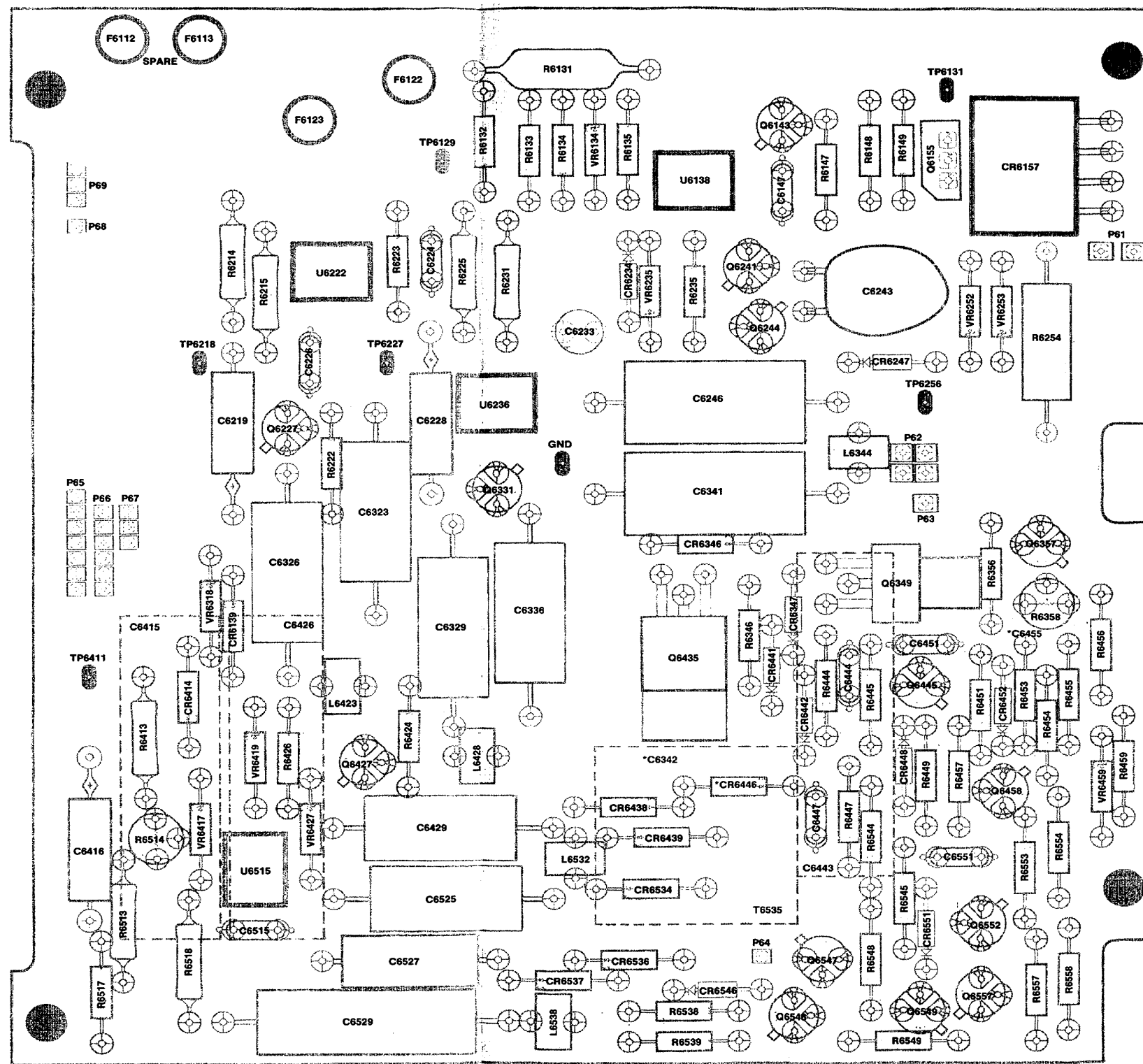
SCHEMATIC-LOGIC BOARD COMPONENTS

| CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|
| C5116 | B5 | R5246 | E6 |
| C5117 | B6 | R5247 | E7 |
| C5131 | G7 | R5248 | E6 |
| C5159 | A5 | R5255 | A5 |
| C5167 | A4 | R5259 | E7 |
| C5219 | F2 | R5263 | A3 |
| C5249 | D7 | R5266 | E8 |
| C5253 | F7 | R5267 | A2 |
| C5263 | A3 | R5268 | A2 |
| C5266 | A2 | R5269 | A2 |
| C5276 | A2 | R5275 | H9 |
| CR5162 | A4 | S0481B | H1 |
| CR5243 | E7 | | |
| CR5244 | E6 | U5117 | B6 |
| CR5245 | E6 | U5127 | G5 |
| CR5254 | A6 | U5147 | C4 |
| | | U5156 | E6 |
| Q5112 | F8 | U5166 | A3,A5,A6 |
| Q5114 | G7 | U5227 | B4 |
| Q5144 | E4 | U5252 | D5,D8,E8 |
| Q5173 | G7 | | |
| Q5179 | G9 | | |
| Q5226 | F7 | | |
| Q5229 | F7 | | |
| Q5237 | F6 | | |
| Q5239 | G9 | | |
| Q5266 | E9 | | |
| Q5273 | H8 | | |
| Q5277 | H9 | | |
| Q5279 | H8 | | |
| R5112 | B7 | | |
| R5116 | B5 | | |
| R5118 | B8 | | |
| R5119 | G4 | | |
| R5121 | G6 | | |
| R5122 | G7 | | |
| R5126 | G4 | | |
| R5128 | G5 | | |
| R5130 | C5 | | |
| R5131 | B4 | | |
| R5132 | C6 | | |
| R5134 | C5 | | |
| R5135 | C6 | | |
| R5136 | C6 | | |
| R5137 | C6 | | |
| R5138 | C5 | | |
| R5139 | C5 | | |
| R5141 | D5 | | |
| R5148 | D6 | | |
| R5155 | H2 | | |
| R5158 | E7 | | |
| R5161 | H2 | | |
| R5163 | A4 | | |
| R5166 | A4 | | |
| R5167 | A5 | | |
| R5168 | A3 | | |
| R5171 | G8 | | |
| R5177 | G8 | | |
| R5178 | G9 | | |
| R5211 | B3 | | |
| R5216 | E2 | | |
| R5221 | F3 | | |
| R5222 | G4 | | |
| R5223 | B4 | | |
| R5225 | F6 | | |
| R5229 | F9 | | |
| R5231 | D6 | | |
| R5232 | D6 | | |
| R5233 | G8 | | |
| R5234 | D5 | | |
| R5235 | D5 | | |
| R5236 | F5 | | |
| R5237 | F6 | | |

