

**TECHNICAL MANUAL**

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

**(INCLUDING REPAIR PARTS)**

**FOR**

**TEKTRONIX  
1502 TIME DOMAIN  
REFLECTOMETER**

**(PATRIOT AIR DEFENSE GUIDED MISSILE SYSTEM)**

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**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.

TABLE OF CONTENTS

		<u>Page</u>
LIST OF ILLUSTRATIONS .....		iii
OPERATOR'S SAFETY SUMMARY.....		iv
SERVICE SAFETY SUMMARY .....		v
Section 0.	GENERAL	
0-1.	Maintenance Forms and Records	0-1
0-2.	Reporting Equipment Improvement Recommendations (EIR)	0-1
0-3.	Administrative Storage	0-1
0-4.	Destruction of Army Material to Prevent Enemy Use	0-1
Section I.	SPECIFICATION.....	1-1
Section II.	OPERATING INSTRUCTIONS.....	2-1
Section III.	THEORY OF OPERATION .....	3-1
Section IV.	CALIBRATION PROCEDURE .....	4-1
	Performance Check.....	4-2
	Calibration Procedure.....	4-6
Section V.	MAINTENANCE .....	5-1
Section VI.	OPTIONS.....	6-1
Section VII.	REPLACEABLE ELECTRICAL PARTS .....	7-1
Section VIII.	DIAGRAMS AND ILLUSTRATIONS .....	8-1
Section IX.	REPLACEABLE MECHANICAL PARTS.....	9-1
Section X.	SCHEMATICS, ACCESSORIES, AND FIGURES .....	10-1
APPENDIX A	MAINTENANCE ALLOCATION CHART .....	A-1

## LIST OF ILLUSTRATIONS

Figure No.		Page	Figure No.		Page
	1502 Time Domain Reflectometer	vi	5-8	Front Panel, Identification of Parts for Assembly Steps 8 through 26	5-9
2-1	1502 TDR with Cover	2-1	5-9	Detail of Plug-in Compartment Seal	5-10
2-2	Battery Connector Polarity	2-2	5-10	Detail of BNC Connector and Washer	5-10
2-3	1502 Front Panel Controls	2-3	5-11	Detail of Pushbuttons and Their Shafts	5-10
2-4	Incident and Reflected Pulses	2-4	5-12	Detail of Subpanel Screwhole Sealing	5-11
2-5	CRT Display of Pulse	2-6	5-13	Detail of Fuseholder Installation	5-11
2-6	TDR Display of R, versus Z	2-7	5-14	Detail of Fuseholder Caps	5-12
2-7	Impedance Nomogram	2-7	5-15	Application of Sealant to Battery Meter	5-12
2-8	Open Cable	2-8	5-16	Alignment of Battery Meter	5-12
2-9	Shorted Cable	2-8	5-17	Application of Sealant to FOCUS and INTENSITY Controls	5-12
2-10	Crimped Cable	2-9	5-18	Application of Sealant to FINE Control Bushing	5-13
2-11	Frayed Cable	2-9	5-19	Application of Sealant to FINE Control Nut	5-13
2-12	X-Y Output Module Strap	2-9	5-20	Installation of Distance Meter	5-13
3-1	Simplified Block Diagram	3-1	5-21	Application of Sealant to ZERO REFERENCE Control Bushing	5-14
3-2	Sampling Diagram	3-2	5-22	Application of Sealant to ZERO REFERENCE Control Nut	5-14
3-3	Program Logic Cycle	3-3	5-23	Application of Sealant to RECORD Toggle-switch Bushing	5-14
3-4	Tunnel Diode Voltage-Current Curve	3-5	5-24	Application of Sealant to RECORD Toggle-switch Nut	5-15
3-5	Functional Block Diagram of Slow Ramp Generator	3-7	5-25	Installation of Rubber Cap-seal on RECORD Toggle-switch	5-15
3-6	Block Diagram of 1502 Power Supply	3-10	5-26	Application of Sealant to the GAIN or the 0 dB DET Control Bushing	5-15
3-7	Chart Recorder Logic	3-12	5-27	Detail Showing Lubrication and Sealing for the Variable Resistor	5-15
3-8	X-Y Output Module Strap	3-13	5-28	Lubrication of the O-rings and Sealing for the Cam-switches	5-16
4-1	Pulse Display	4-2	5-29	Installation of the POWER SWITCH	5-16
4-2	Jitter Check	4-4	5-30	Lubrication of POSITION Control Knobs	5-17
4-3	Aberration Check	4-4	5-31	Installation of Knob on Shaft	5-17
4-4	Fall Time	4-5	5-32	Lubrication of ZERO REFERENCE Knob	5-17
4-5	Power Supply Test Points and Adjustments	4-8	5-33	Installation of Knob on ZERO REFERENCE Control	5-17
4-6	Main Board Test Points	4-9	5-34	Lubrication of FOCUS and INTENSITY Control Knobs	5-18
4-7	Pulse Generator Output	4-10	5-35	Sealing of Battery Pack Screwholes	5-18
4-8	Time Marks Aligned (Standard)	4-8	5-36	Application of Dielectric Type Compound	5-18
4-9	Time Marks Aligned (Metric)	4-13	5-37	Detail of Front Panel Jacks	5-19
4-10	Pulse Display	4-15	5-38	Detail of X-Y Module Thumbscrews	5-19
4-11	Loop Gain Adjustment	4-16	5-39	Sealing of Latch Assembly Screwholes	5-20
4-12	Reflected-fall Time Check	4-16			
4-13	Vertical Amp/Slow Ramp Board	4-17			
4-14	X-Y Output Module Connection Link	4-17			
5-1	DC Fuse Location	5-3			
5-2	Transistor and Integrated Circuit Lead Configuration	5-4			
5-3	Rear View of the HV Board	5-5			
5-4	230 Vac Transformer Wiring	5-6			
5-5	Subpanel, Identification of Parts	5-7			
5-6	Rubber Seals, Edge Sealing for Subpanel	5-8			
5-7	Detail of Implosion Shield Sealing	5-8			

## 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.

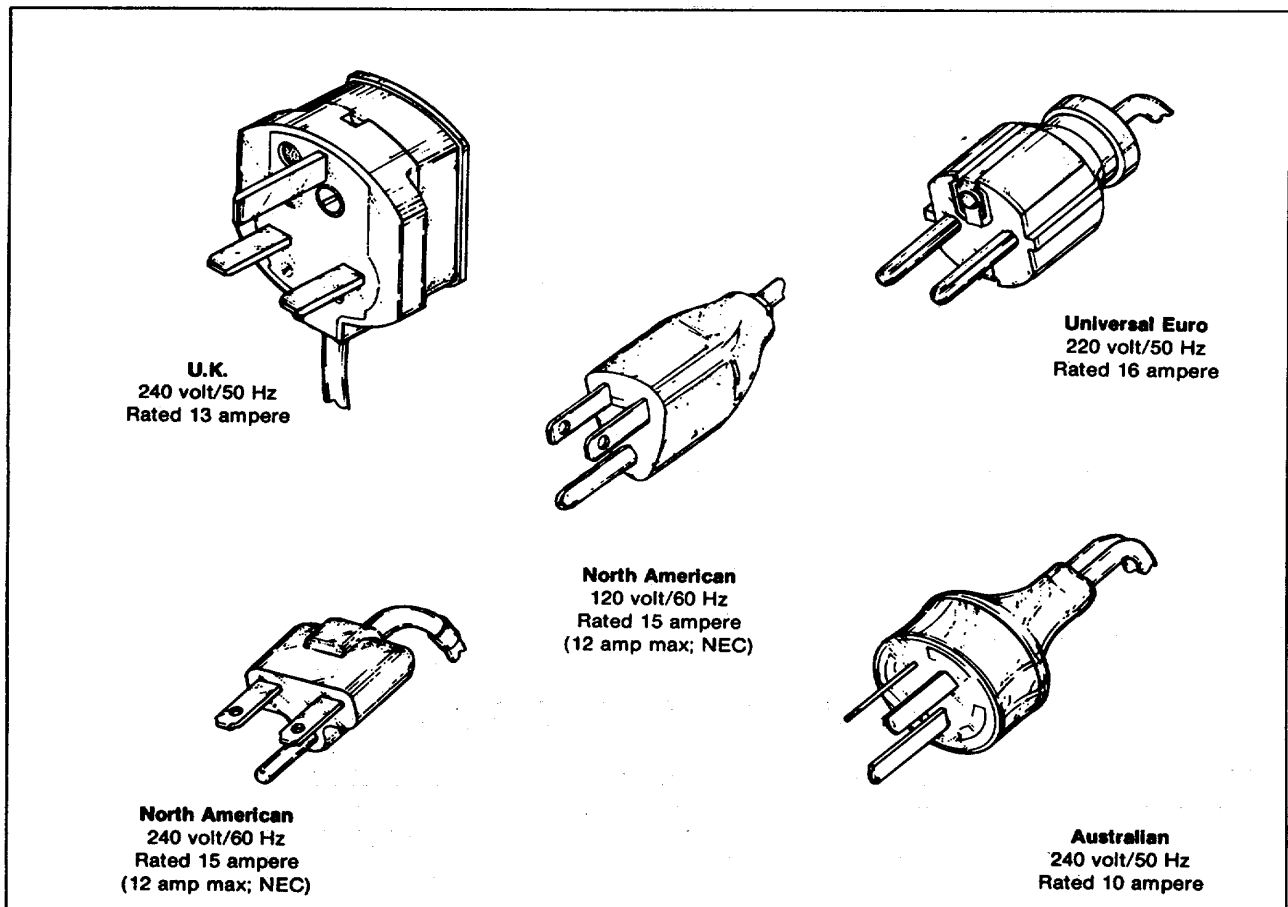
**Use Care When Servicing With Power On**

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.

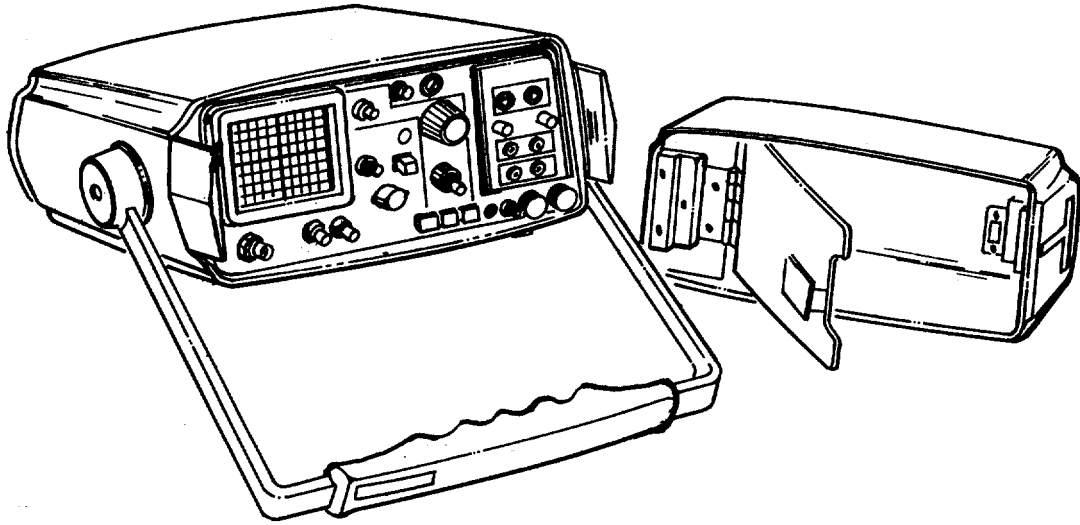
**Power Source**

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 ( $\rho$ ) 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 $\rho$ /div to 500 m $\rho$ /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**

<b>Accessories stored in the 1502 cover</b>	
<b>Accessory</b>	<b>Tektronix Part Number</b>
1 50 $\Omega$ BNC Terminator	011-0123-00
1 Precision 50 $\Omega$ 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
<b>Accessories not stored in the 1502 cover</b>	
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**

<b>Characteristics</b>	<b>Performance Requirements</b>	<b>Supplemental Information</b>
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**

<b>Characteristics</b>	<b>Performance Requirements</b>	<b>Supplemental Information</b>
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 $\Omega$
Vertical	0.09 to 0.13 V/div (adjustable)	Source impedance 10 k $\Omega$
Pen Lift Mode 1 Source	$V_s = 5$ V Nominal with $R_s = 10$ k $\Omega$	
Mode 2 (inverted Mode 1) Source	$V_s = 5$ V Nominal with $R_s = 10$ k $\Omega$	
Y-T Plug-in Chart Recorder Interface		
Horizontal	0.4 V/div	Source impedance 200 $\Omega$ (switched)
Vertical	0.2 V/div	Source impedance 200 $\Omega$ (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**

<b>Characteristics</b>	<b>Performance Requirements</b>	<b>Supplemental Information</b>		
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**

<b>Characteristics</b>	<b>Performance Requirements</b>	<b>Supplemental Information</b>
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.

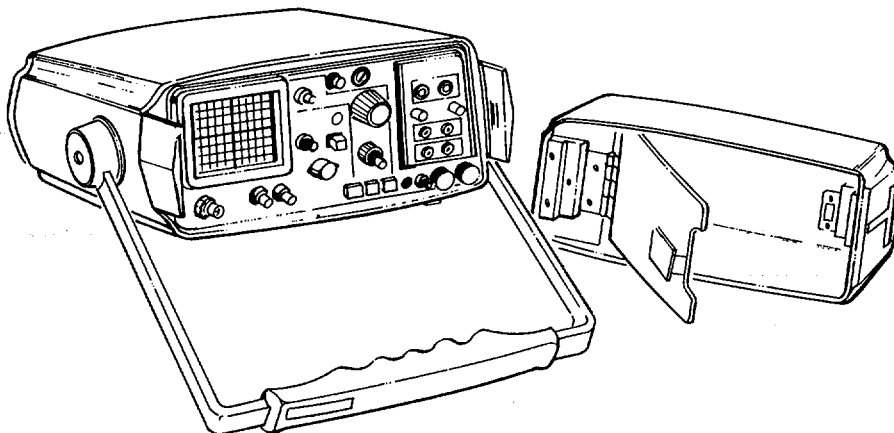


Figure 2-1. 1502 TDR With Cover



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.*

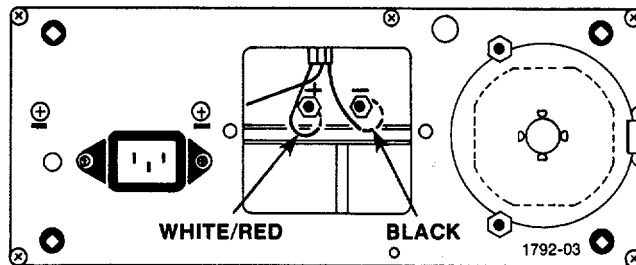


Figure 2-2. Battery Connector Polarity

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.  |

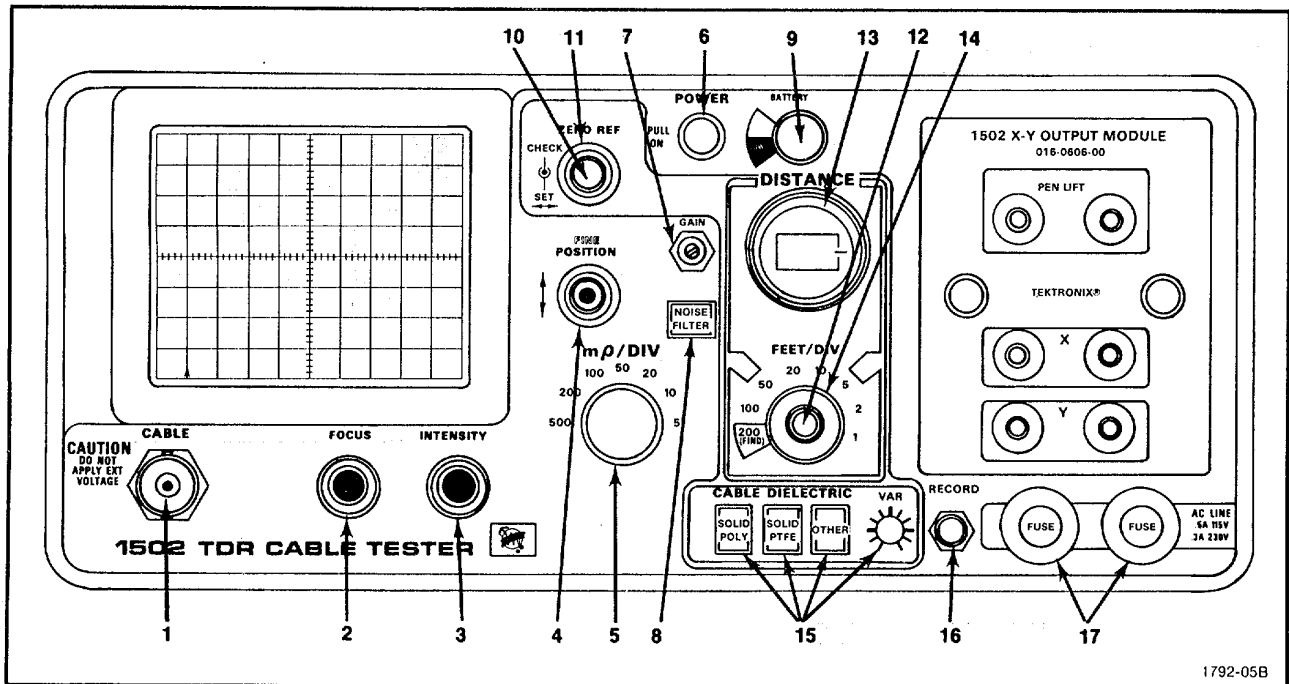


Figure 2-3. 1502 Front Panel Controls.

- |   |   |  |   |
|---|---|--|---|
| <p>7. GAIN</p> <p>8. NOISE FILTER</p> <p>9. BATTERY</p> <p>10. ZERO REF CHECK</p> <p>11. ZERO REF SET</p> <p>12. MULTIPLIER</p> | <p>Screwdriver adjust to set the gain of the vertical amplifier.</p> <p>Reduces displayed noise. Display rate is reduced by a factor of 10.</p> <p>Meter to indicate the relative charge of the power pack.</p> <p>Momentary contact pushbutton. When pushed, checks the horizontal location of the incident pulse on the crt when the DISTANCE dial is being used.</p> <p>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.</p> <p>Two-position switch (red control) for X.1 or X1 multiplier. Affects both the DISTANCE dial and the FEET/DIV (METRES/DIV) control.</p> | <p>13. DISTANCE</p> <p>14. FEET/DIV (METRES/DIV)</p> <p>15. CABLE DIELECTRIC</p> | <p>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).</p> <p>Selects the horizontal deflection factor:<br/> X1 = 1 - 200 ft/div (25 cm - 50 m/div).<br/> X.1 = 0.1 - 20 ft/div (2.5 cm - 5 m/div).</p> <p>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.</p> |
|---|---|--|---|

- 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.

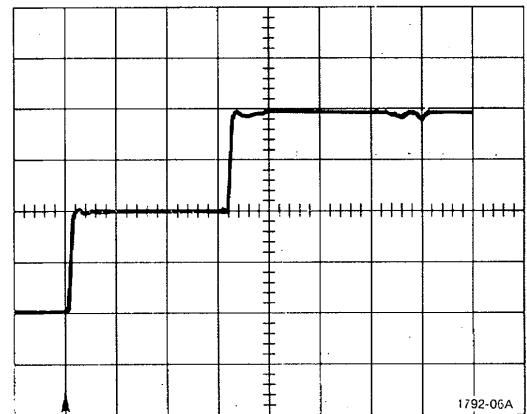


Figure 2-4. Incident and Reflected Pulses.

- 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  $\Omega$  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 $\Omega$ BNC	011-0102-00
Adapter, 50 to 125 $\Omega$	017-0090-00
Adapter, 50 to 75 $\Omega$	017-0091-00
Adapter, 50 to 93 $\Omega$	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).*

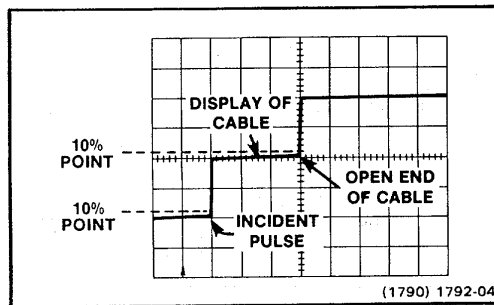


Figure 2-5. CRT Display of Pulse.