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SCHMATIC-LOGIC
10-13

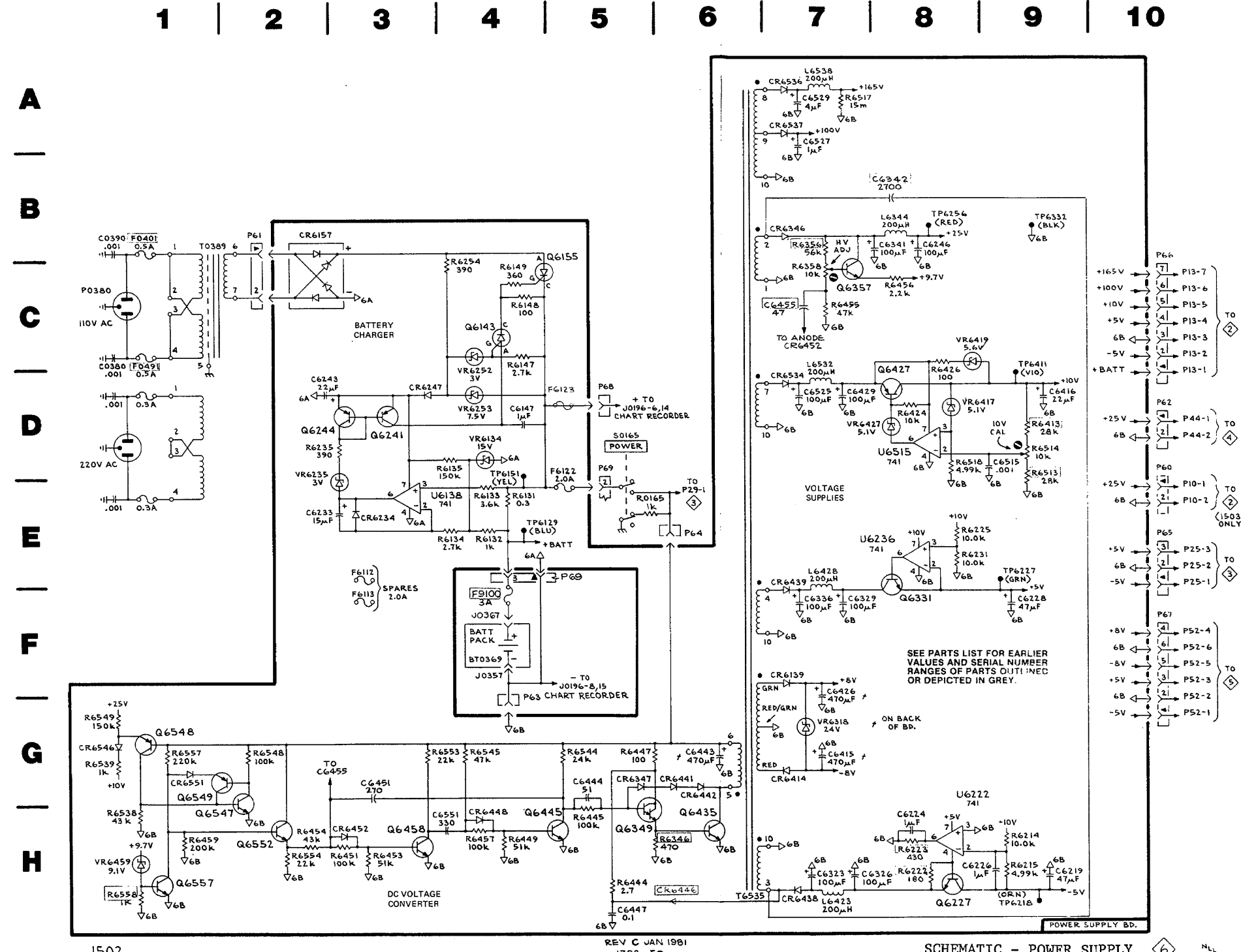


*See Parts List for serial number ranges.

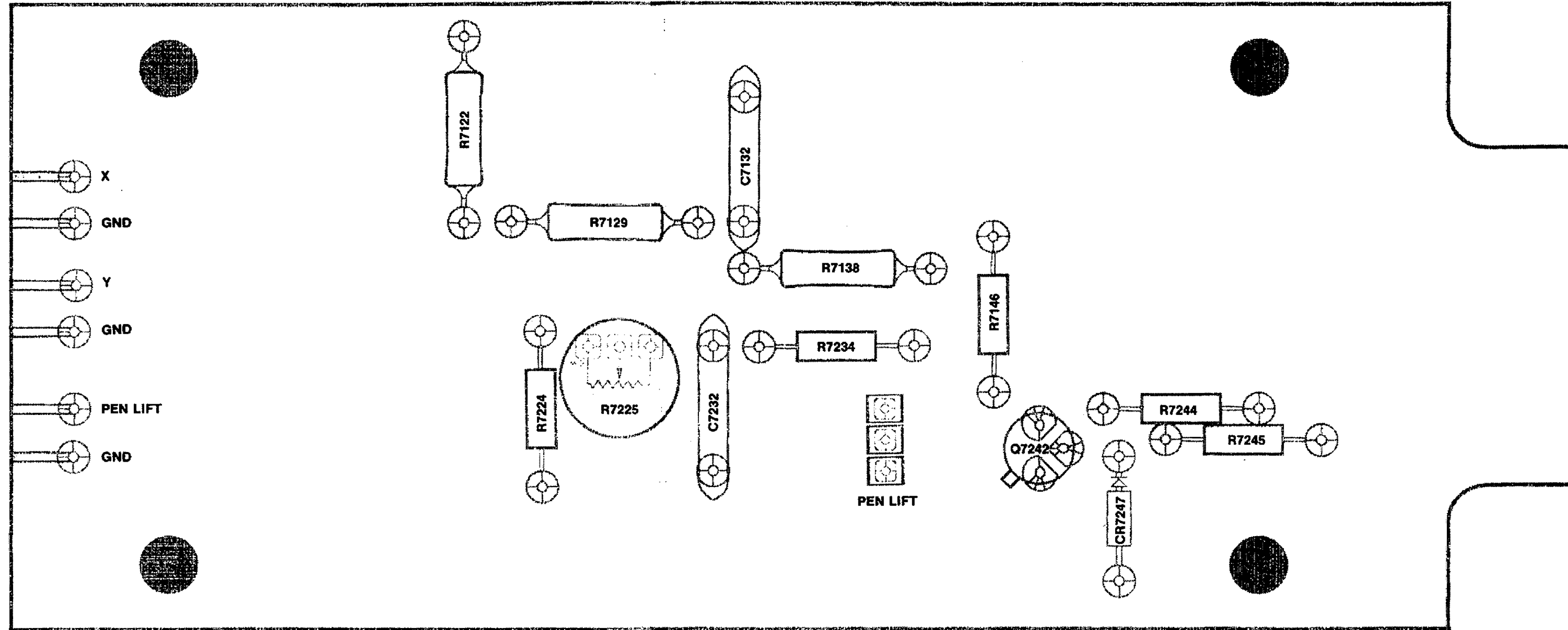
Power Supply
SCHEMATIC-POWER SUPPLY
10-14

1792-49

| CKT NO | GRID LOC | CKT NO | GRID LOC |
|--------|----------|--------|----------|
| BT0369 | F4 | Q6458 | H3 |
| | | Q6547 | H2 |
| C0380 | D1 | Q6548 | G1 |
| C0390 | C1 | Q6549 | G2 |
| C6147 | D5 | Q6552 | H2 |
| C6219 | H10 | Q6557 | H1 |
| C6224 | H8 | | |
| C6226 | H9 | | |
| C6228 | F9 | R6131 | E5 |
| C6233 | E3 | R6132 | E4 |
| C6243 | D3 | R6133 | E4 |
| C6246 | B8 | R6134 | E4 |
| C6323 | H7 | R6135 | D4 |
| C6326 | H8 | R6147 | C5 |
| C6329 | F8 | R6148 | C5 |
| C6336 | F7 | R6149 | C5 |
| C6341 | B8 | R6214 | H9 |
| C6342 | B8 | R6215 | H9 |
| C6415 | G8 | R6222 | H8 |
| C6416 | D10 | R6223 | H8 |
| C6426 | G8 | R6225 | E9 |
| C6429 | D8 | R6231 | E9 |
| C6443 | G7 | R6235 | D3 |
| C6444 | G5 | R6254 | C4 |
| C6447 | H6 | R6346 | H6 |
| C6451 | C8 | R6356 | B8 |
| C6455 | C7 | R6358 | C7 |
| C6515 | D9 | R6413 | D9 |
| C6525 | D7 | R6424 | D8 |
| C6527 | A7 | R6426 | D8 |
| C6529 | A7 | R6444 | H6 |
| C6551 | H4 | R6445 | H5 |
| | | R6447 | G6 |
| | | R6449 | H5 |
| CR6139 | F7 | R6451 | H3 |
| CR6157 | B3 | R6453 | H3 |
| CR6234 | E3 | R6454 | H3 |
| CR6247 | D4 | R6455 | C8 |
| CR6346 | B7 | R6456 | C8 |
| CR6347 | G6 | R6457 | H4 |
| CR6414 | G7 | R6459 | H2 |
| CR6438 | H7 | R6513 | E9 |
| CR6439 | F7 | R6514 | D9 |
| CR6441 | G6 | R6517 | A8 |
| CR6442 | G6 | R6518 | D9 |
| CR6446 | H6 | R6538 | H1 |
| CR6448 | H4 | R6539 | G1 |
| CR6452 | H3 | R6544 | G5 |
| CR6534 | D7 | R6545 | G4 |
| CR6536 | A7 | R6548 | G2 |
| CR6537 | A7 | R6549 | G1 |
| CR6546 | G1 | R6553 | G4 |
| CR6551 | G2 | R6554 | H3 |
| | | R6557 | G2 |
| | | R6558 | H1 |
| F0401 | B1 | | |
| F0401 | B1 | | |
| F0491 | C1 | S0165 | E6 |
| F0491 | C1 | | |
| F6112 | F3 | | |
| F6113 | F3 | T6535 | H8 |
| F6122 | E5 | | |
| L6344 | B8 | U6138 | E4 |
| L6423 | H7 | U6222 | H9 |
| L6428 | F7 | U6236 | E8 |
| L6532 | D7 | U6515 | D8 |
| L6538 | A7 | | |
| Q6143 | C4 | VR6134 | D4 |
| Q6155 | C5 | VR6235 | E3 |
| Q6227 | H9 | VR6252 | D4 |
| Q6241 | D3 | VR6253 | D4 |
| Q6244 | D3 | VR6318 | G7 |
| Q6331 | F8 | VR6417 | D9 |
| Q6349 | H6 | VR6419 | C9 |
| Q6357 | C8 | VR6427 | D8 |
| Q6427 | D8 | VR6459 | H1 |
| Q6435 | H6 | | |
| Q6445 | H5 | | |