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 ( $\rho$ ), which is called the voltage reflection coefficient. Rho ( $\rho$ ) 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  $-1 \rho$ .

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  $50 \Omega$ . (When  $\rho$  equals  $+1$ , the transmission line load is an open circuit. When  $\rho$  equals  $-1$ , the transmission line load is a short. If the line is terminated by  $R_L > 50 \Omega$ ,  $\rho$  is positive and if the line is terminated by  $R_L < 50 \Omega$ ,  $\rho$  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,  $\rho$  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.

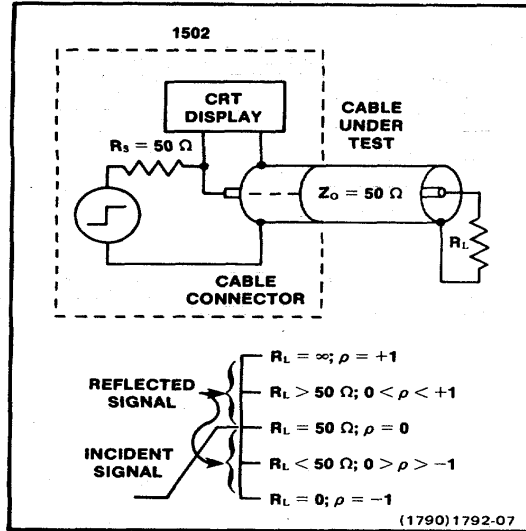


Figure 2-6. TDR Display of  $R_L$  vs  $Z_0$ .

### 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.

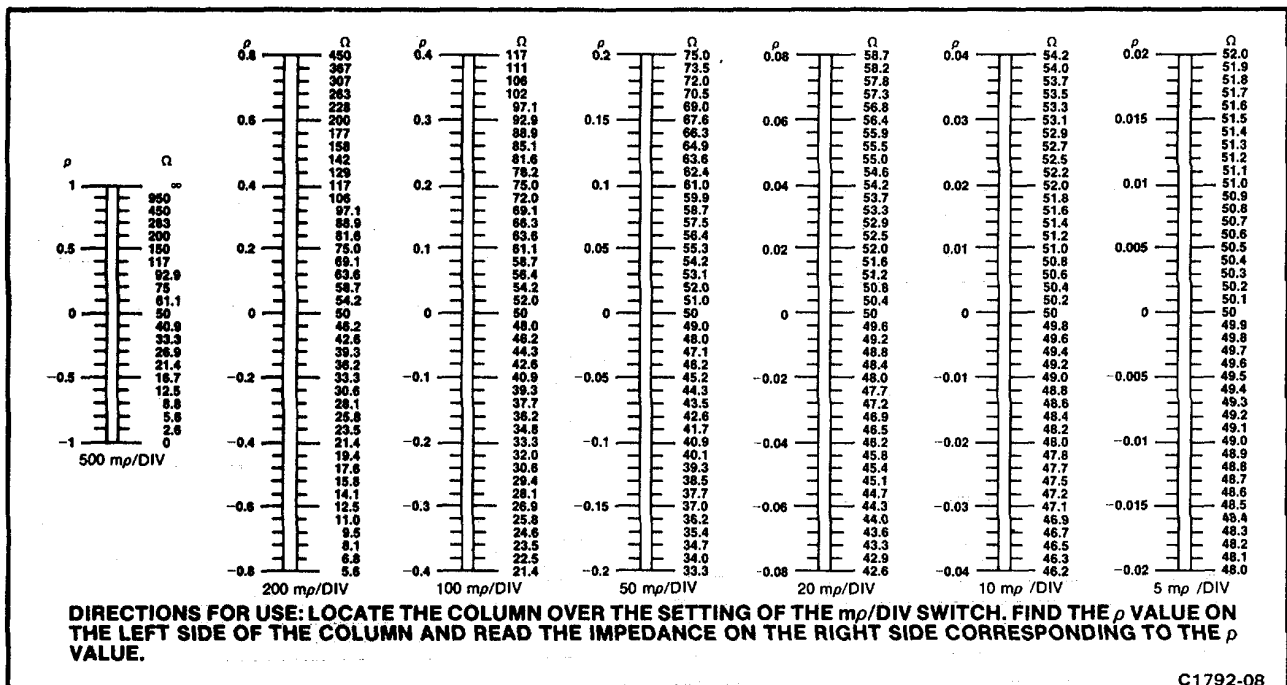


Figure 2-7. Impedance Nomograph.

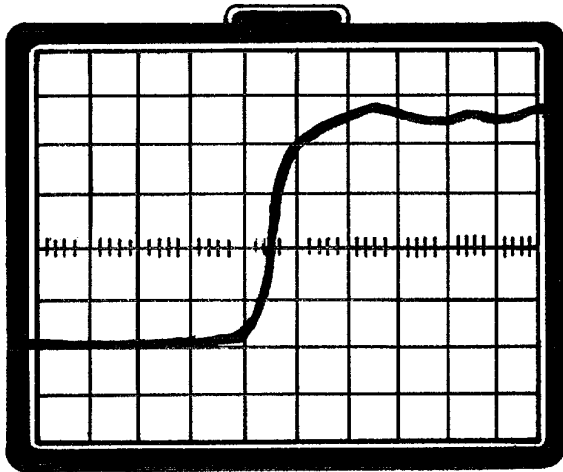


Figure 2-8. Open Cable.

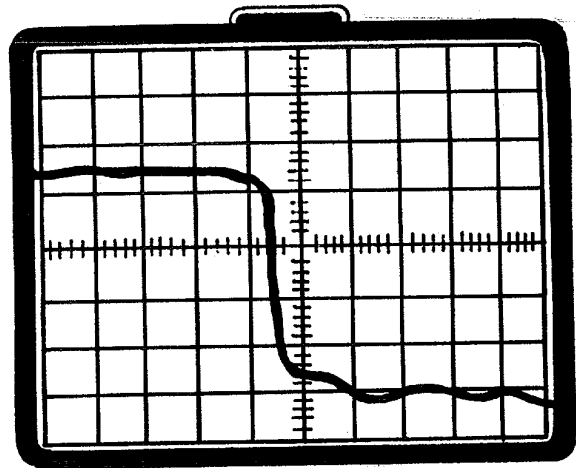
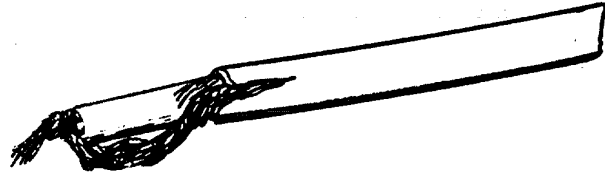
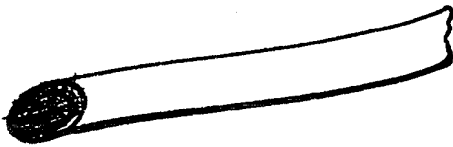


Figure 2-9. Shorted Cable.



### CHECKING CABLES WITH IMPEDANCE OTHER THAN 50 W

Cables with a characteristic impedance other than 50  $\Omega$  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  $\Omega$ , either connect an impedance-matching adapter (50 to 75  $\Omega$ , 50 to 93  $\Omega$ , 50 to 125  $\Omega$ , etc.) to the CABLE connector and connect a short length of cable (with impedance the same as the adapter, i.e., 75  $\Omega$ , 93  $\Omega$ , 125  $\Omega$ , 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.

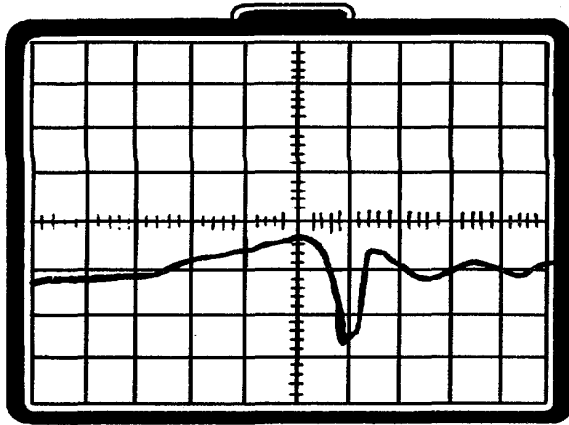


Figure 2-10. Crimped Cable.

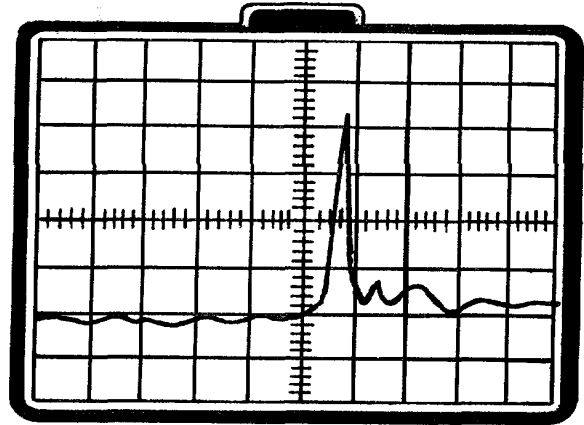
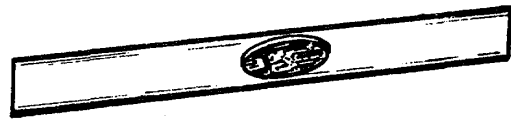


Figure 2-11. Frayed Cable.



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.

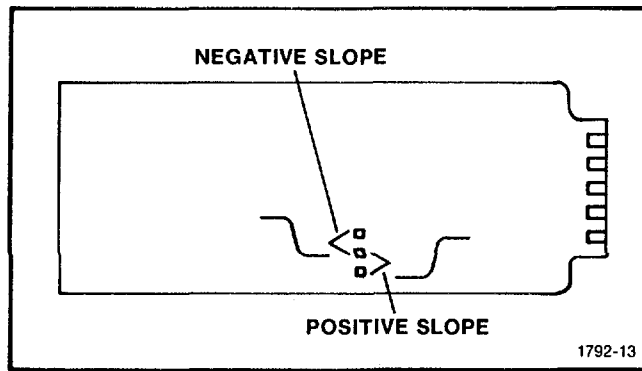


Figure 2-12. X-Y Output Module Strap.

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

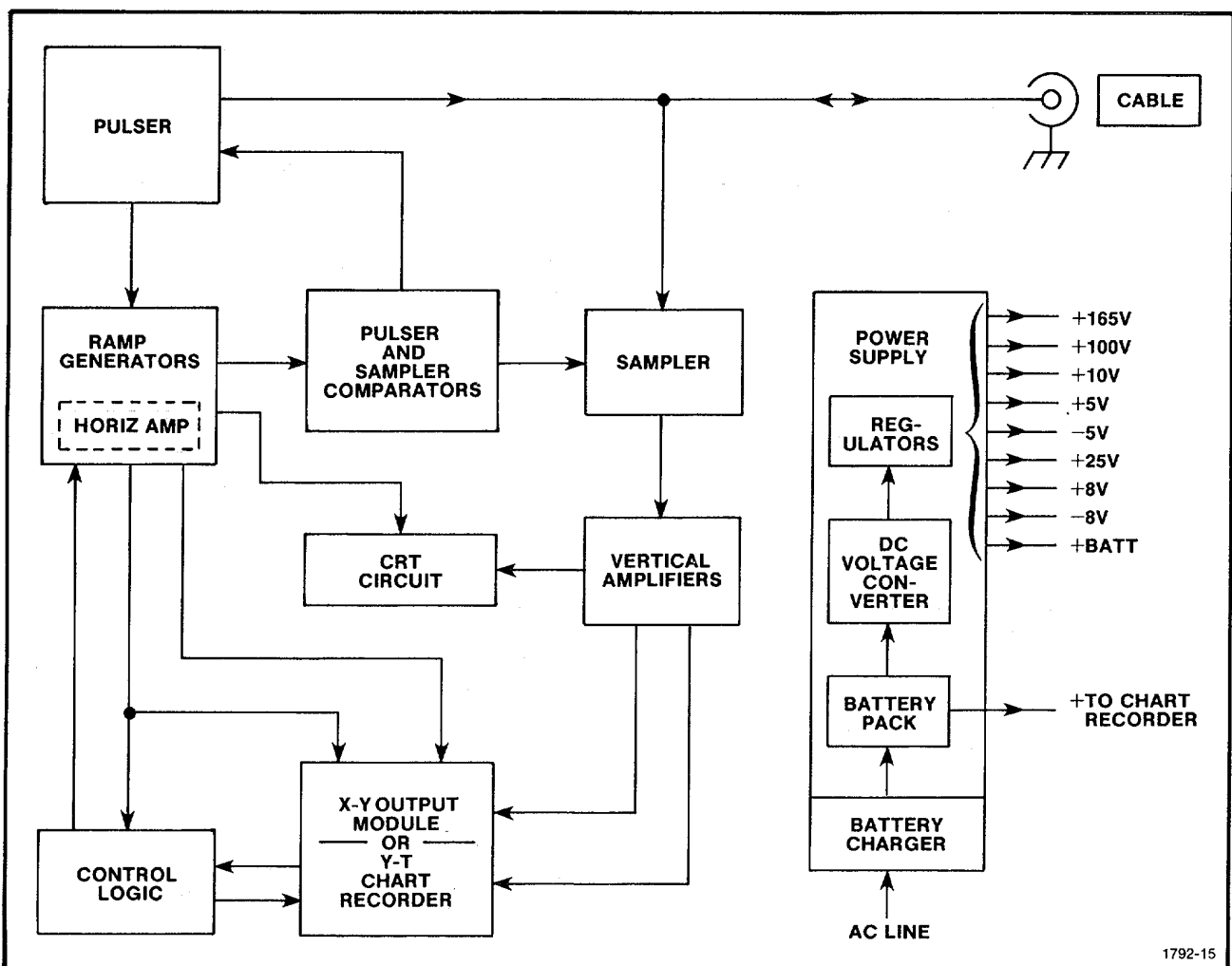


Figure 3-1. Simplified Block Diagram-1502

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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.

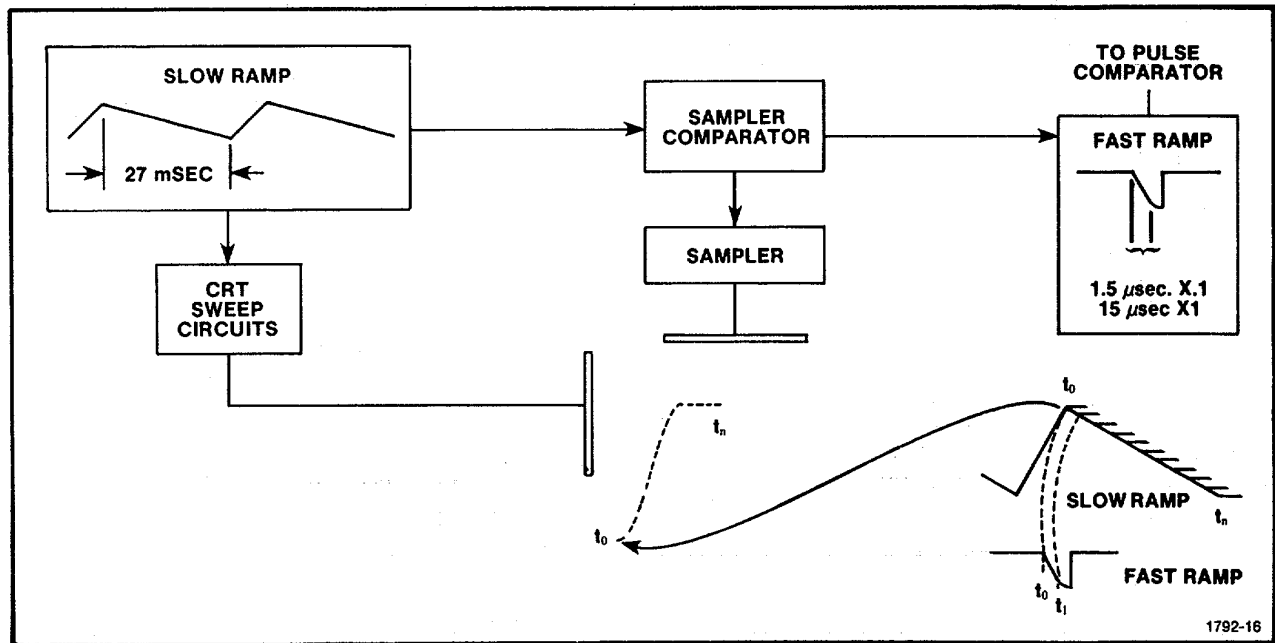


Figure 3-2. Sampling Diagram.

## 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  $\Omega$ . 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.

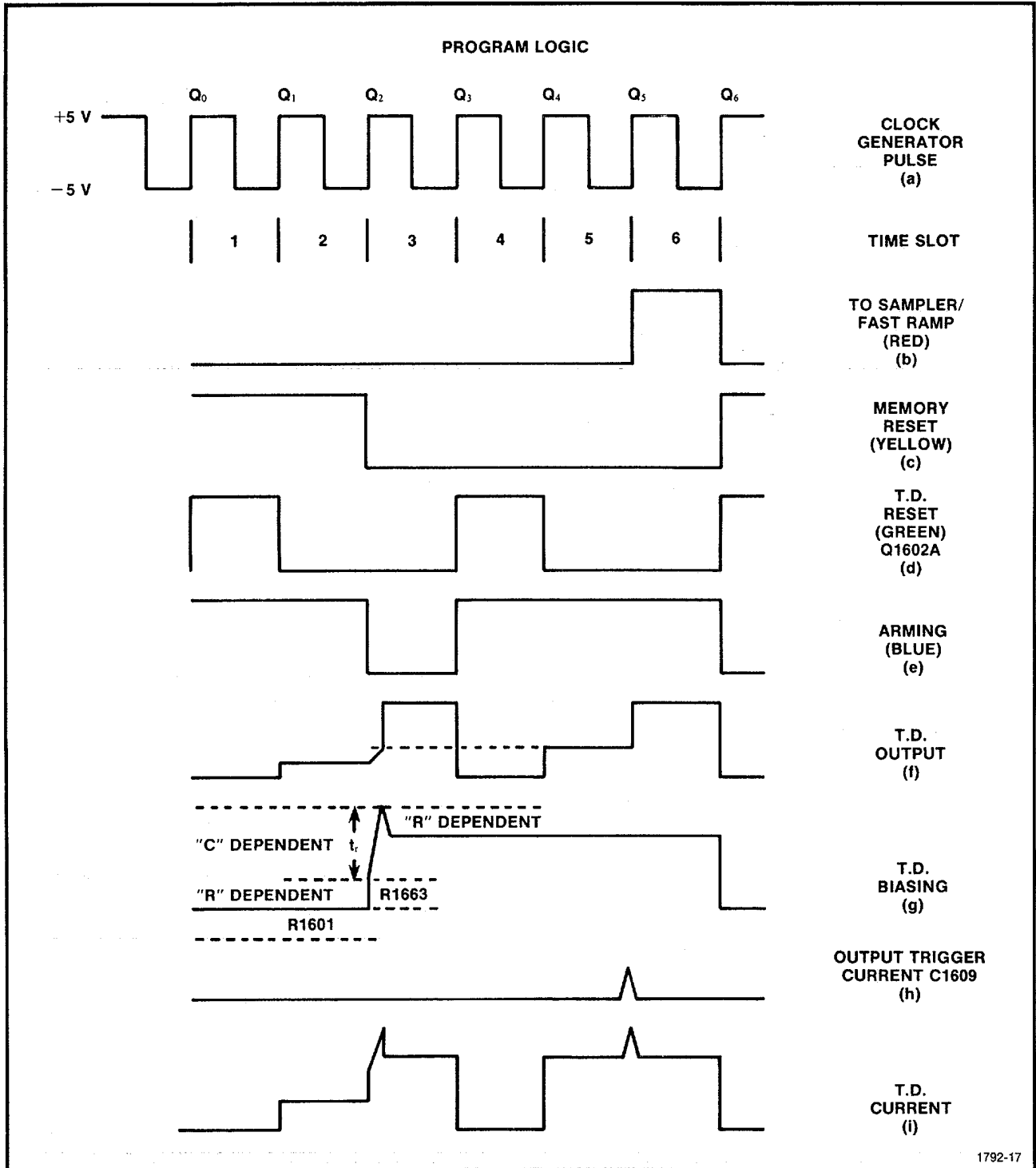


Figure 3-3. Program Logic Cycle.

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.