SCHEMATIC-POWER SUPPLY



1792-51

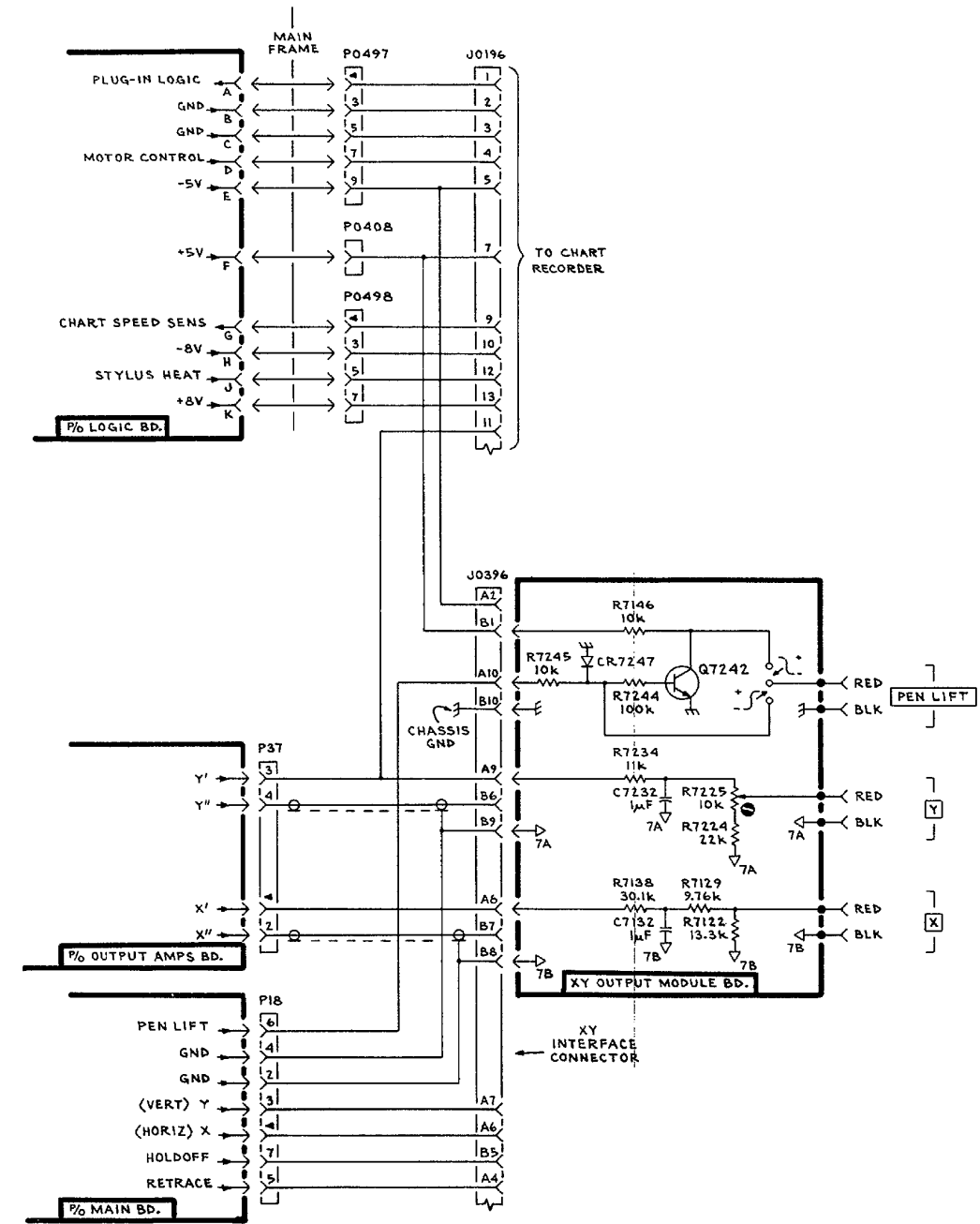
X-Y Output Module

SCHEMATIC-POWER SUPPLY COMPONENTS

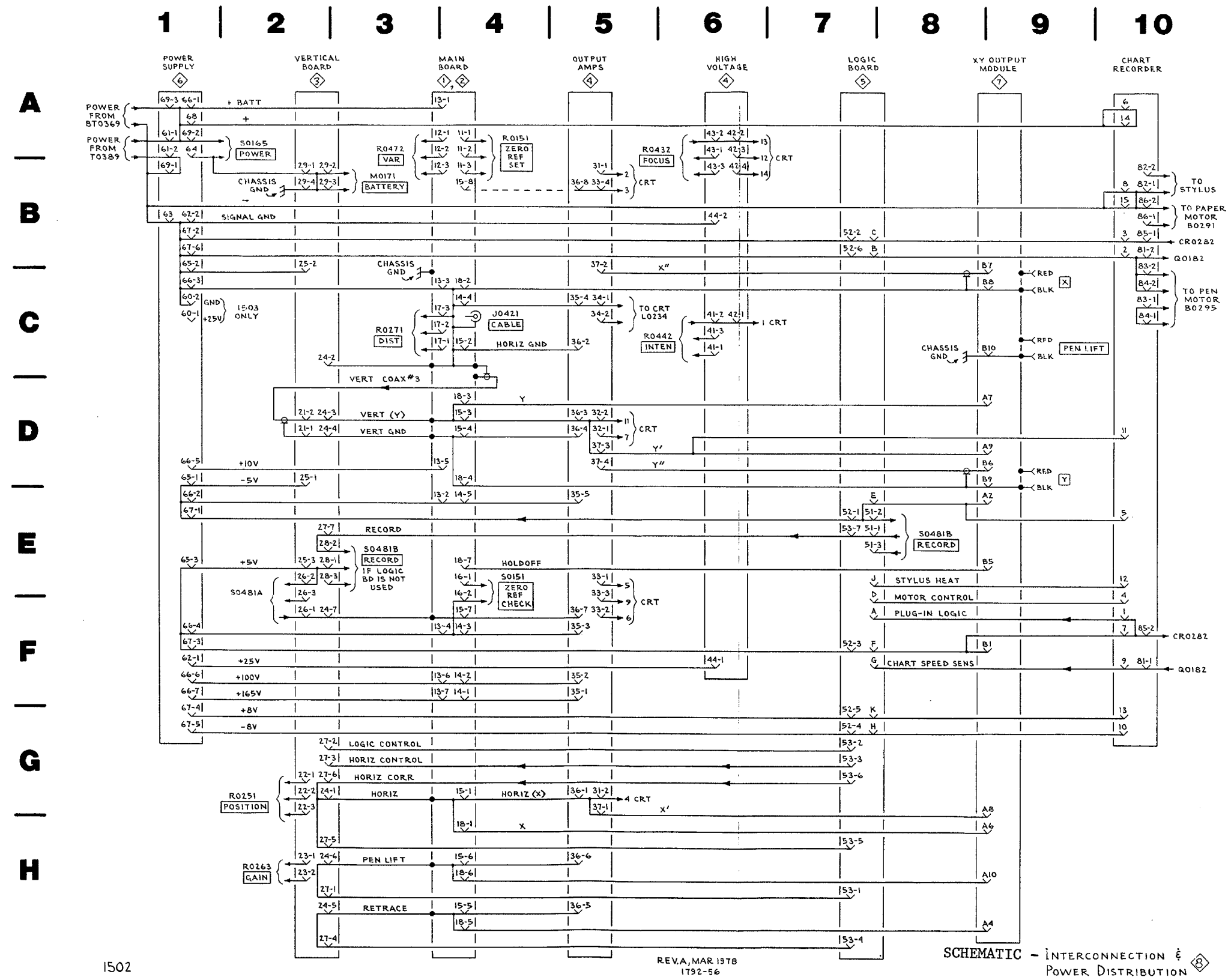
1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10

| CKT NO | GRID LOC |
|--------|----------|
| C7132 | F6 |
| C7232 | E6 |
| CR7247 | D6 |
| Q7242 | E7 |
| R7122 | F7 |
| R7129 | F7 |
| R7138 | F6 |
| R7146 | D6 |
| R7224 | E7 |
| R7225 | E7 |
| R7234 | E6 |
| R7244 | E6 |
| R7245 | E6 |

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1502
REV. B, MAR 1978
1792-52
SCHEMATIC - XY OUTPUT MODULE &
CHART RECORDER INTERCONNECT



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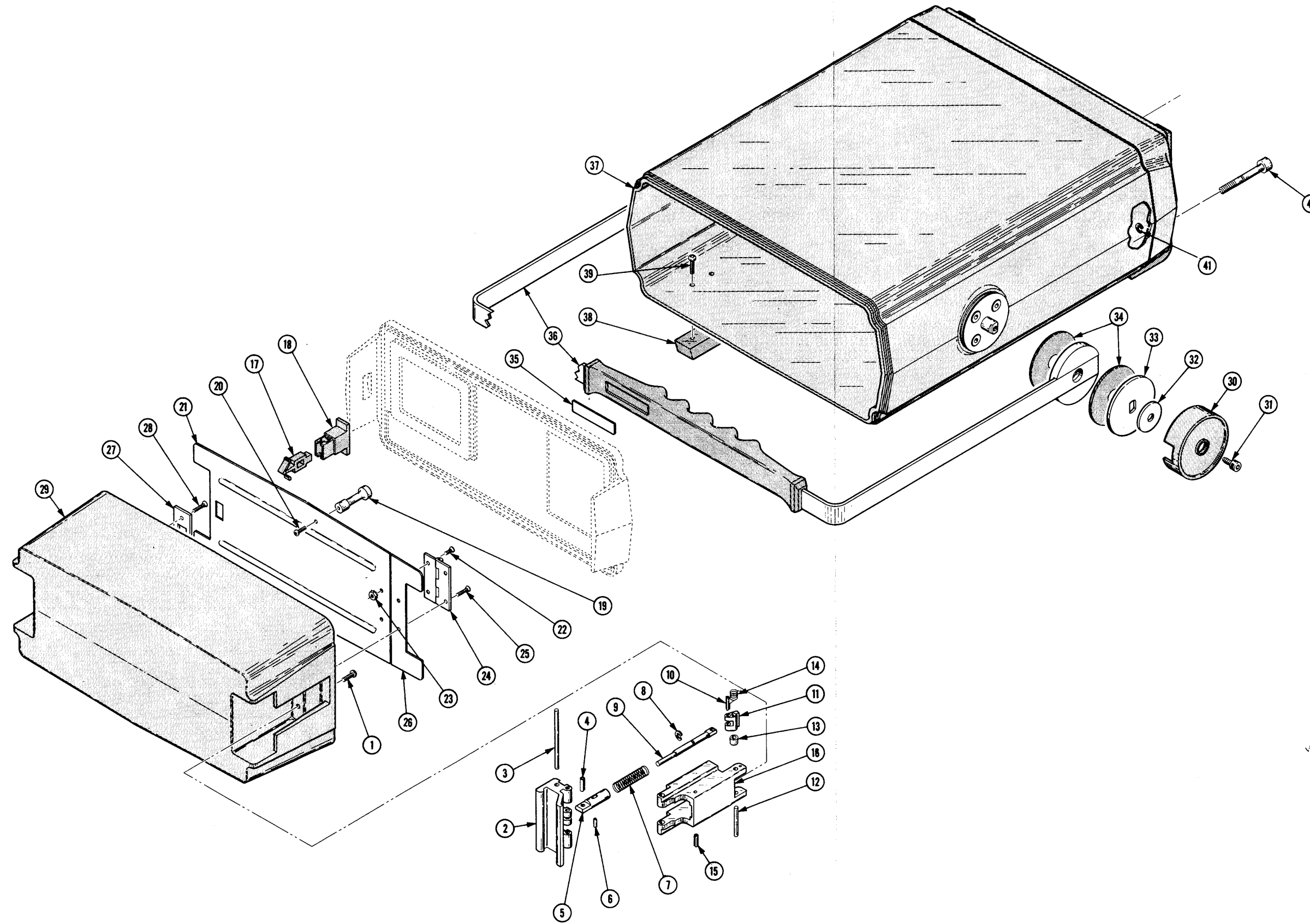