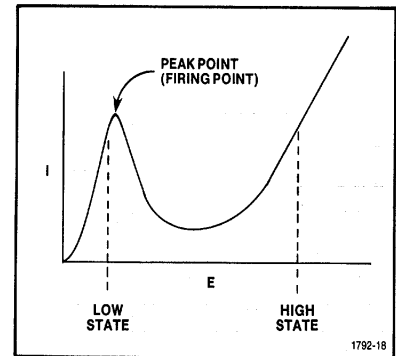


Figure 3-4. Tunnel Diode Voltage-Current Curve.

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.

REV A FEB 1980

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 strobos is determined by the physical length of the shorted strip lines. The generated strobe is differentiated by capacitors C1635 and C1636 and then strobos 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 Sampler 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 strobos 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.

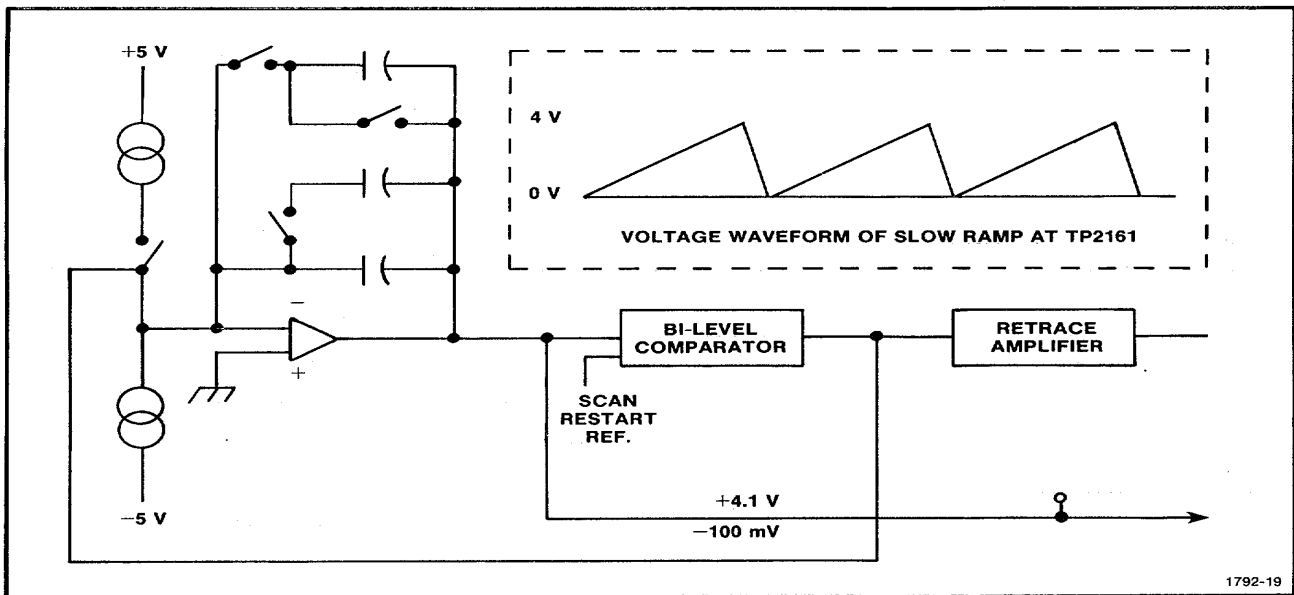


Figure 3-5. Functional Block Diagram of Slow Ramp Generator.

**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 $\mu$ /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  $\mu$ F capacitor C2137. Additional noise filtering can be obtained by activating the NOISE FILTER switch, S2254, which adds 0.1  $\mu$ 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  $\mu$ 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.

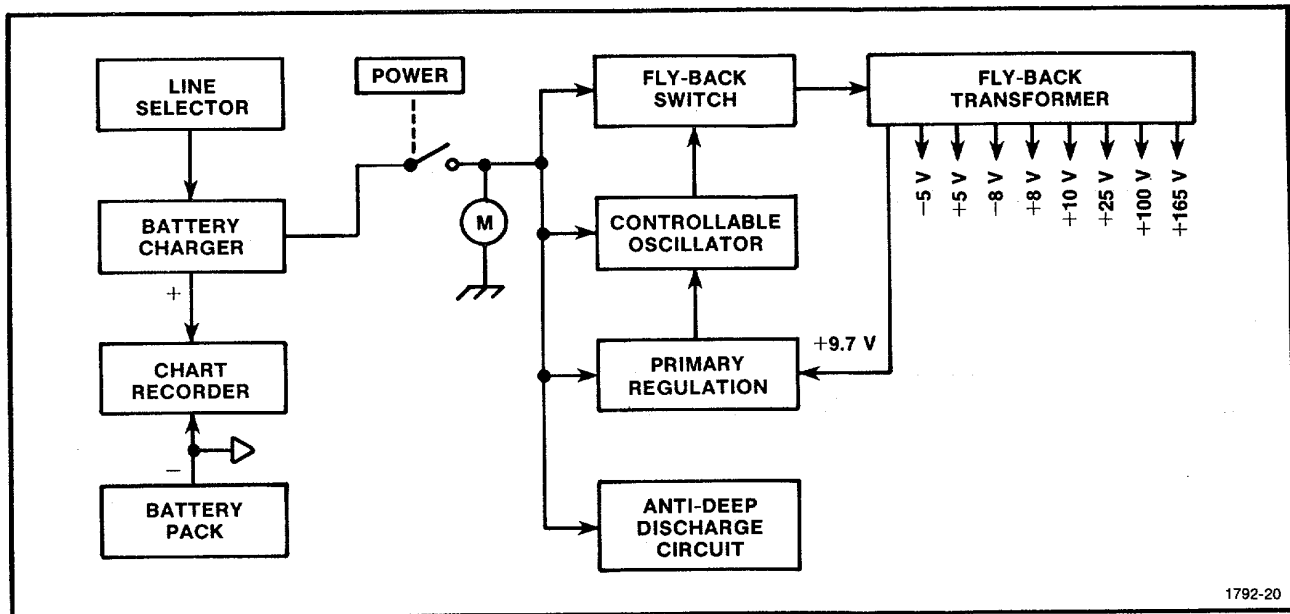


Figure 3-6. Block Diagram of 1502 Power Supply.

**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  $\mu$ 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  $\mu$ s and low during the remainder of the period. The 8  $\mu$ 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.

REV C FEB 1980

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 $\mu$ 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.)

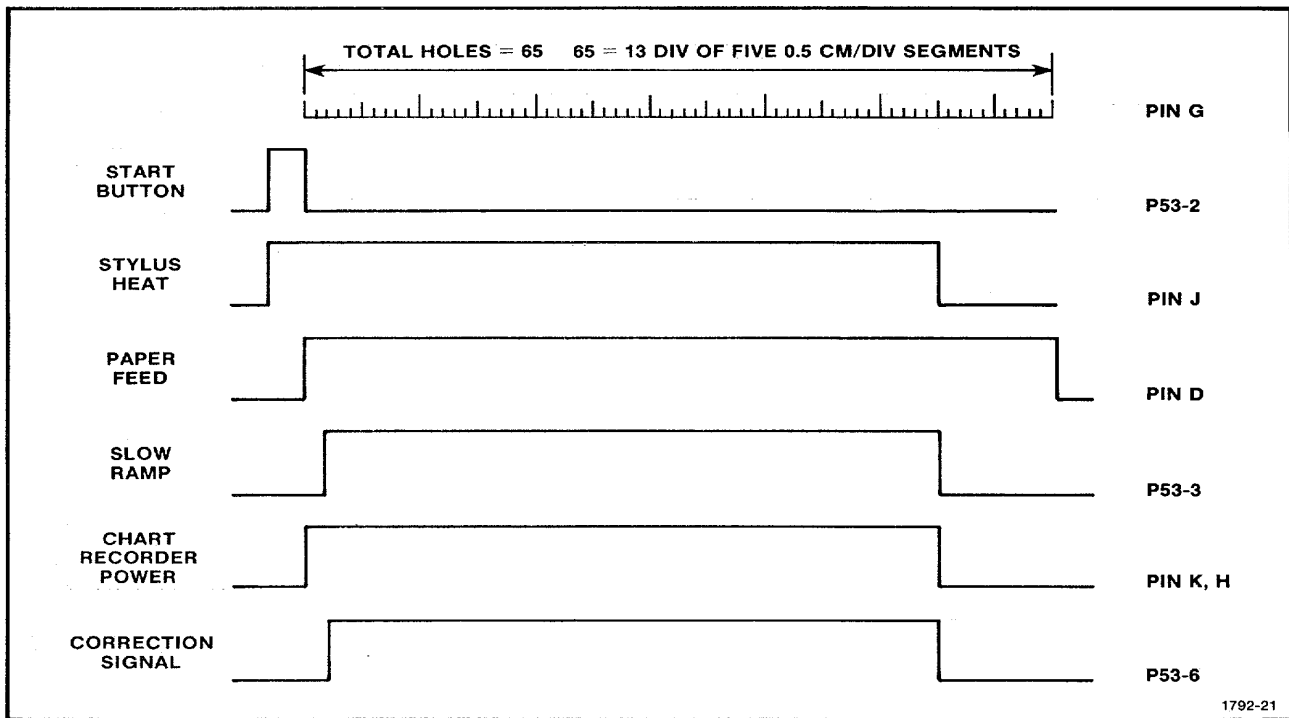


Figure 3-7. Chart Recorder Logic.

**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.

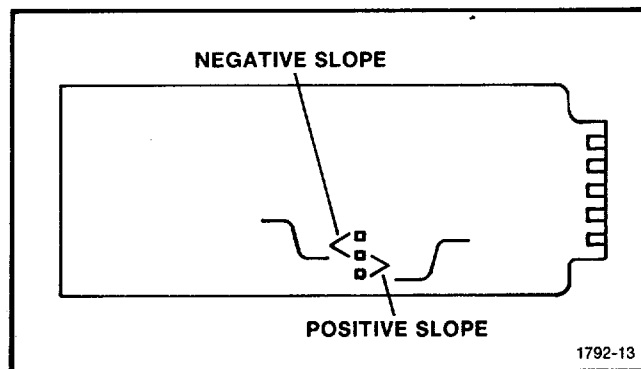


Figure 3-8. X-Y Output Module Strap.

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 $\Omega$  (8 k $\Omega$  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**

<b>Performance Description</b>	<b>Requirement</b>	<b>Application</b>	<b>Example</b>
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 μs to 10 μs markers	Calibration	TEKTRONIX TG 501
Pulse Generator	50 μs period 2.5 μs 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.

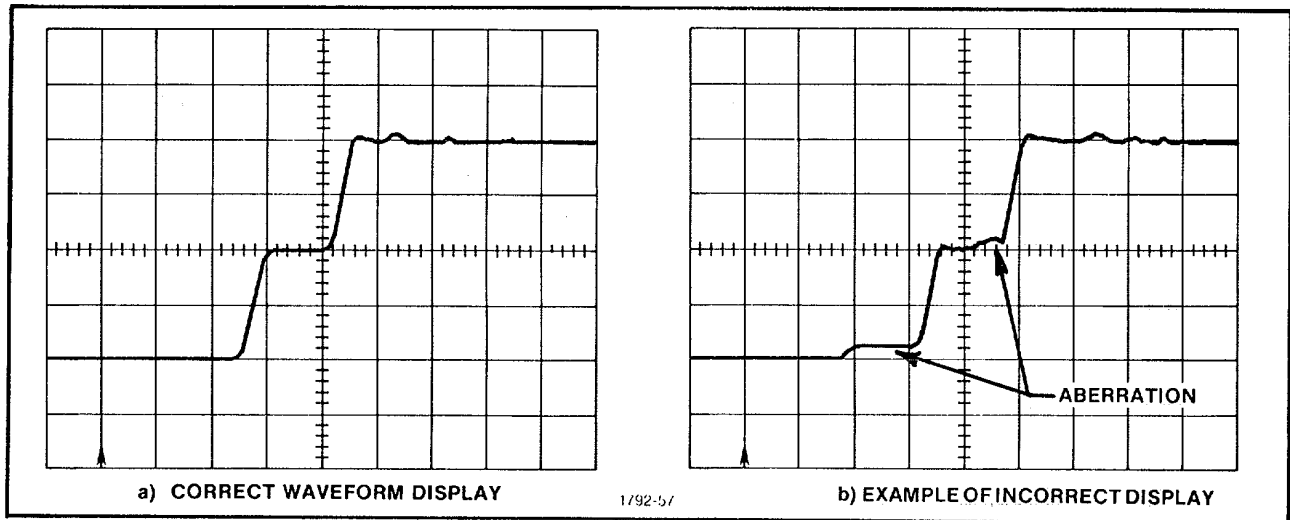


Figure 4-1. Pulse Display.



11. Remove the 50  $\Omega$  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  $\Omega$  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  $\Omega$  cable from the CABLE connector, and connect the precision 50  $\Omega$  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  $\pm 1$  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  $\pm 1$  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  $\Omega$  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

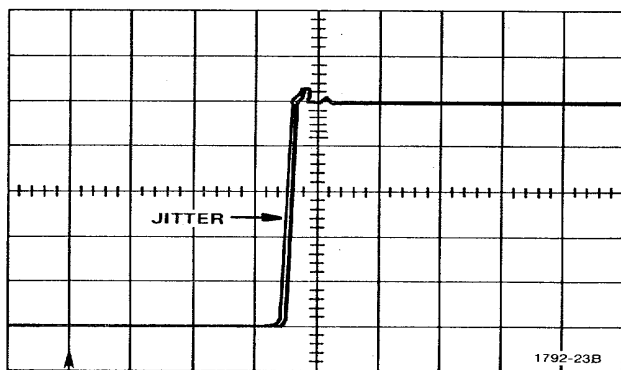


Figure 4-2. Jitter Check.

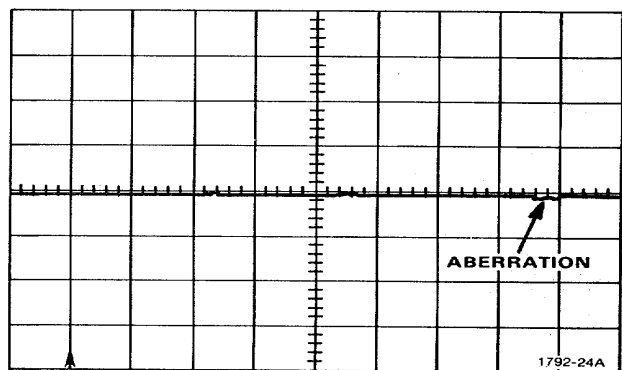


Figure 4-3. Aberration Check.

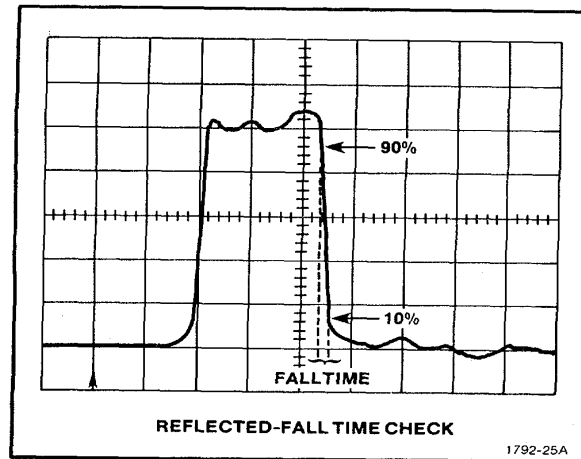


Figure 4-4. Falltime.

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  $\Omega$  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  $\Omega$  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  $\pm 0.12$  divisions ( $\pm 0.6$  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  $\Omega$  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 ( $\pm 1$  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  $009.2 \pm 1.0$  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  $009.2 \pm 1.0$  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.

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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.

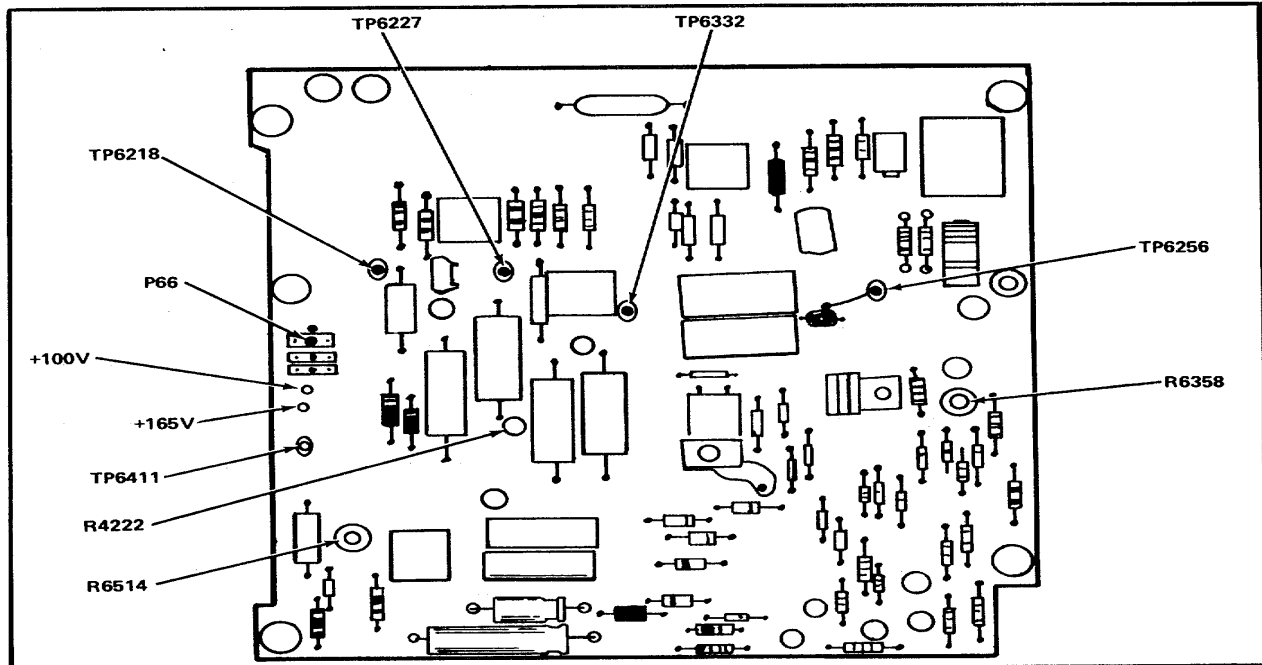


Figure 4-5. Power Supply Test Points And Adjustments.

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  $\Omega$  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.

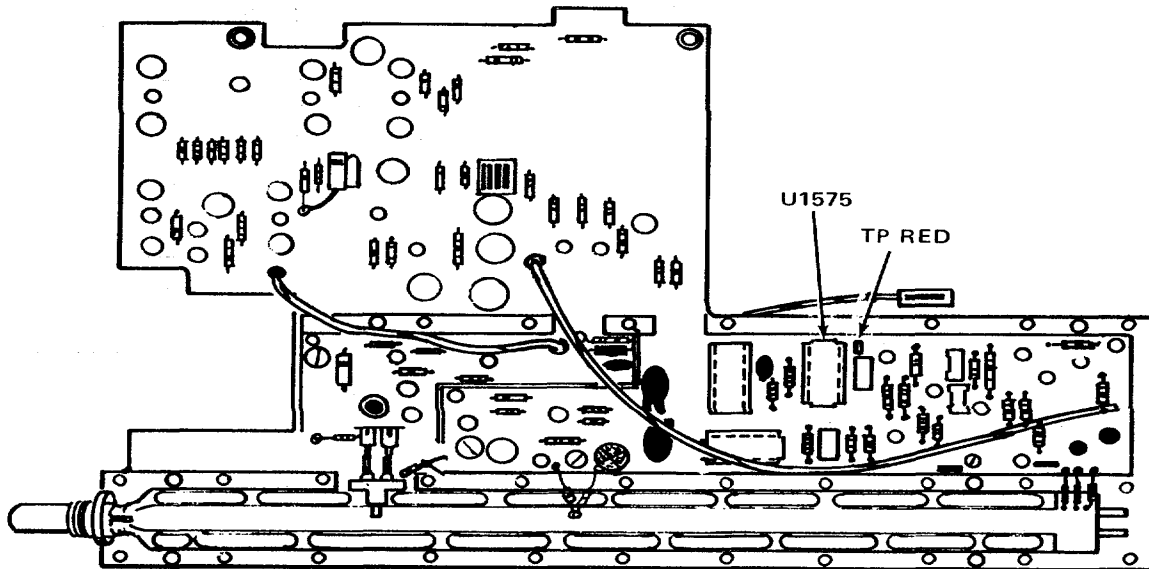


Figure 4-6. Main Board Test Points.