Figure 1. Cabinet and Access Box
10-21

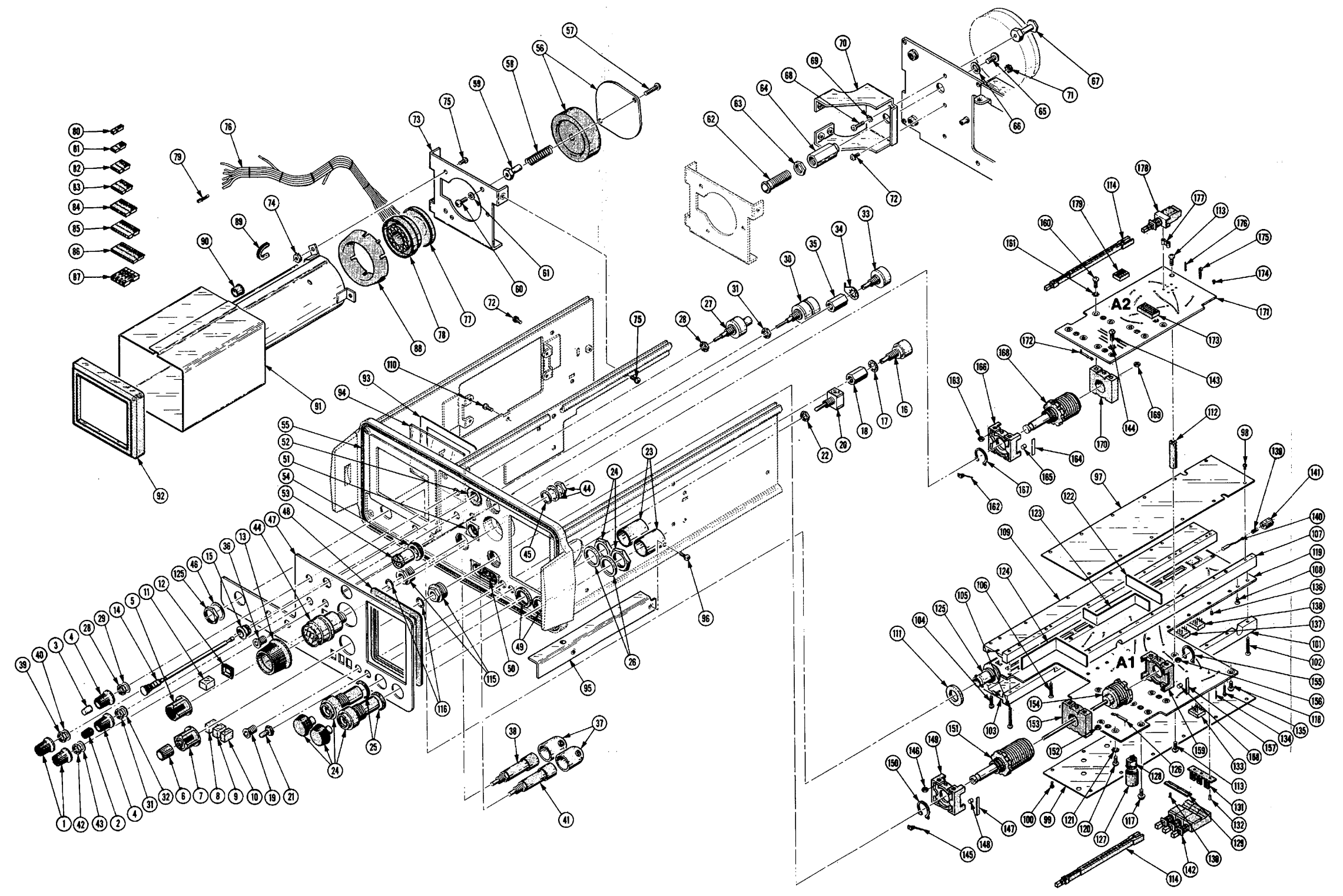
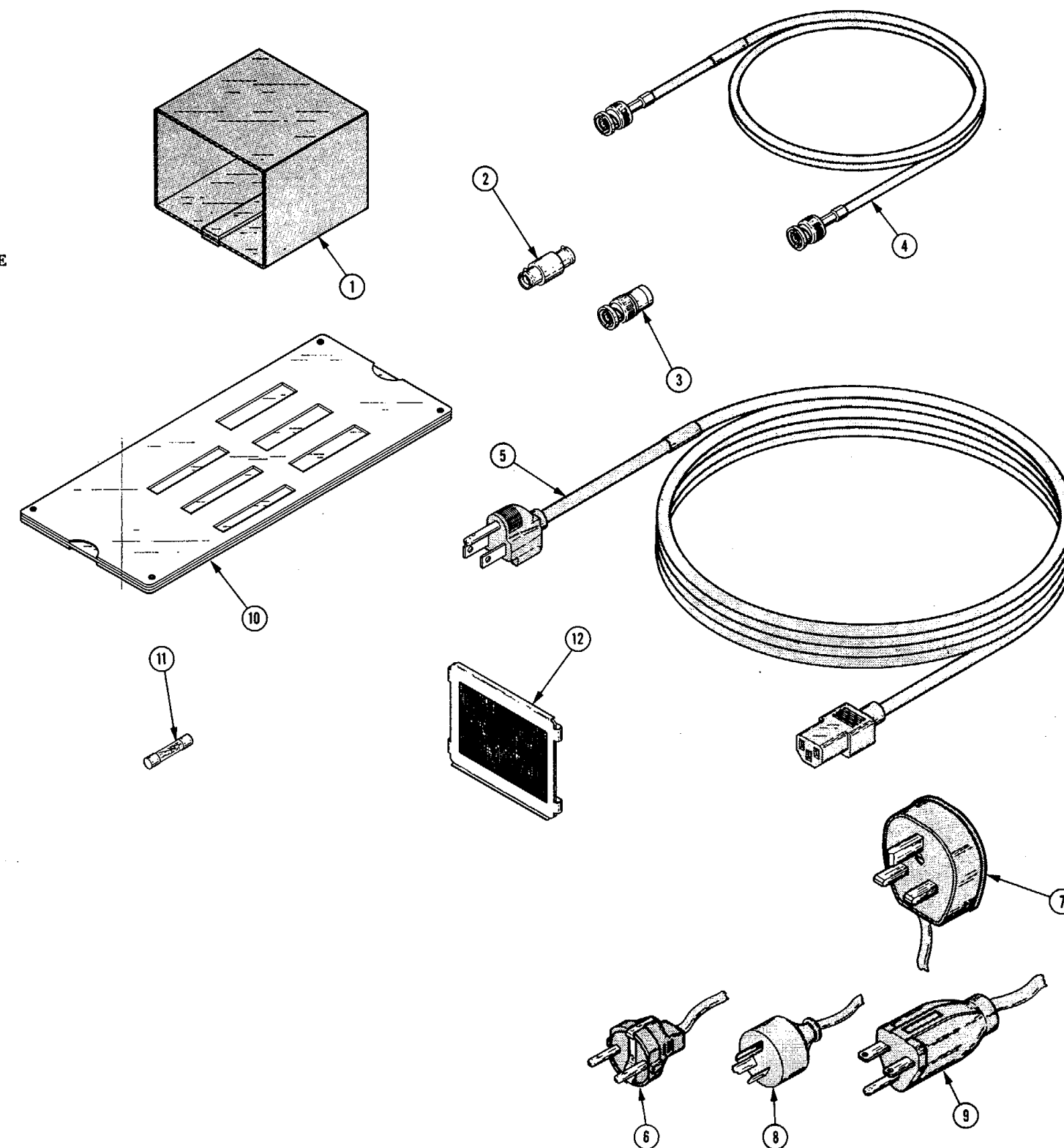


Figure 2.. Chassis

| Fig. & Index No. | Tektronix Part No. | Serial/Model No. Eff | Dscont | Qty | 1 | 2 | 3 | 4 | 5 | Name & Description | Mfr Code | Mfr Part Number |
|----------------------|--------------------|----------------------|----------|-----|---|---|---|---|---|---|----------|------------------|
| STANDARD ACCESSORIES | | | | | | | | | | | | |
| -1 | 016-0297-00 | | | 1 | | | | | | VISOR,CRT: | 80009 | 016-0297-00 |
| -2 | 103-0028-00 | | | 1 | | | | | | ADAPTER,CONN:BNC FEMALE TOFEMALE | 91737 | UC914/UDURAPLATE |
| -3 | 011-0123-00 | | | 1 | | | | | | CONNECTOR,PLUG,:50 OHM,BNC | 80009 | 011-0123-00 |
| -4 | 012-0482-00 | | | 1 | | | | | | CABLE ASSY,RF:50 OHM,36 INCH LONG | 80009 | 012-0482-00 |
| -5 | 161-0066-00 | | | 1 | | | | | | CABLE ASSY,PWR,:3,18 AWG,115V,98.0 L | 80009 | 161-0066-00 |
| -6 | 161-0066-09 | XB102860 | | 1 | | | | | | CABLE ASSY,PWR:3,0.75MM SQ,220V,96.0 L (EUROPEAN ONLY) | 80126 | OBD |
| -7 | 161-0066-10 | XB102860 | | 1 | | | | | | CABLE ASSY,PWR:3,0.75MM SQ,240V,96.0 L (UNITED KINGDOM ONLY) | 80126 | OBD |
| -8 | 161-0066-11 | XB102860 | | 1 | | | | | | CABLE ASSY,PWR:3,0.75MM,240V,96.0L (AUSTRALIAN ONLY) | 80126 | OBD |
| -9 | 161-0066-12 | XB102860 | | 1 | | | | | | CABLE ASSY,PWR:3,18 AWG,240V,96.0 L (NORTH AMERICAN ONLY) | 80126 | OBD |
| -10 | 003-0700-00 | | | 1 | | | | | | . RULE,SLIDE:TIME DOMAIN REFLECTOMETER | 80009 | 003-0700-00 |
| | 062-1538-00 | B010100 | B060940X | 1 | | | | | | . DATA SHEET:003-0700-01 | 80009 | 062-1538-00 |
| -11 | 159-0029-00 | B010100 | B059999 | 1 | | | | | | FUSE,CARTRIDGE:3AG,0.3A,250V,SLOW-BLOW | 71400 | MDL3/10 |
| | 159-0032-00 | B060000 | | 2 | | | | | | FUSE,CARTRIDGE:3AG,0.5A,250V,SLOW-BLOW | 71400 | MDL 1/2 |
| | 159-0054-00 | B010100 | B059999 | 1 | | | | | | FUSE,CARTRIDGE:3AG,0.15A,250V,SLOW-BLOW | 71400 | MDL 15/100 |
| | 159-0029-01 | B060000 | | 1 | | | | | | FUSE,CARTRIDGE:BUSSMAN ONLY | 71400 | BUSS MDL 3/10 |
| -12 | 378-0055-00 | | | 1 | | | | | | FILTER,MESH:CRT | 80009 | 378-0055-00 |
| | 013-0130-00 | XB060960 | | 1 | | | | | | ADAPTER,CONN:BNC TO PROBE | 80009 | 013-0130-00 |
| | 070-1792-01 | | | 1 | | | | | | MANUAL,TECH:INSTRUCTION | 80009 | 070-1792-01 |
| | 070-1790-00 | | | 1 | | | | | | MANUAL,TECH:OPERATOR | 80009 | 070-1790-00 |
| OPTIONAL ACCESSORIES | | | | | | | | | | | | |
| | 017-0064-00 | | | 1 | | | | | | ADAPTER,CONN:TYPE BNC TO GR,MALE | 24655 | 0874-9800-QBPA |
| | 103-0058-00 | | | 1 | | | | | | ADAPTER,CONN:N FEMALE TO BNC MALE | 91836 | KN99-46TR5 |
| | 103-0032-00 | | | 1 | | | | | | ADAPTER,CONN:BNC MALE TO UHF FEMALE | 24931 | 29-JP116-1 |
| | 103-0035-00 | | | 1 | | | | | | ADAPTER,CONN:BNC DUAL BINDING POST | 05276 | 1296 |
| | 103-0045-00 | | | 1 | | | | | | ADAPTER,CONN:BNC FEMALE TO N MALE | 91836 | KN99-35 |
| | 013-0076-00 | | | 1 | | | | | | ADAPTER,CONN:BNC FEMALE TO CLIP LEADS | 80009 | 013-0076-00 |
| | 017-0089-00 | | | 1 | | | | | | ADAPTER,CONN:GR TO TYPE F,FEMALE | 80009 | 017-0089-00 |
| | 017-0021-00 | | | 1 | | | | | | ADAPTER,CONN:TYPE N TO GR,MALE | 80009 | 017-0021-00 |
| | 017-0063-00 | | | 1 | | | | | | ADAPTER,CONN:BNC TO GR | 24655 | 0874-9700 |
| | 017-0062-00 | | | 1 | | | | | | ADAPTER,CONN:TYPE N TO GR,FEMALE | 80009 | 017-0062-00 |
| | 017-0090-00 | | | 1 | | | | | | FIXTURE,CAL:50 OHM TO 125OHM | 80009 | 017-0090-00 |
| | 017-0091-00 | | | 1 | | | | | | FIXTURE,CAL:50 OHM TO 75 OHM | 80009 | 017-0091-00 |
| | 017-0092-00 | | | 1 | | | | | | ADPTR,TDR IMPD:50 OHM TO 93 OHM | 80009 | 017-0092-00 |
| | 006-1658-00 | | | 1 | | | | | | CHART,RCDG,PPR:BLACK | 80009 | 006-1658-00 |
| | 006-1658-01 | | | 1 | | | | | | CHART,RCDG,PPR:GRAY | 80009 | 006-1658-01 |
| | 006-1658-02 | | | 1 | | | | | | CHART,RCDG,PPR:100 ROLL,CASE,GRAY | 80009 | 006-1658-02 |
| | 015-0327-00 | | | 1 | | | | | | FILTER,DIR CUR: | 80009 | 015-0327-00 |
| | 011-0132-00 | | | 1 | | | | | | STATIC SUPPR: | 80009 | 011-0132-00 |