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, $\mu$ s
Variable Duration	Fully ccw
Period	Ext Trig
Low Level	-1.5
High Level	2.0
Back Term	Pull Out
All pushbuttons	Out

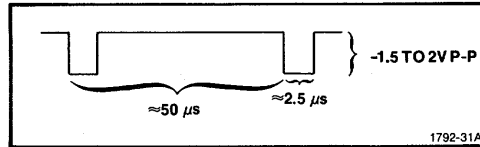


Figure 4-7. Pulse Generator Output.

46. Set the TG 501 Time Mark Generator for 0.2  $\mu$ 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.

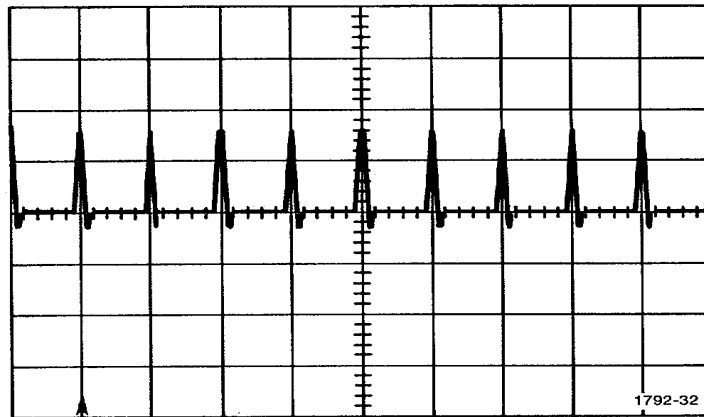


Figure 4-8. Time Marks Aligned (Standard).

(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  $\mu$ 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  $\mu$ 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  $\Omega$  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 $\mu s$
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  $\mu s$  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.

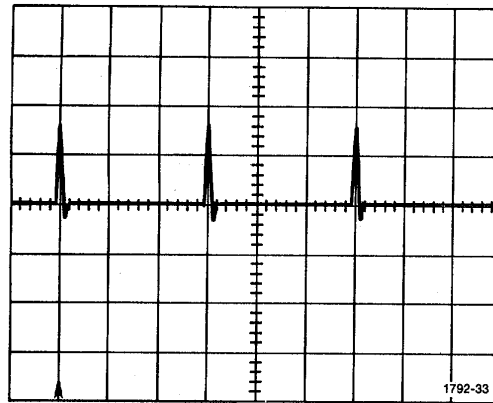


Figure 4-9. Time Marks Aligned (Metric).

(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  $\mu$ 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 $\mu$ 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  $\mu$ 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  $\mu$ 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 $\mu$ 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  $50 \Omega$  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  $50 \Omega$  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.

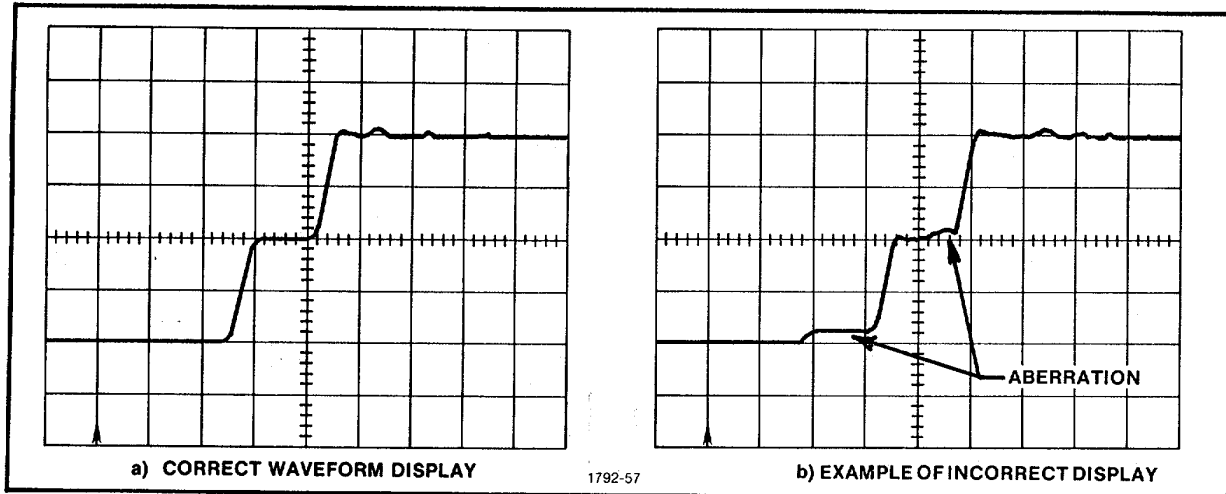


Figure 4-10. Pulse Display.

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  $\Omega$  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  $\leq 0.7$  division ( $\leq 0.875$  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  $\Omega$  terminator. Use the POSITION controls to locate the base of the pulse at the horizontal centerline.

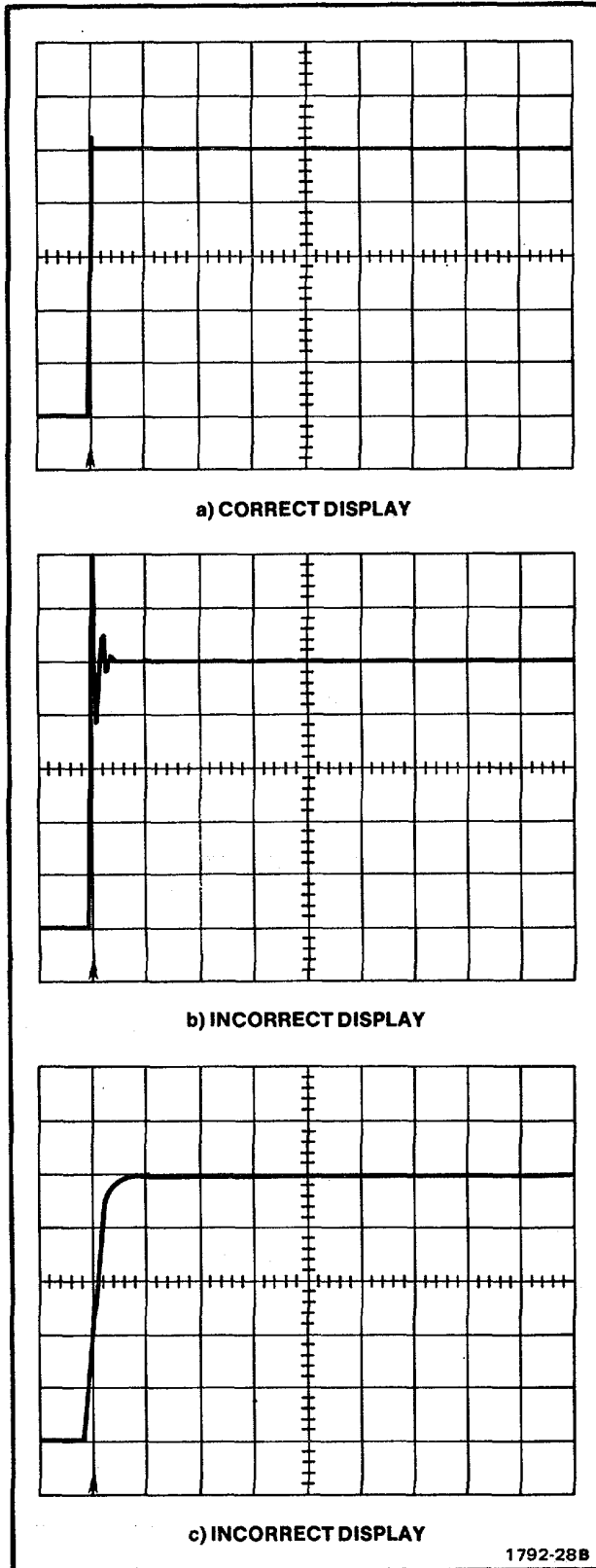


Figure 4-11. Loop Gain Adjustment.

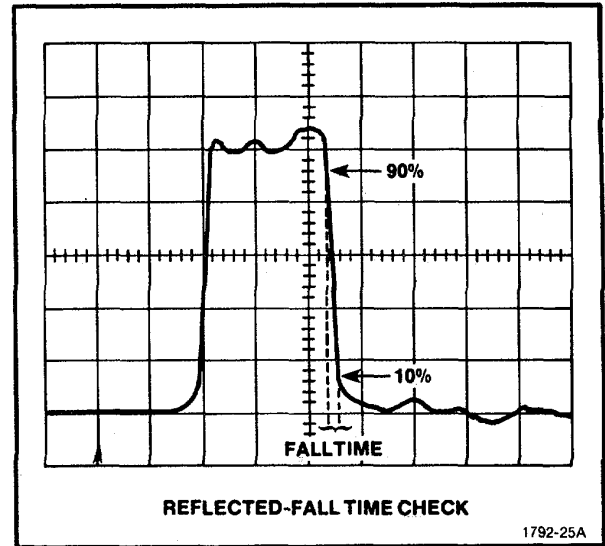


Fig. 4-12. Reflected-Fall Time Check.

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  $m\mu/DIV$  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  $0.400 \pm 0.008$  volt.

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

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

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

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

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

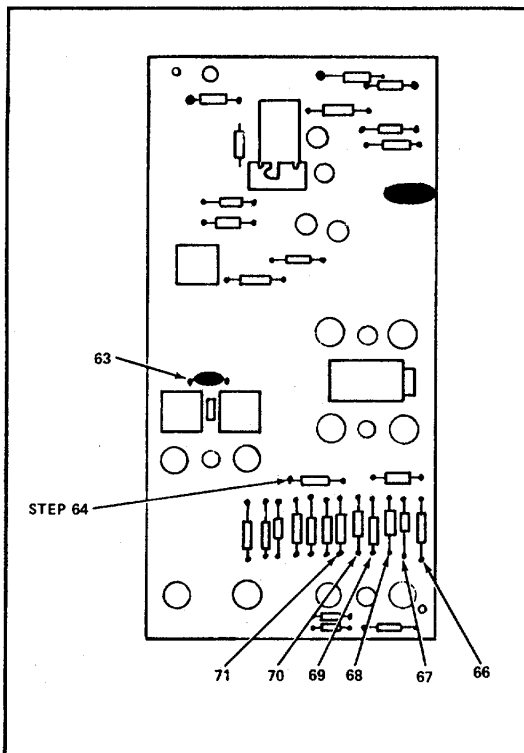


Figure 4-13. Vertical AMP/Slow Ramp Board.

## 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.

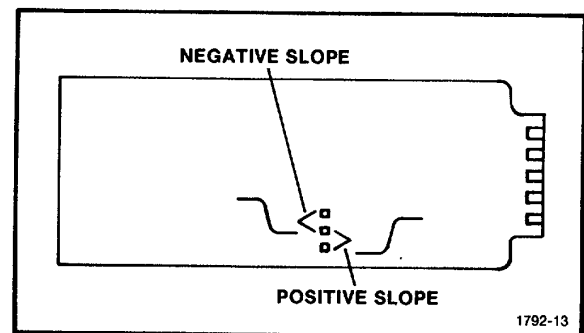


Figure 4-14. Output Module Connection Link.

### **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.

<b>CAUTION</b>
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*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.

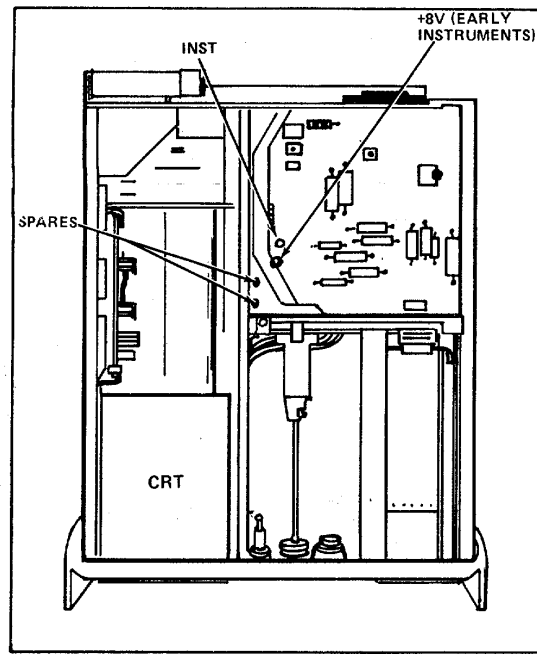


Figure 5-1. DC Fuse Location.

**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.

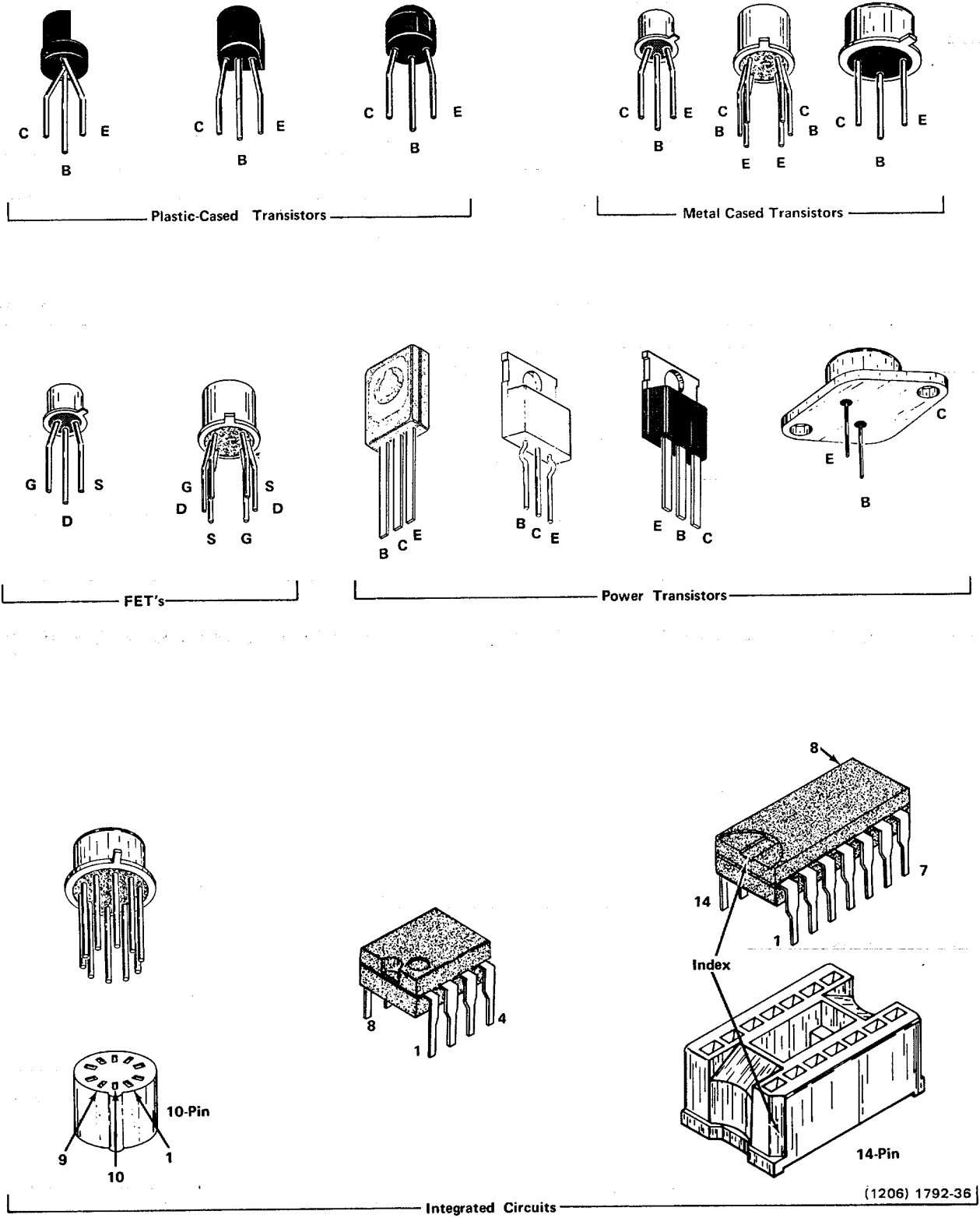


Figure 5-2. Transistor and Integrated Circuit Lead Configuration.

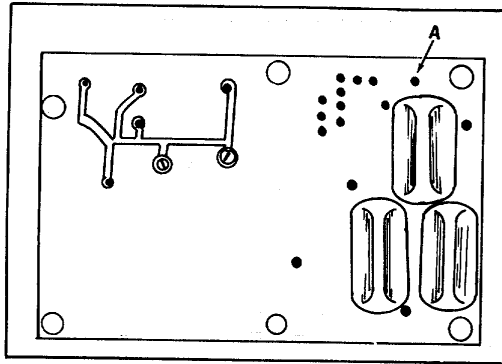


Figure 5-3. Rear View of The HV Board.

### 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.

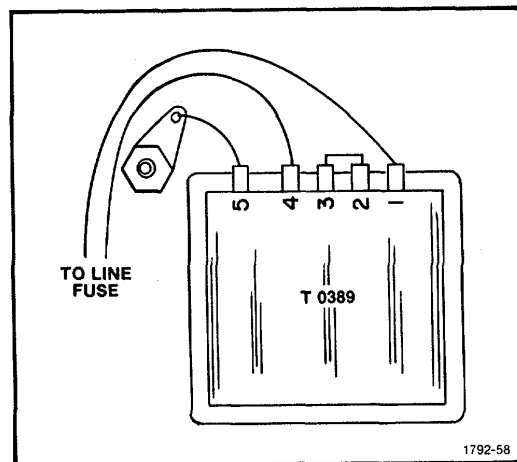


Figure 5-4. 230 Vac Transformer Wiring.

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.

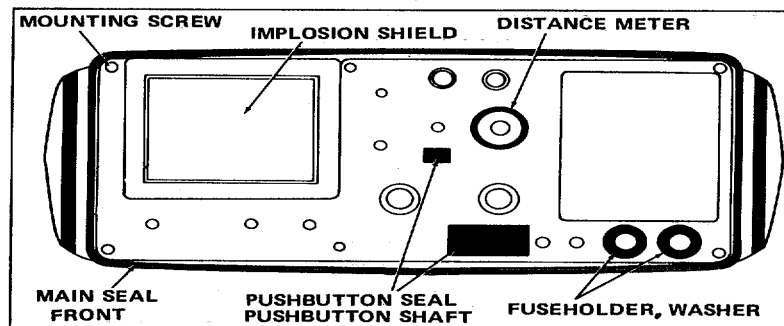


Figure 5-5. Subpanel, Identification of Parts.

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.

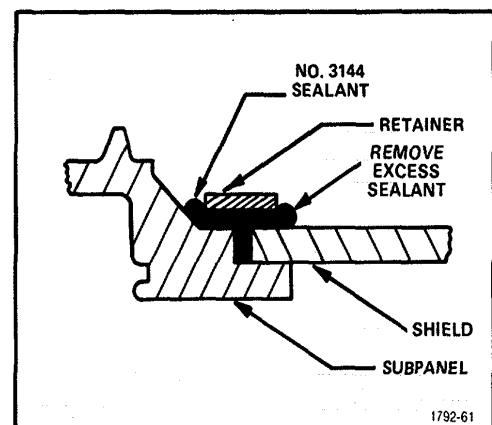
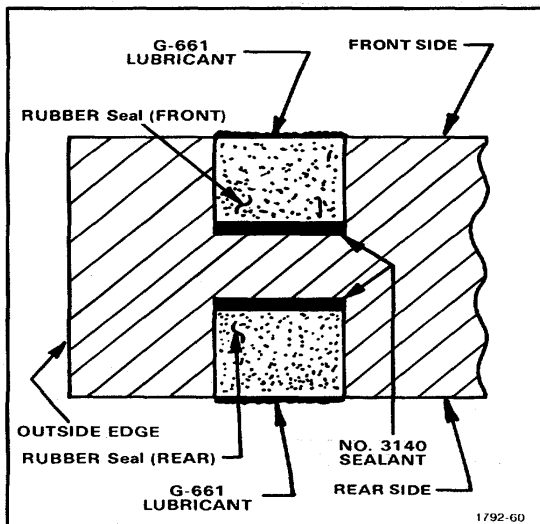


Figure 5-6. Rubber Seals, edge sealing for subpanel.

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.