Accessories

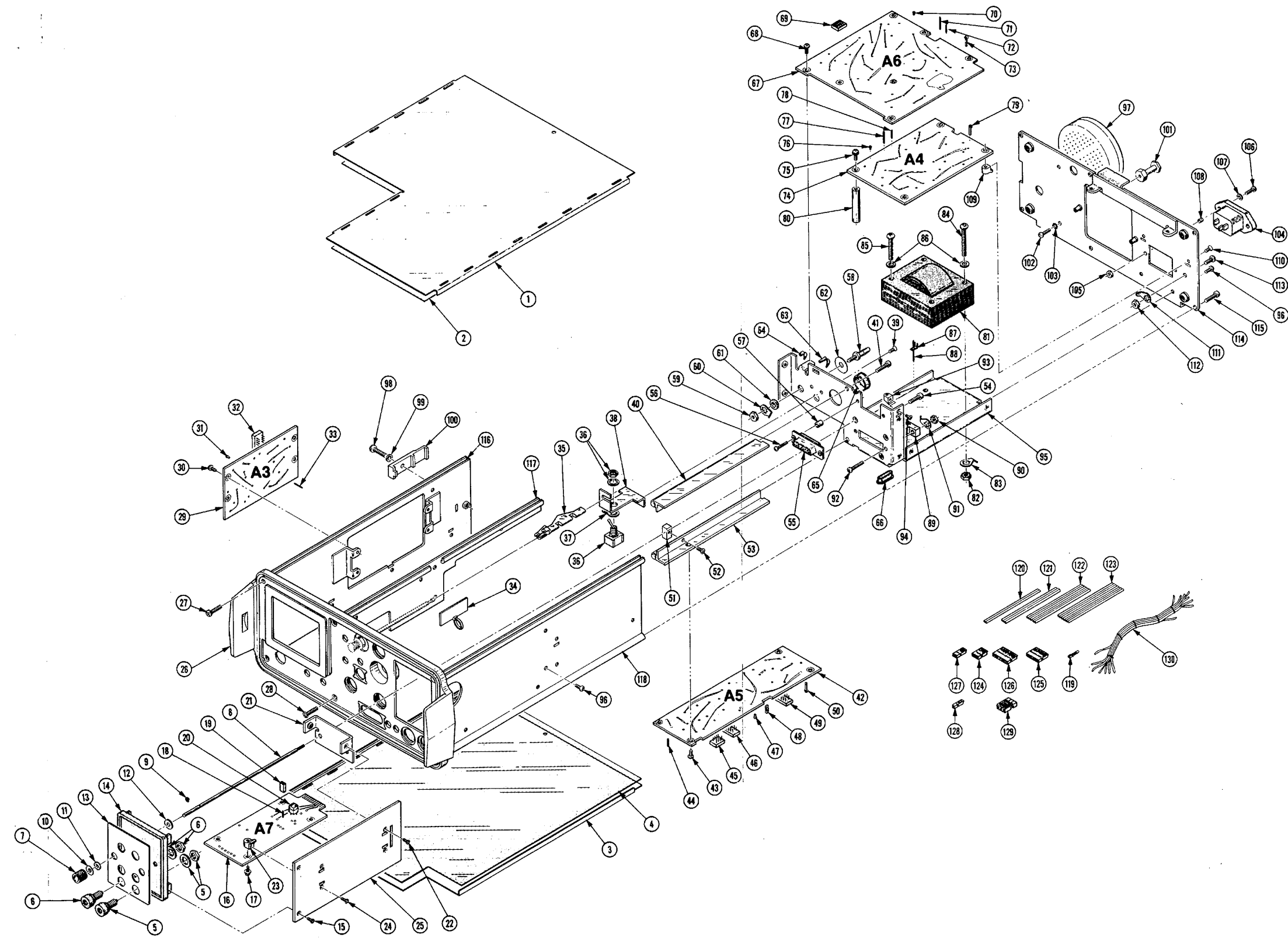


Figure 3. Front and Frame

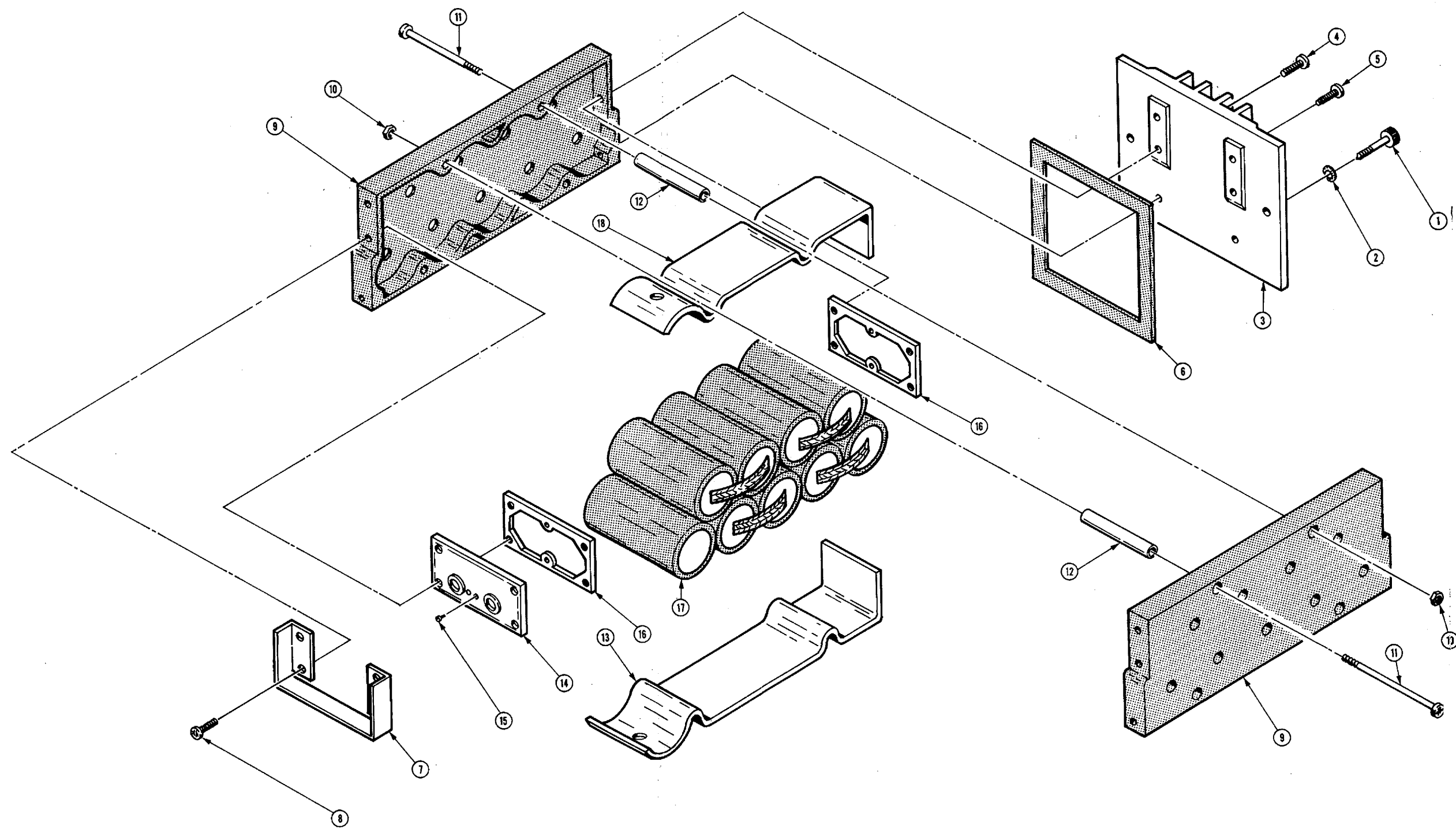


Figure4. Battery Pack