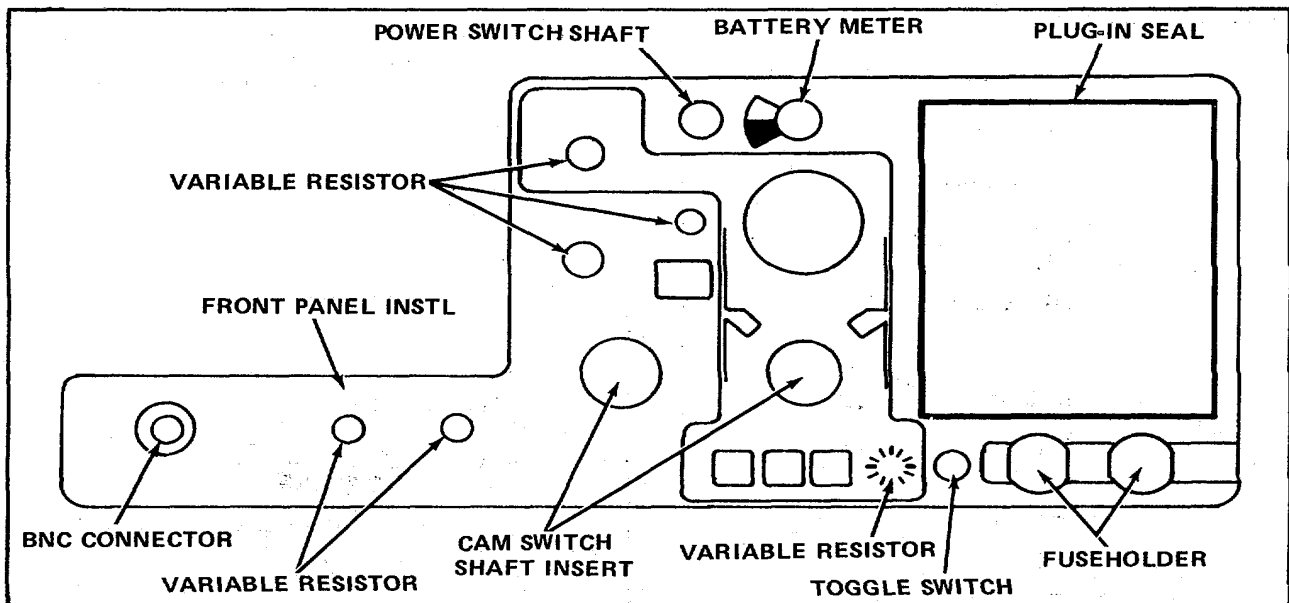


Figure 5-8. Front Panel, Identification of Parts For Assembly Step 8 Through 26.

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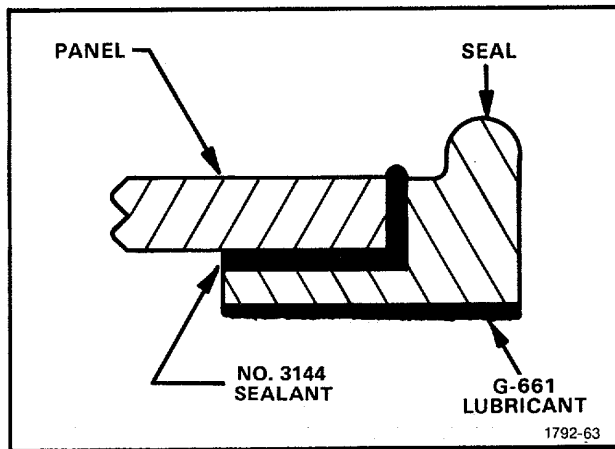


Figure 5-9. Detail of Plug-In Compartment seal.

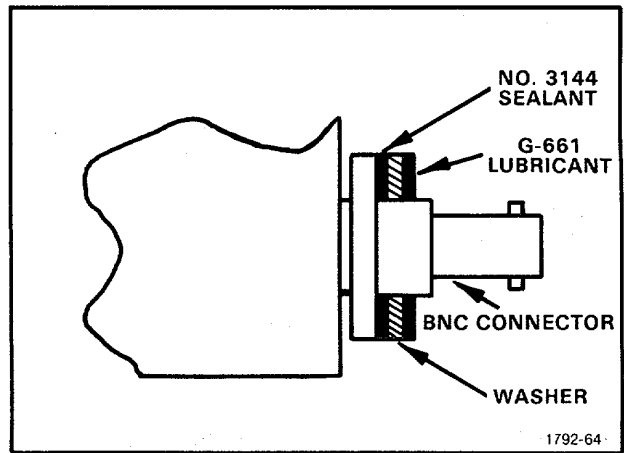


Figure 5-10. Detail of BNC Connector and Washer.

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.

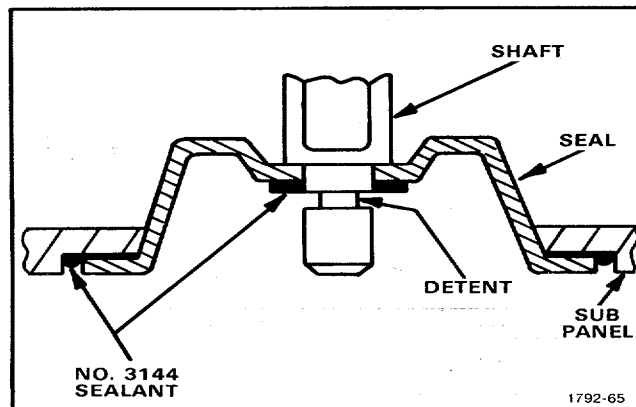


Figure 5-11. Detail of Pushbuttons and their shafts.

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.

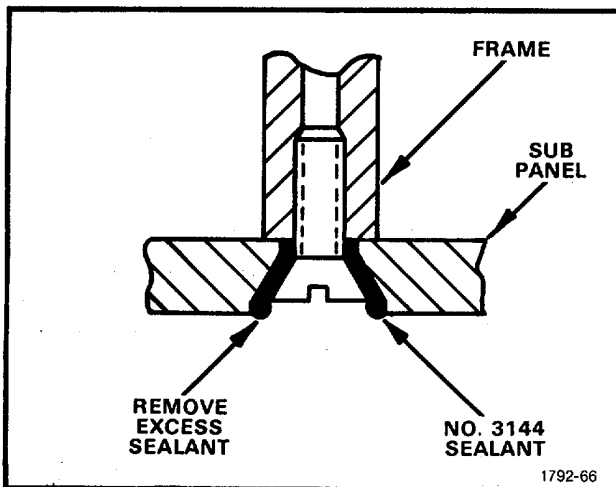


Figure 5-12. Detail of Subpanel screwhole sealing.

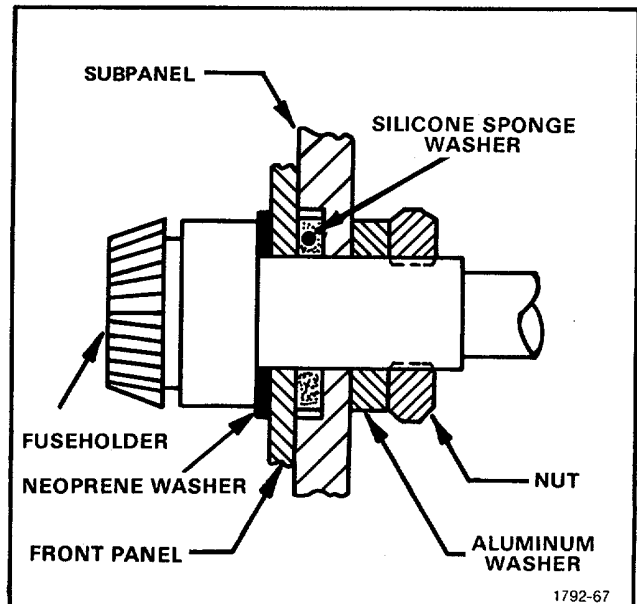


Figure 5-13. Detail of Fuseholder installation.

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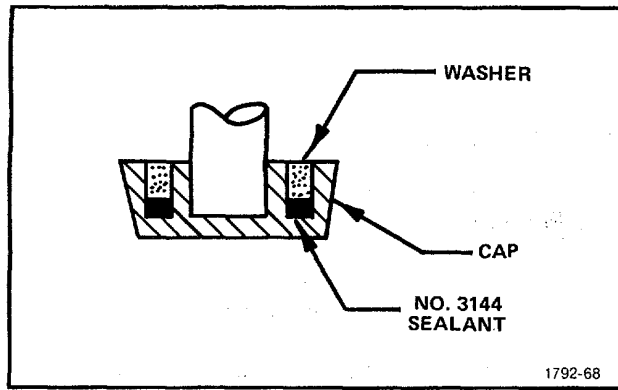


Figure 5-14. Detail of Fuseholder Caps.

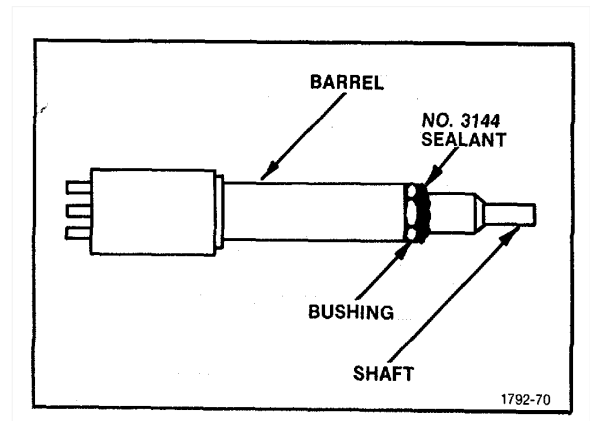


Figure 5-16. Alignment of Battery Meter

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.

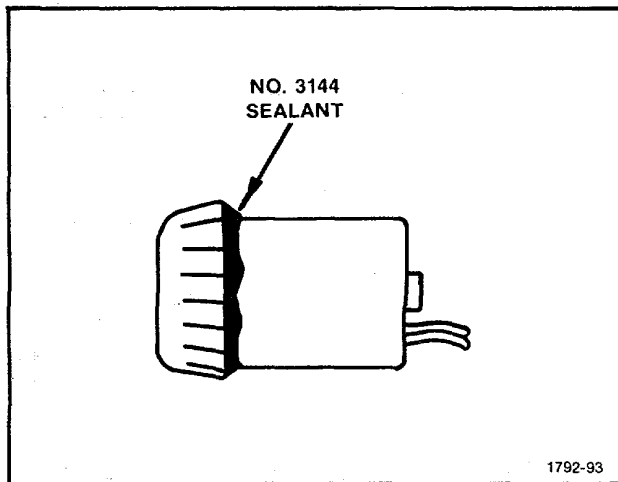


Figure 5-15. Application of sealant to Battery Meter.

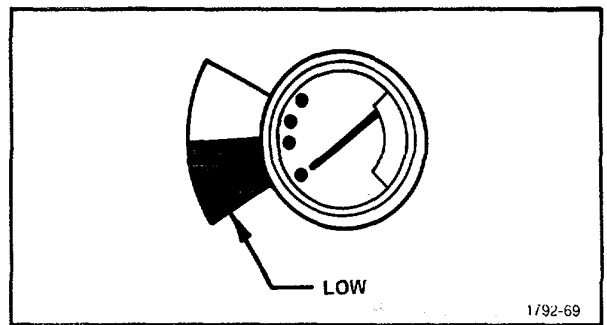


Figure 5-17. Application of sealant to FOCUS and INTENSITY controls.

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.

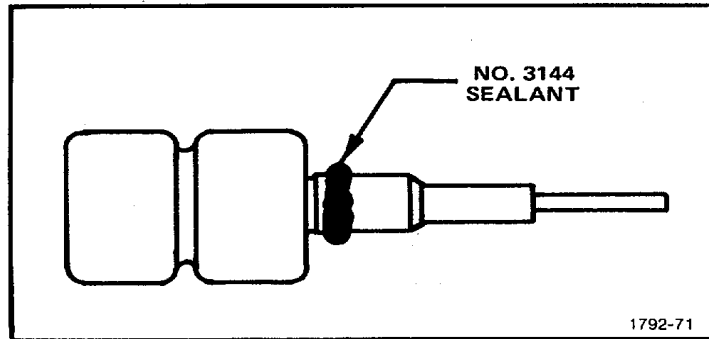


Figure 5-18. Application of sealant to FINE control bushing

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.

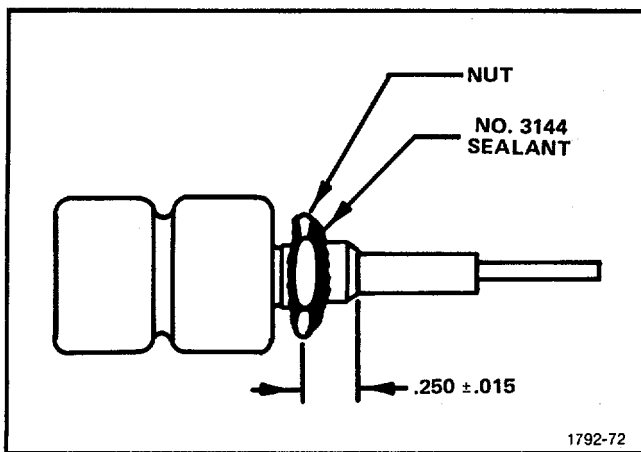


Figure 5-19. Application of sealant to FINE control nut.

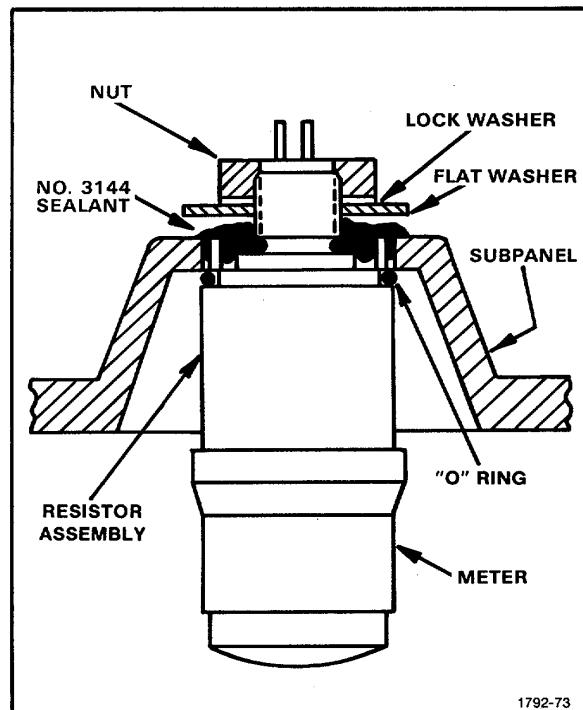


Figure 5-20. Installation of Distance Meter.

**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.

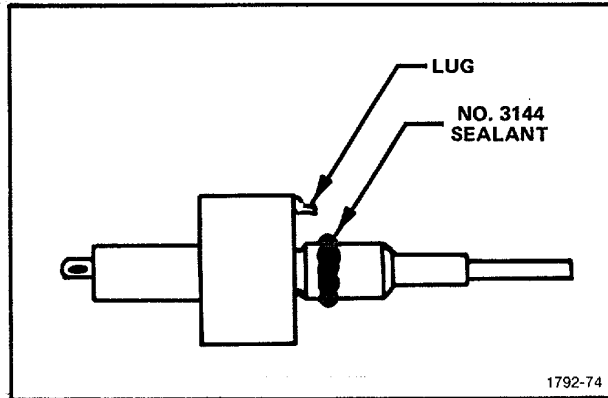


Figure 5-21. Application of sealant to ZERO REFERENCE control bushing.

- 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).

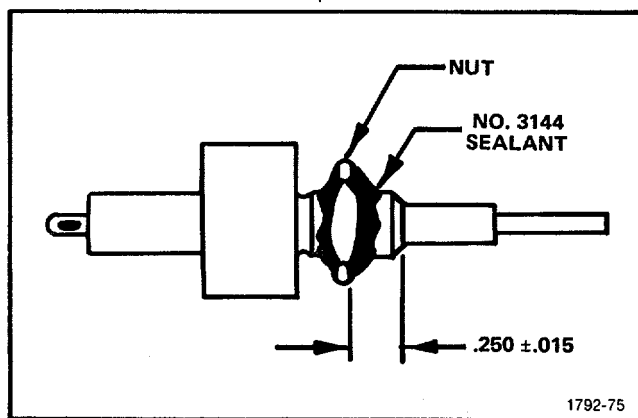


Figure 5-22. Application of sealant to ZERO REFERENCE control bushing.

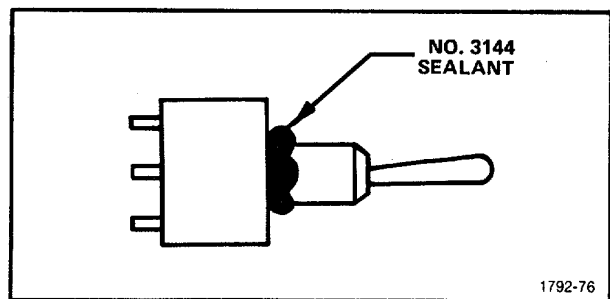


Figure 5-23. Application of sealant to RECORD toggle-switch bushing.

@FEB 1980

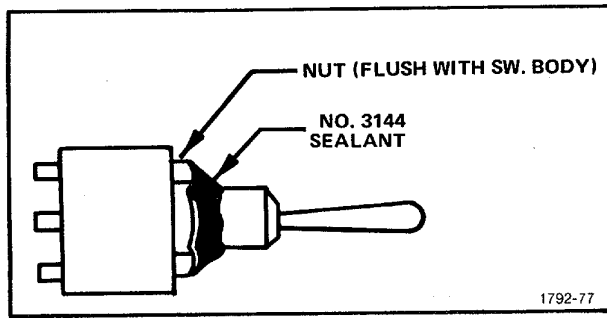


Figure 5-24. Application of sealant to RECORD toggle-switch nut.

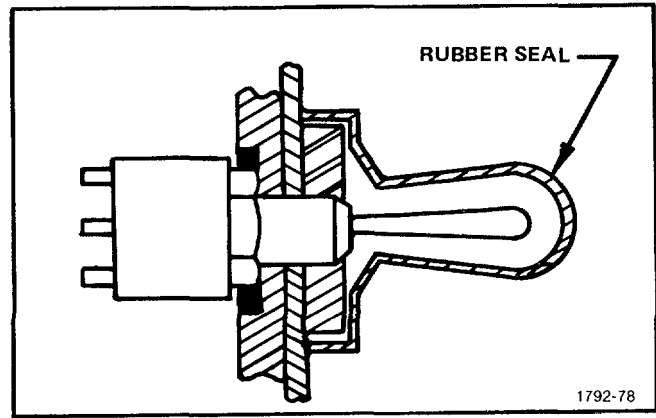


Figure 5-25. Installation of rubber Cap-Seal on RECORD toggle-switch.

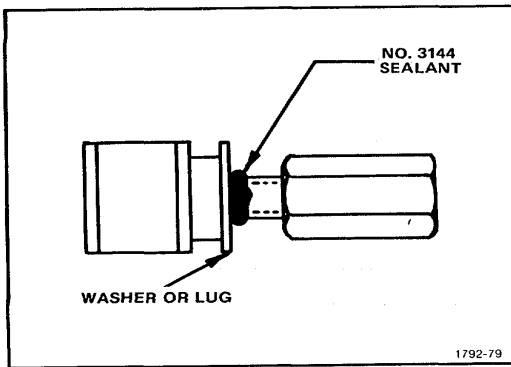


Figure 5-26. Application of sealant to the GAIN or the 0-dB SET control bushing.

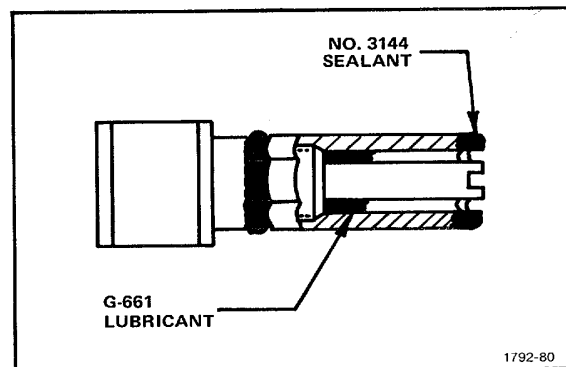


Figure 5-27. Application of sealant to the GAIN or the 0-dB SET control bushing.

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  $20 \pm 3$  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.

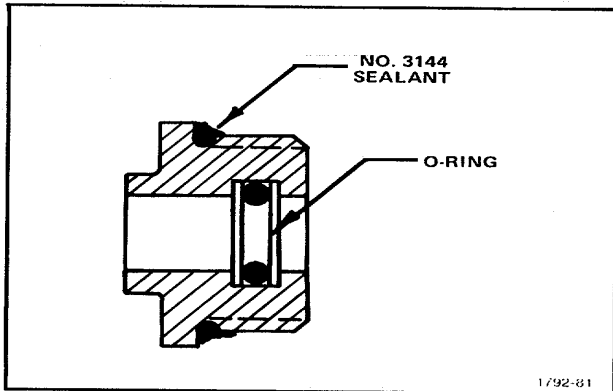


Figure 5-28. Lubrication of the O-rings and sealing for the cam switches

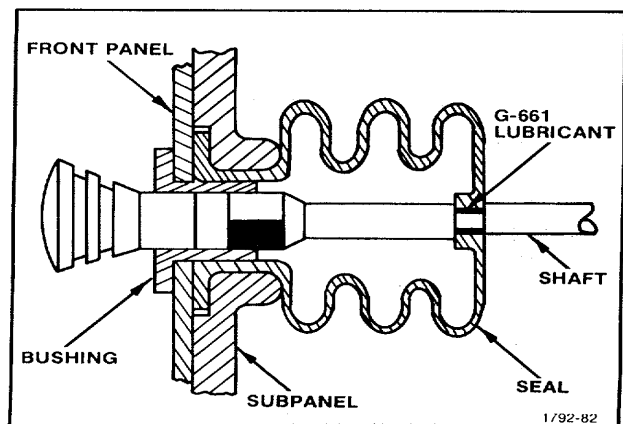


Figure 5-29. Installation of the POWER SWITCH.



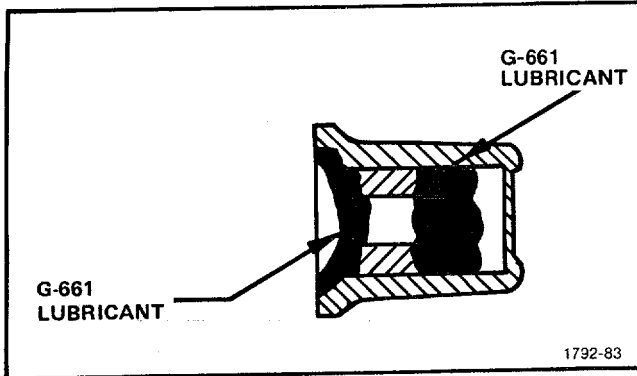


Figure 5-30. Lubrication of POSITION control knob.

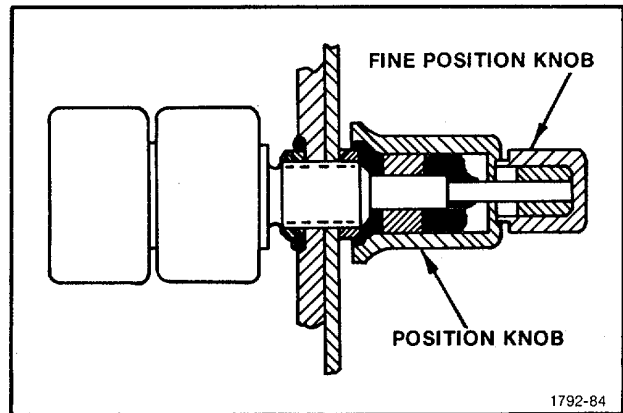


Figure 5-31. Installation of knob on shaft..

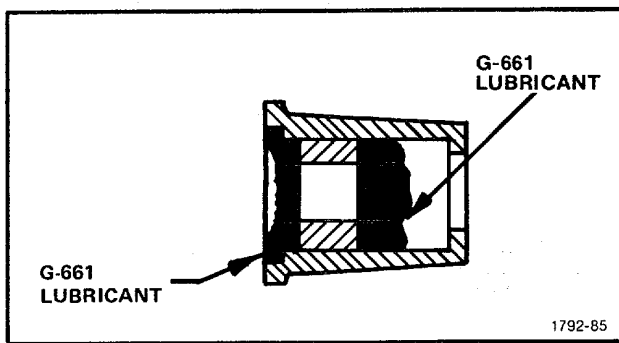


Figure 5-32. Lubrication of ZERO REFERENCE knob.

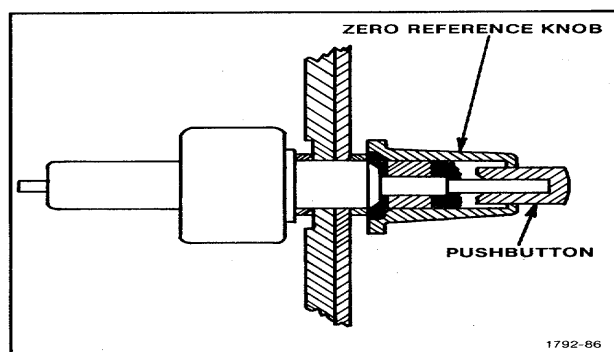


Figure 5-33. Installation of knob on ZERO REFERENCE control.

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.

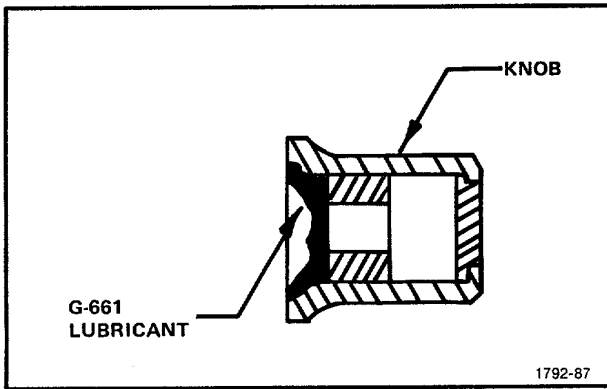


Figure 5-34. Lubrication of FOCUS and INTENSITY control knobs.

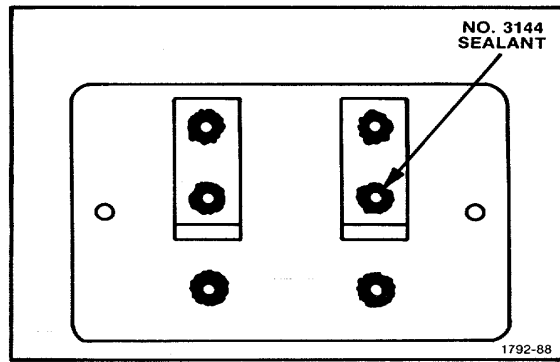


Figure 5-35. Sealing of Battery Pack screwholes

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.

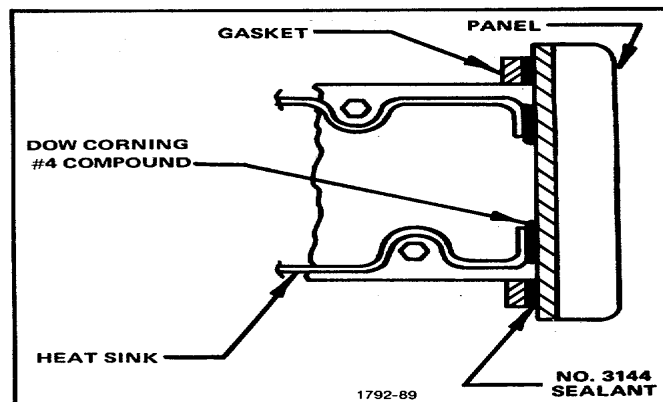


Figure 5-36. Application of dielectric type compound.

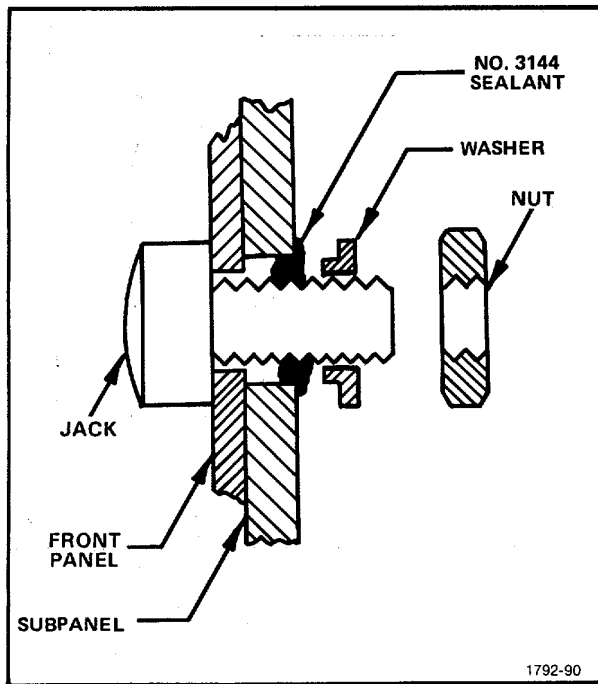


Figure 5-37. Detail of front panel jacks.

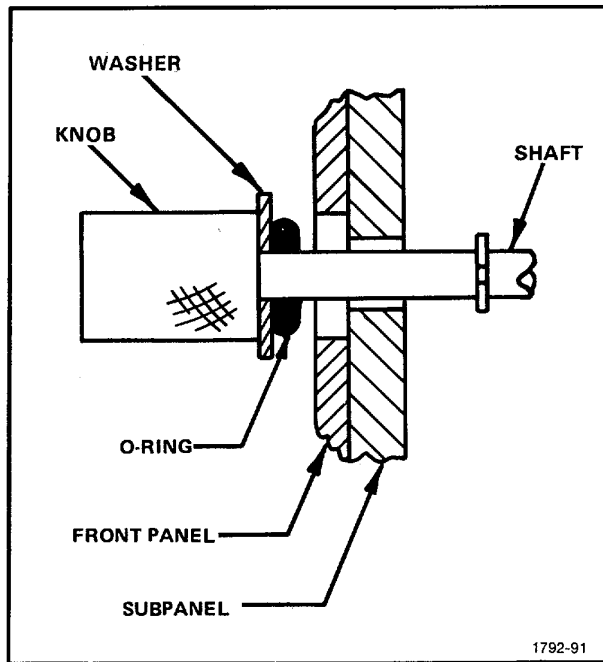


Figure 5-38. Detail of X-Y Module thumbscrews

- 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.

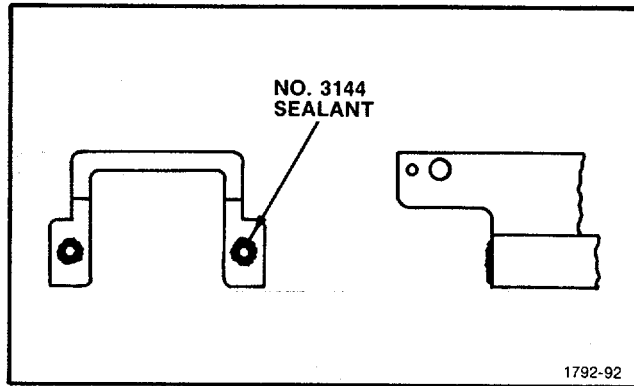


Figure 5-39. Sealing of latch assembly screwholes.

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
91361	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
56289	CENTRALAB INC	7158 MERCHANT AVE	EL PASO, TX 79915
59660	SUB NORTH AMERICAN PHILIPS CORP		
59821	BUSSMAN MFG., DIVISION OF MCGRAW- EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71400	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
71590	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
72982	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
73138	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
75915	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80009	ELECTRA-MIDLAND CORP., MEPCO DIV.	22 COLUMBIA ROAD	MORRISTOWN, NJ 07960
80031	MALLORY CAPACITOR CO., DIV. OF	3029 E. WASHINGTON STREET	
90201	P.R. MALLORY AND CO., INC.	P. O. BOX 372	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
93958	REPUBLIC ELECTRONICS CORPORATION	176 E 7TH STREET	PATERSON, NJ 07524
95275	VITRAMON, INC.	P O BOX 544	BRIDGEPORT, CT 06601
96733	SAN FERNANDO ELECTRIC MFG CO	1501 FIRST ST	SAN FERNANDO, CA 91341
S3629	PANEL COMPONENTS CORP.	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



Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
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%,100OV	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 DI:680PF,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			SEMICONV DEVICE SILICON,30V,150MA	01295	1N4152R
CR1609	152-0140-01			SEMICONV DEVICE TUNNEL,8PF,10MA	03508	SMTD995
CR1632	152-0335-01			SEMICONV DEVICE SILICON,SNAP-OFF,40V	50101	GC20279
CR1691	152-0141-02			SEMICONV DEVICE.SILICON,30V,150MA	01295	1N4152R
CR1703	152-0489-00			SEMICONV DEVICE:TNL,GE,21MA,1.5PF W/GND	80009	152-0489-00
CR1732	152-0631-00			SEMICONV DEVICE:SILICON,GATE,CER PKG	80009	152-0631-00

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
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

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
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

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
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

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		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			SEMICOND DEVICE:ZENER,1W,91V,5%	80009	152-0513-00

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		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%,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

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		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)		

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		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,ELCLT:1UF,20%,35V	56289	196D105X0035HA1
C3246	290-0534-00			CAP.,FXD,ELCLT: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



Ckt No.	Tektronix	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
	Part No.	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)

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		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			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR4156	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR4211	152-0429-00			SEMICONV DEVICE:SILICON,5000V,10MA	14099	SA3282
CR4311	152-0429-00			SEMICONV DEVICE:SILICON,5000V,10MA	14099	SA3282
CR4313	152-0429-00			SEMICONV DEVICE:SILICON,5000V,10MA	14099	SA3282
CR4323	152-0429-00			SEMICONV 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			SEMICONV DEVICE:ZENER,0.4W,150V,5%	04713	SZG275K1RL

REV SEP 1983

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		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

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
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

Ckt No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
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			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR6157	152-0488-00			SEMICONV DEVICE:SILICON,200V,1500MA	04713	SDA317
CR6234	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6247	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6346	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR6347	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6414	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR6438	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR6439	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR6441	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6442	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6446	152-0400-00	B010100	B020394	SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR6448	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6452	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6534	152-0400-00			SEMICONV DEVICE:SILICON,400V,1A	80009	152-0400-00
CR6536	152-0586-00			SEMICONV DEVICE:SILICON,600V,500MA	14936	RGP10J-011
CR6537	152-0586-00			SEMICONV DEVICE:SILICON,600V,600MA	14936	RGP10J-011
CR6546	152-0141-02			SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
CR6551	152-0141-02			SEMICONV 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

Ckt No.	Tektronix		Serial/Model No.		Name & Description	Mfr	
	Part No.	Eff	Dscont	Code		mfr Part Number	
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

Ckt No.	Tektronix	Serial/Model No.		Name & Description	Mfr	
	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			SEMICONV DEVICE:ZENER,0.4W,15V,5%	14552	TD3810983
VR6235	152-0278-00			SEMICONV DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR6252	152-0278-00			SEMICONV DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
VR6253	152-0127-00			SEMICONV DEVICE:ZENER,0.4W,7.5V,5%	04713	SZG35009K2
VR6318	152-0265-00			SEMICONV DEVICE:ZENER,0.4W,24V,5%	04713	SZG35009K8
VR6417	152-0195-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755
VR6419	152-0175-00			SEMICONV DEVICE:ZENER,0.4W,5.6V,5%	04713	SZG35008
VR6427	152-0195-00			SEMICONV DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755
VR6459	152-0306-00			SEMICONV 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:

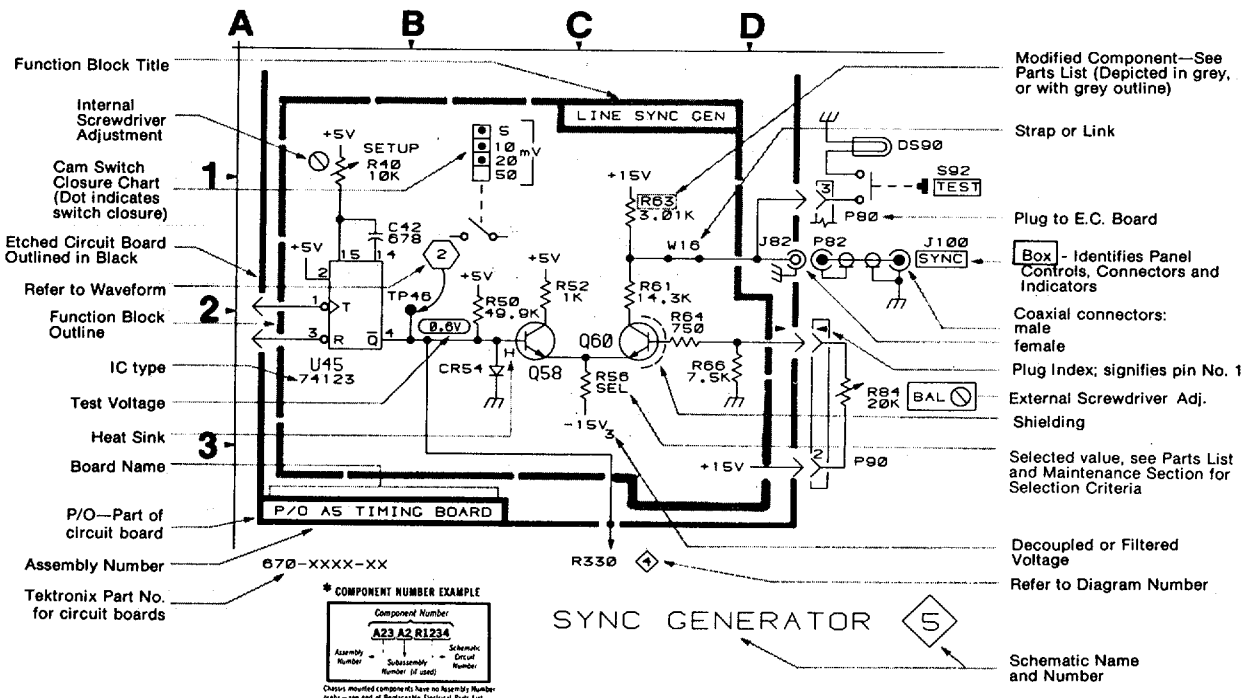
- Capacitors = Values one or greater are in picofarads (pF).
- Values less than one are in microfarads ( $\mu$ F).
- Resistors = Ohms ( $\Omega$ ).

**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	OBD	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

REV SEP 1983

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

REV SEP 1993

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	Model No. 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	B102694	1	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	B102694	1	PANEL,FRONT:	80009	333-1991-05
				1	PANEL,FRONT: (OPTION 5 ONLY)	80009	333-2119-02
	333-2119-04	B102695		1	PANEL,FRONT: (OPTION 5 ONLY)	80009	333-2119-04
-48	348-0421-00	B010100	B060959	1	SEAL,INDICATOR:BATTERY LEVEL (REPLACEABLE WITH FRONT PANEL ASSY)	80009	348-0421-00
		B060960		1			
-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	B010209	1	PAD,CUSHIONING:REAR CRT W/PLATE ***** (ATTACHING PARTS)*****	80009	348-0342-01
-57	211-0513-00	B010100	B010209	2	SCREW,MACHINE:6-32 X 0.625 INCH,PNH STL ***** (END ATTACHING PARTS)*****	83385	OBD
-58	214-1304-00	B010100	B010209	2	SPRING,HLCPS:0.30 OD X 1.25 INCH LONG	80009	214-1304-00
-59	361-0109-00	B010100	B010209	2	NUT,PLAIN,HEX:0.641 INCH LONG,W/0.375 HEX ***** (ATTACHING PARTS)*****	80009	361-0109-00
-60	211-0507-00	B010100	B010209	2	SCREW,MACHINE: 6-32 X 0.312 INCH,PNH STL	83385	OBD
-61	210-0006-00	B010100	B010209	2	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 No.	Tektronix Part No.	Serial/Model No.		Qty	Name & Description	Mfr	
		Eff	Dscont			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. Eff	Model No. Dscont Qty	1 2 3 4 5	Name & Description	Mfr 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	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.		Qty	Name & Description	Mfr	
		Eff	Dscont			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.

**A-1/(A-2 blank)**

By Order of the Secretary of the Army:

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

Official:

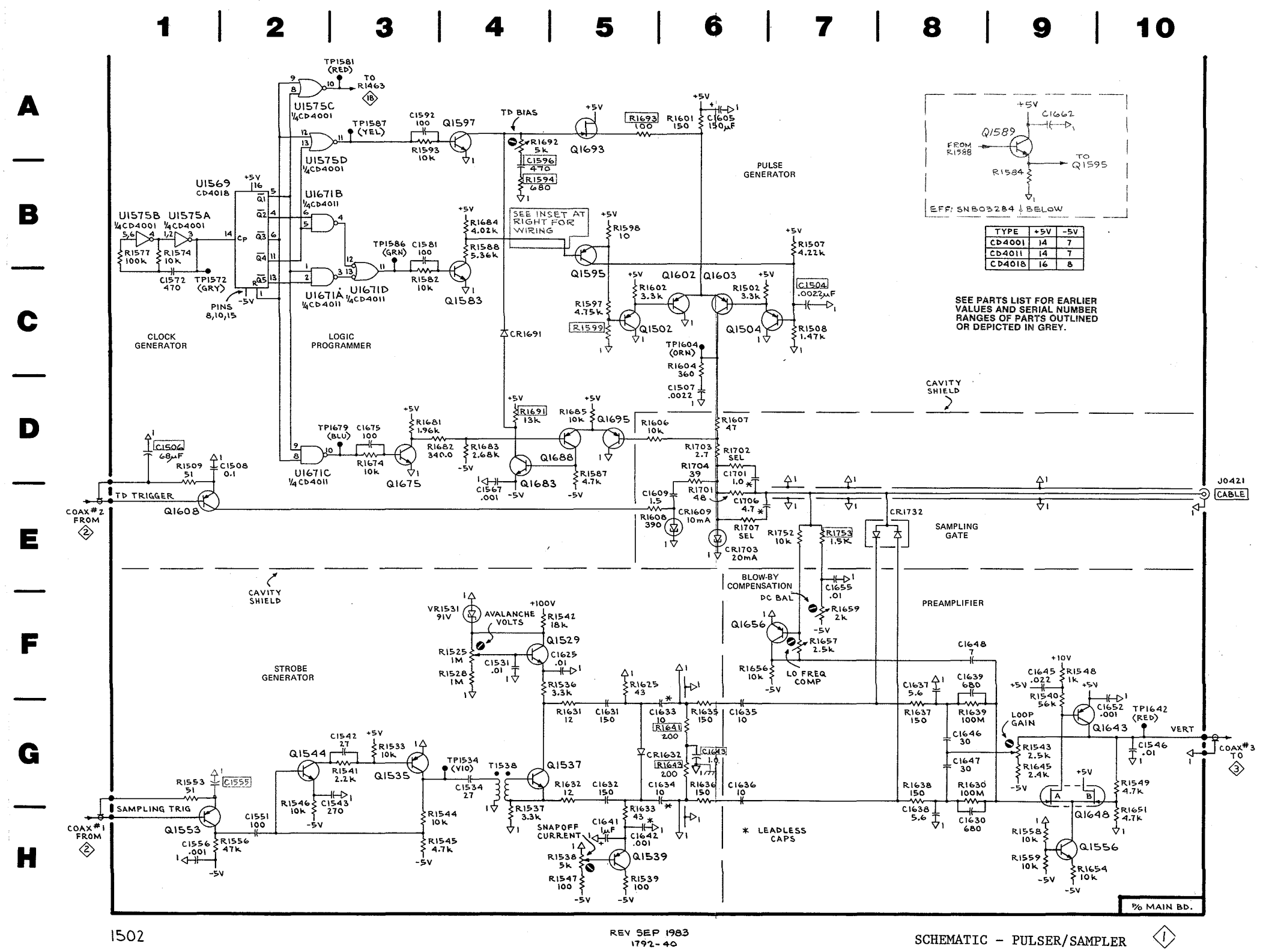
**R. L. DILWORTH**  
*Brigadier General, United States Army*  
*The Adjutant General*

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		
C1161	F12	Q1529	F4	R1542	F4
C1237	E15	Q1535	G3	R1543	G9
C1313	C13	Q1537	G4	R1544	H3
C1325	E14	Q1539	H5	R1545	H3
C1332	F15	Q1544	G2	R1546	G2
C1341	E17	Q1553	H1	R1547	H5
C1345	H17	Q1556	H9	R1548	F9
C1435	F13	Q1583	C4	R1549	G10
C1464	D12	Q1589	A9	R1553	G1
C1504	C7	Q1595	B5	R1556	H1
C1507	D8	Q1597	A4	R1558	H9
C1507	D1	Q1602	C6	R1559	H9
C1508	D2	Q1603	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	R1443	H16		
Q1337	F14	R1443	H16		
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		
Q1413	C14	R1528	F4	VR1531	F4
Q1425	E16	R1533	G3		
Q1431	E16	R1533	G3		
Q1443	G16	R1536	F4		
Q1444	G17	R1537	F4		
Q1447	G16	R1537	F4		
Q1448	G16	R1538	H5		
Q1502	C5	R1539	H5		
		R1540	G9		
		R1541	G3		

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



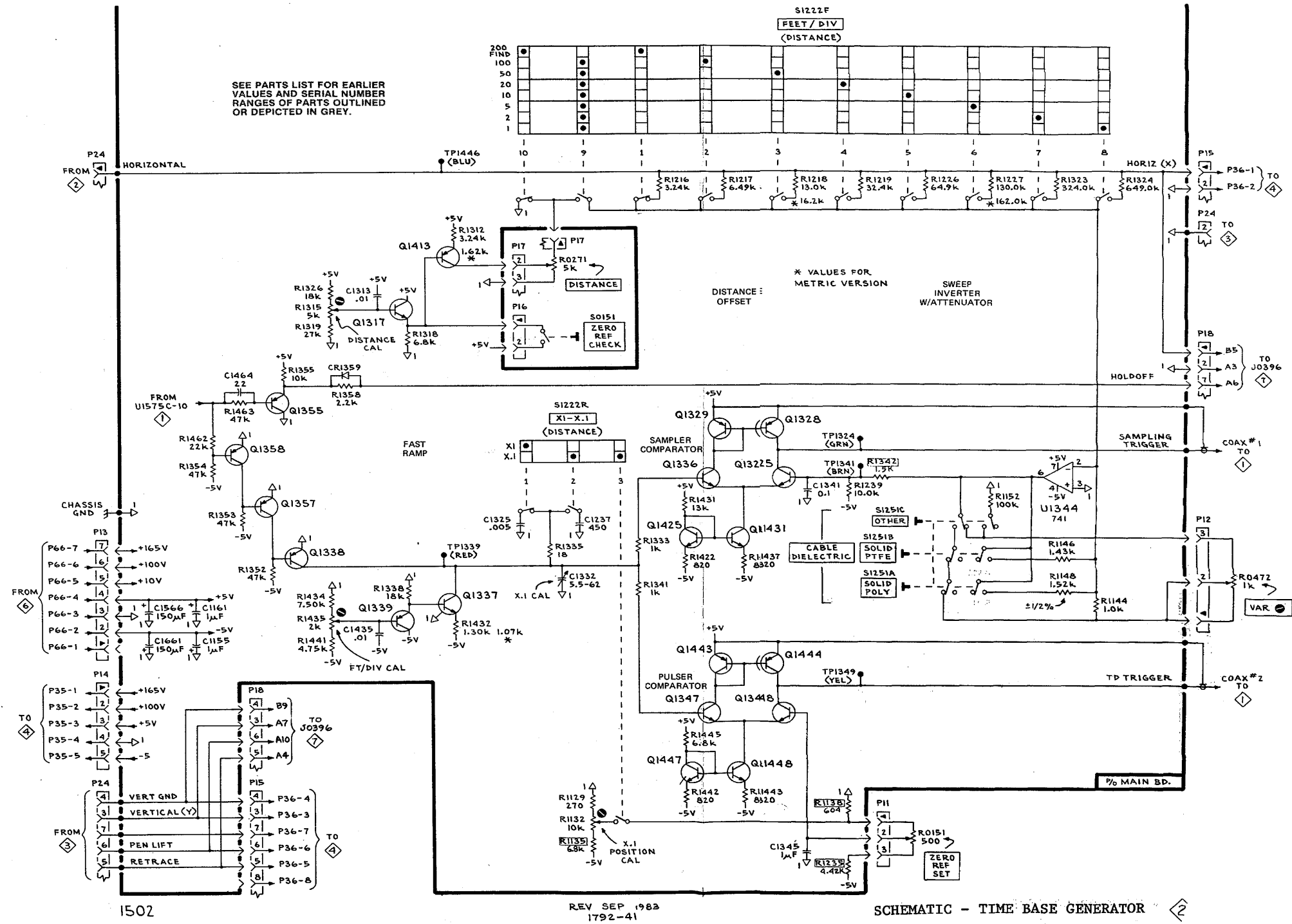
SCHMATIC-PULSER/SAMPLER

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	G6
C1625	F8	R1138	H17	R1638	G8
C1630	H8	R1144	F19	R1639	G8
C1631	G5	R1146	F19	R1641	G6
C1632	G5	R1148	F19	R1643	G9
C1633	G6	R1152	E18	R1645	G6
C1634	G6	R1216	B16	R1651	H10
C1635	G6	R1217	B16	R1654	H9
C1636	G6	R1218	B17	R1656	F7
C1637	F8	R1219	B17	R1657	F7
C1638	H8	R1226	B18	R1659	F7
C1639	F8	R1227	B18	R1674	D3
C1641	H5	R1235	H17	R1681	D3
C1642	H5	R1239	E17	R1682	D3
C1643	G6	R1312	C14	R1683	D4
C1645	F9	R1315	C13	R1684	B4
C1646	G8	R1318	D14	R1685	D5
C1647	G8	R1319	C13	R1691	D4
C1648	F8	R1323	B19	R1692	A4
C1652	G10	R1324	B20	R1693	A5
C1655	E7	R1326	C13	R1701	E6
C1661	F11	R1333	E16	R1702	D6
C1662	B9	R1335	F15	R1703	D6
C1675	D3	R1338	F13	R1704	D6
C1701	D6	R1341	F16	R1707	E6
C1706	E6	R1342	E17	R1752	E7
CR1359	D13	R1352	F12	R1753	E7
CR1609	E6	R1353	E12		
CR1632	G5	R1354	E12	S0151	D14
CR1691	C4	R1355	D13	S1222	A17
CR1703	E6	R1358	D13	S1251	F18
CR1732	E8	R1422	F16	T1538	G4
Q1317	C13	R1431	E16	U1344	E19
Q1325	E17	R1432	F14	U1569	B2
Q1328	D17	R1434	F13	U1575	B1,B2
Q1329	D16	R1435	F13	U1671	B2,D2
Q1336	E16	R1437	F16	VR1531	F4
Q1337	F14	R1441	H16		
Q1338	F13	R1445	G16		
Q1339	F13	R1462	D12		
Q1347	G16	R1463	D12		
Q1348	G16	R1502	C6		
Q1355	D13	R1507	B7		
Q1357	E12	R1508	C7		
Q1358	E12	R1509	D1		
Q1413	C14	R1525	F4		
Q1425	E16	R1528	F4		
Q1431	E16	R1533	G3		
Q1443	G16	R1536	F4		
Q1444	G17	R1537	H4		
Q1447	G16	R1538	H5		
Q1448	G16	R1539	H5		
Q1502	C5	R1540	G9		
		R1541	G3		

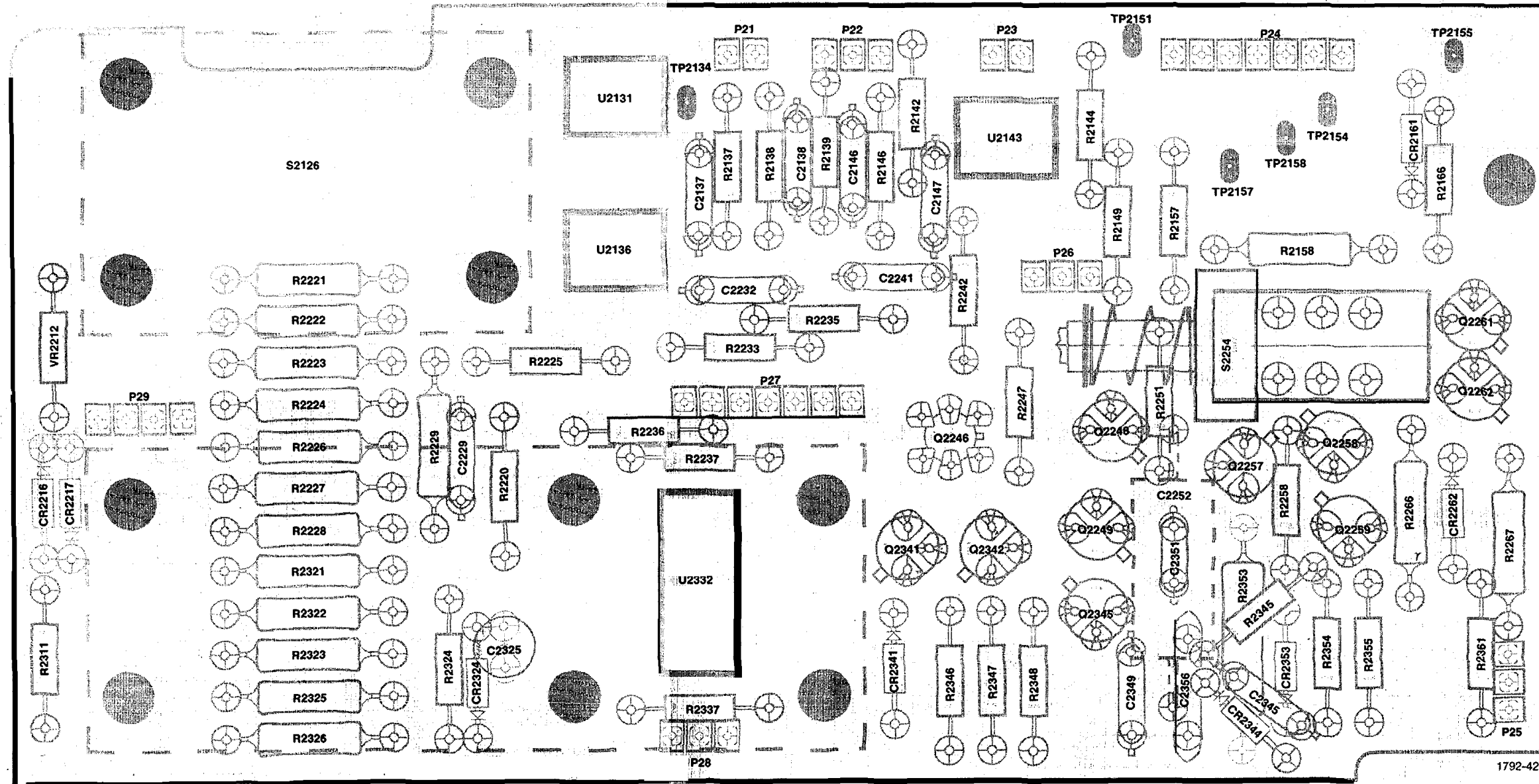
NOTE: THIS GRID LOCATOR APPLIES TO BOTH DIAGRAMS  
 1 AND 2

A  
B  
C  
D  
E  
F  
G  
H

11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20



SCHMATIC-TIME BASE GENERATOR



1792-42

Vertical Amplifier/Slow Ramp Board

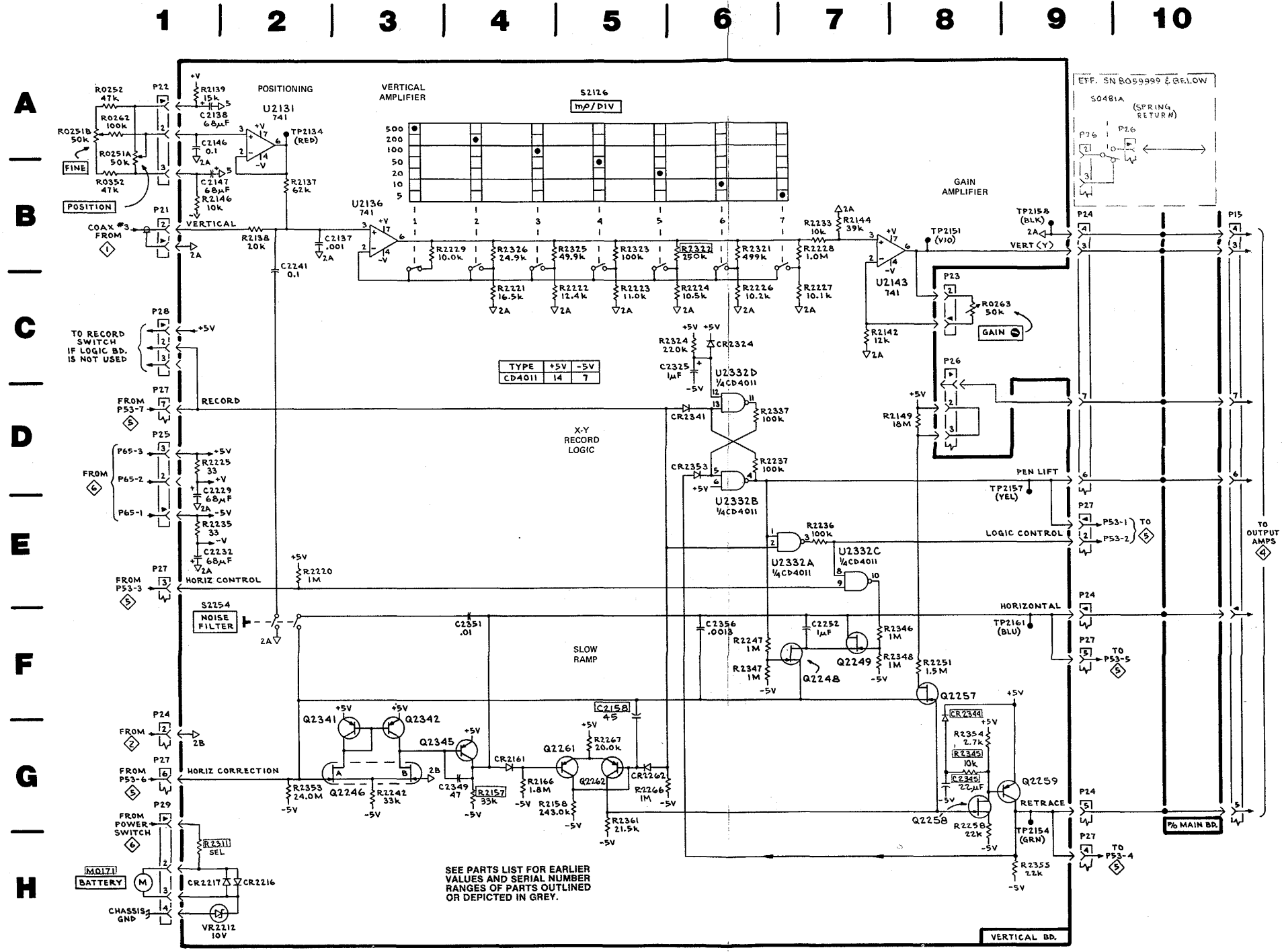
SCHEMATIC-VERT AMPL/SLOW RAMP COMPONENTS



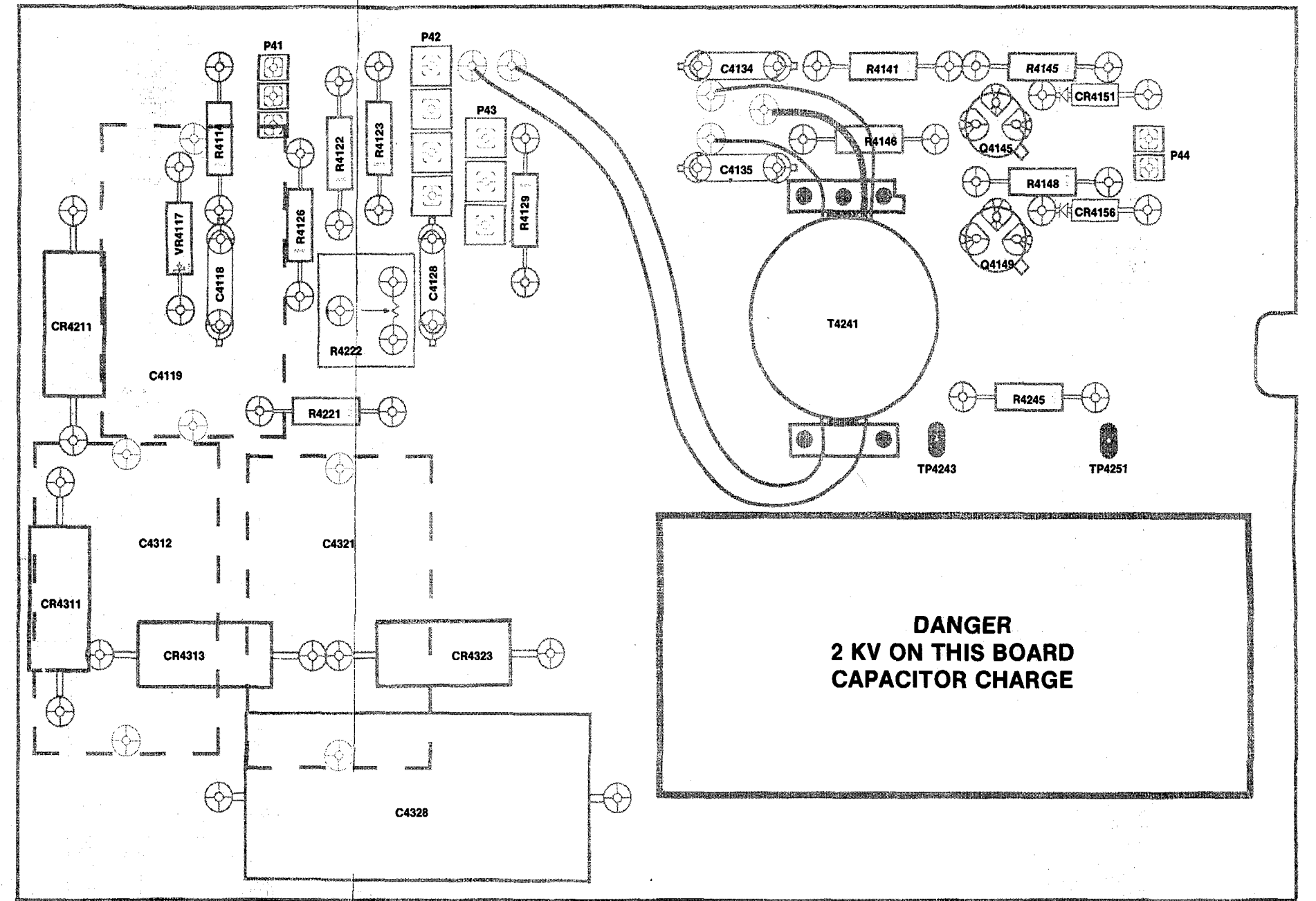
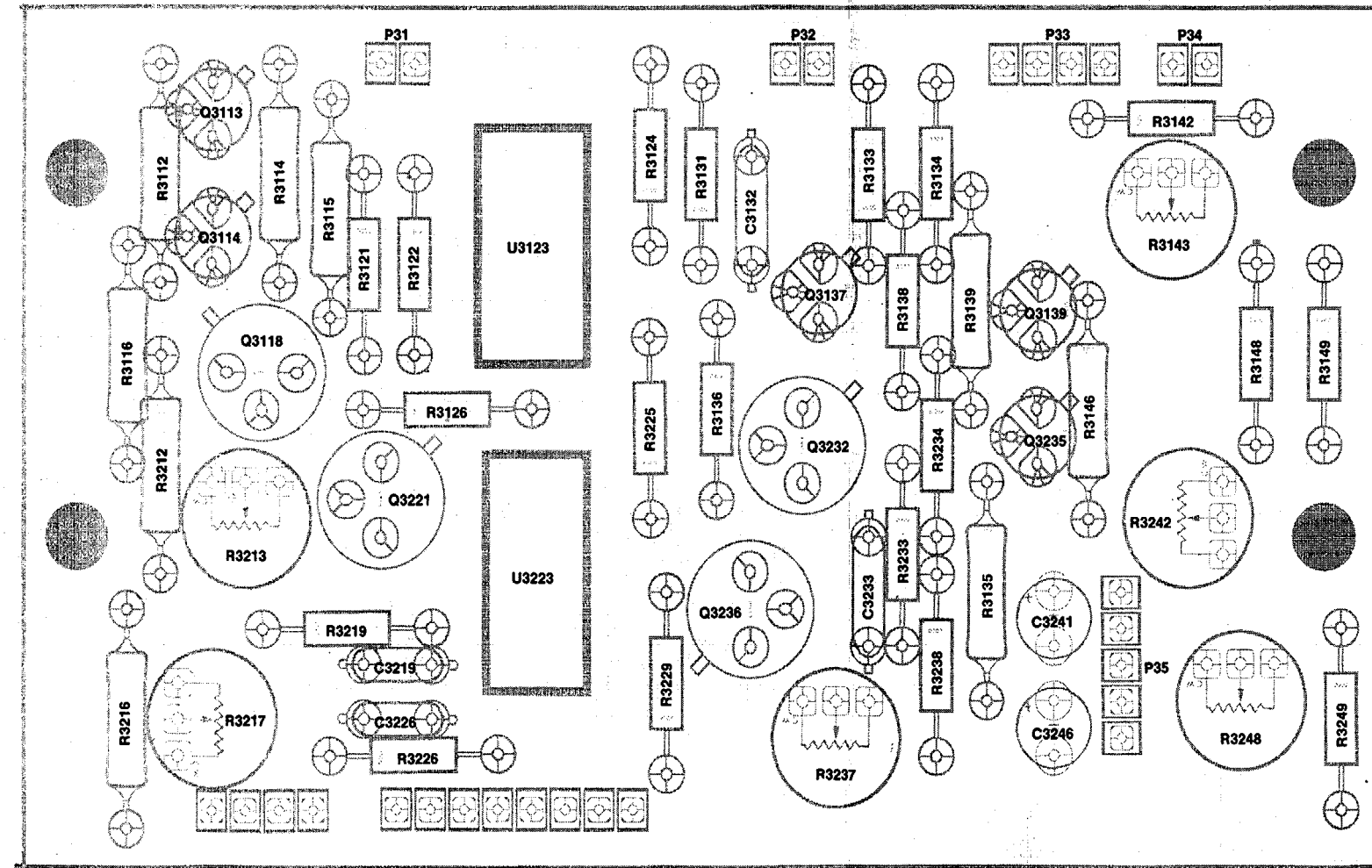




CKT NO	GRID LOC	CKT NO	GRID LOC
C2137	B3	R2311	H2
C2138	A2	R2321	B6
C2146	A2	R2322	B6
C2147	B2	R2323	B5
C2158	G5	R2324	C6
C2229	E2	R2325	B5
C2232	E2	R2326	B4
C2241	C2	R2337	D7
C2252	F7	R2345	G8
C2325	C6	R2346	F8
C2345	G8	R2347	F7
C2349	G4	R2348	F8
C2351	F4	R2353	G2
C2352	F7	R2354	G9
C2356	F6	R2355	H9
		R2361	G5
CR2161	G4		
CR2216	H2	S0481A	D8
CR2217	H2	S2126	A5
CR2262	G6	S2254	F2
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		



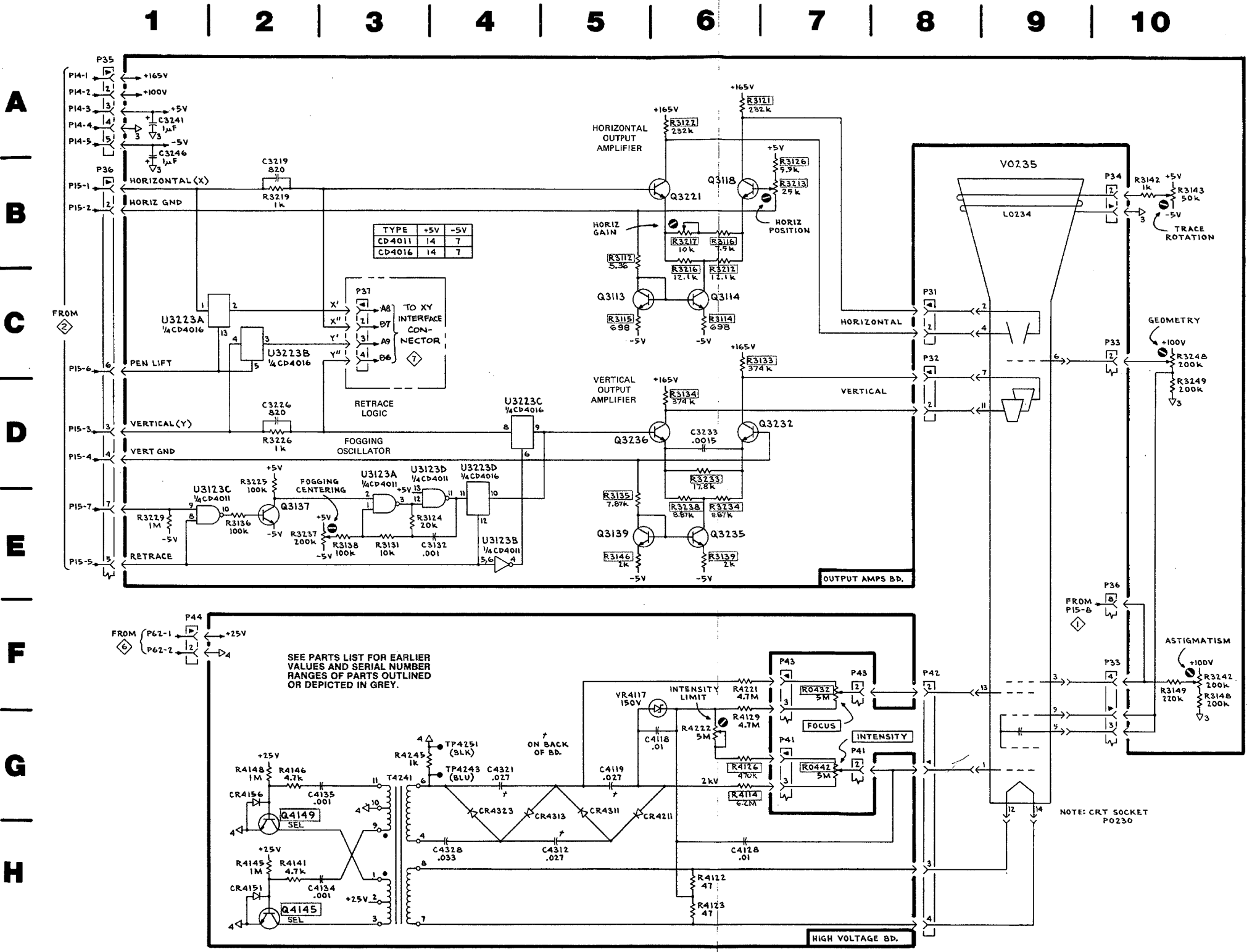
SCHEMATIC-VERTICAL AMP/SLOW RAMP



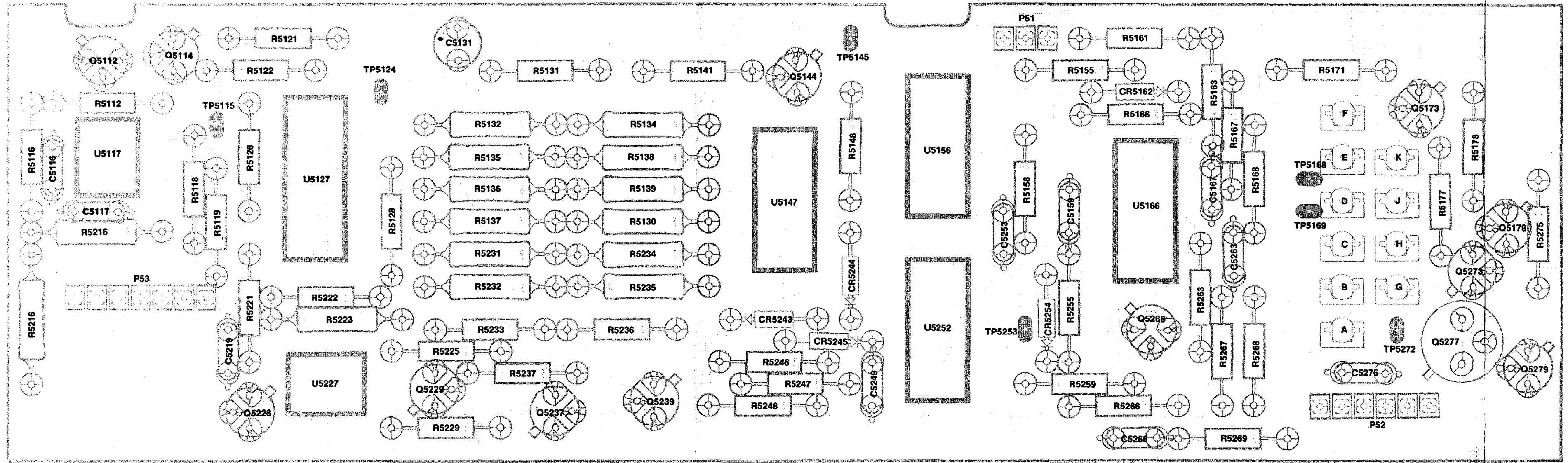
**DANGER**  
**2 KV ON THIS BOARD**  
**CAPACITOR CHARGE**

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.

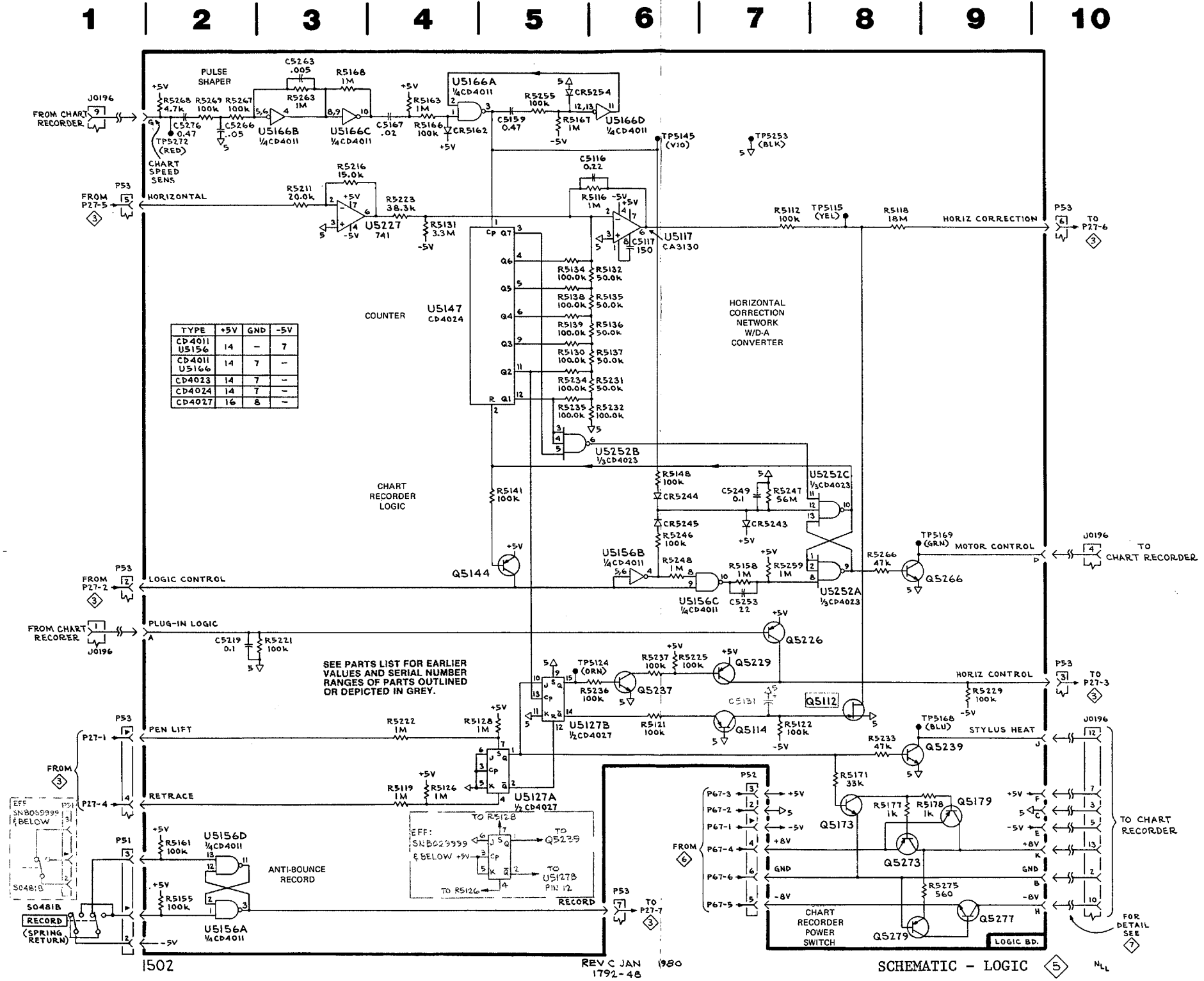
1792-47

Logic Board

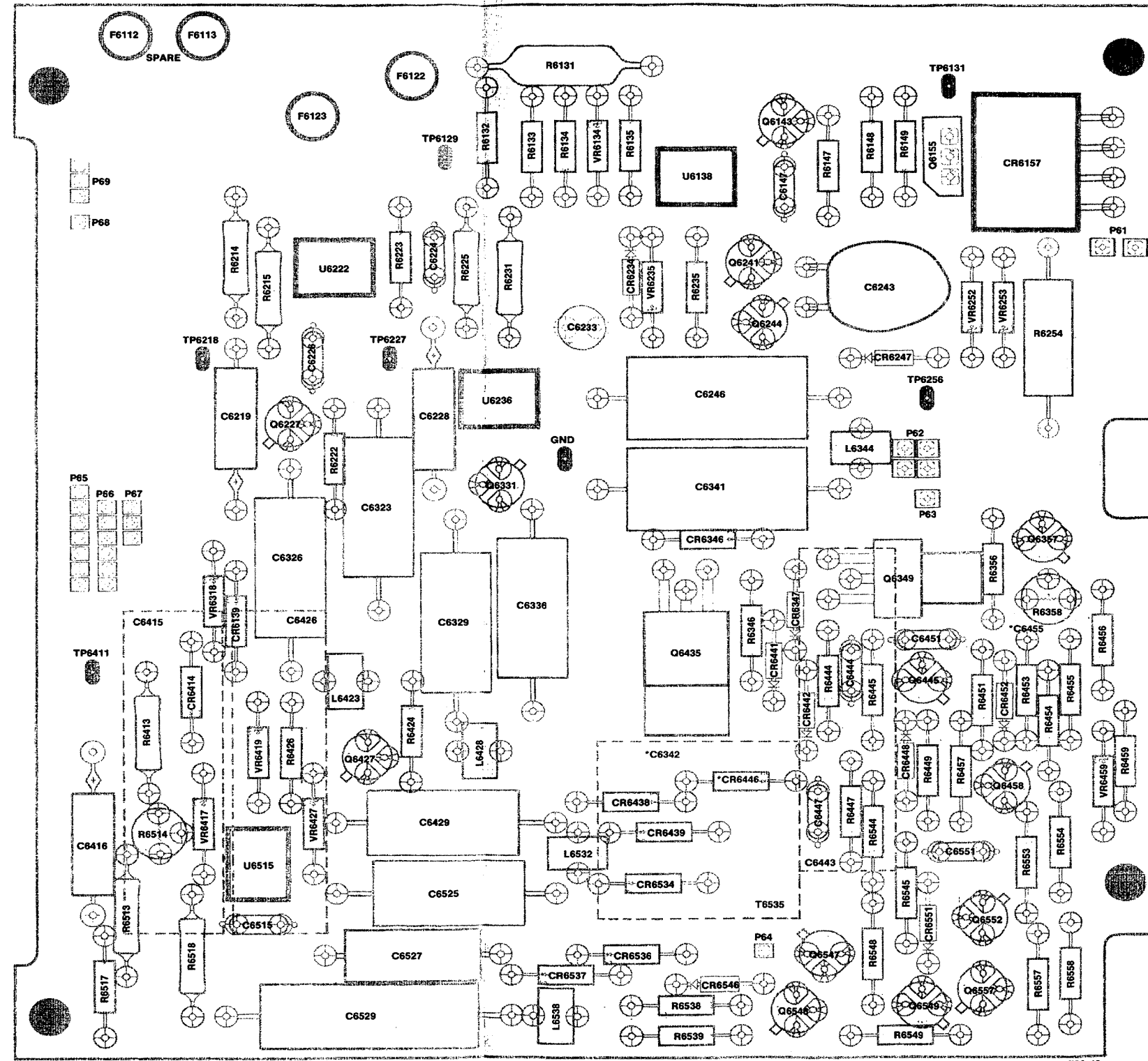
SCHEMATIC-LOGIC BOARD COMPONENTS

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



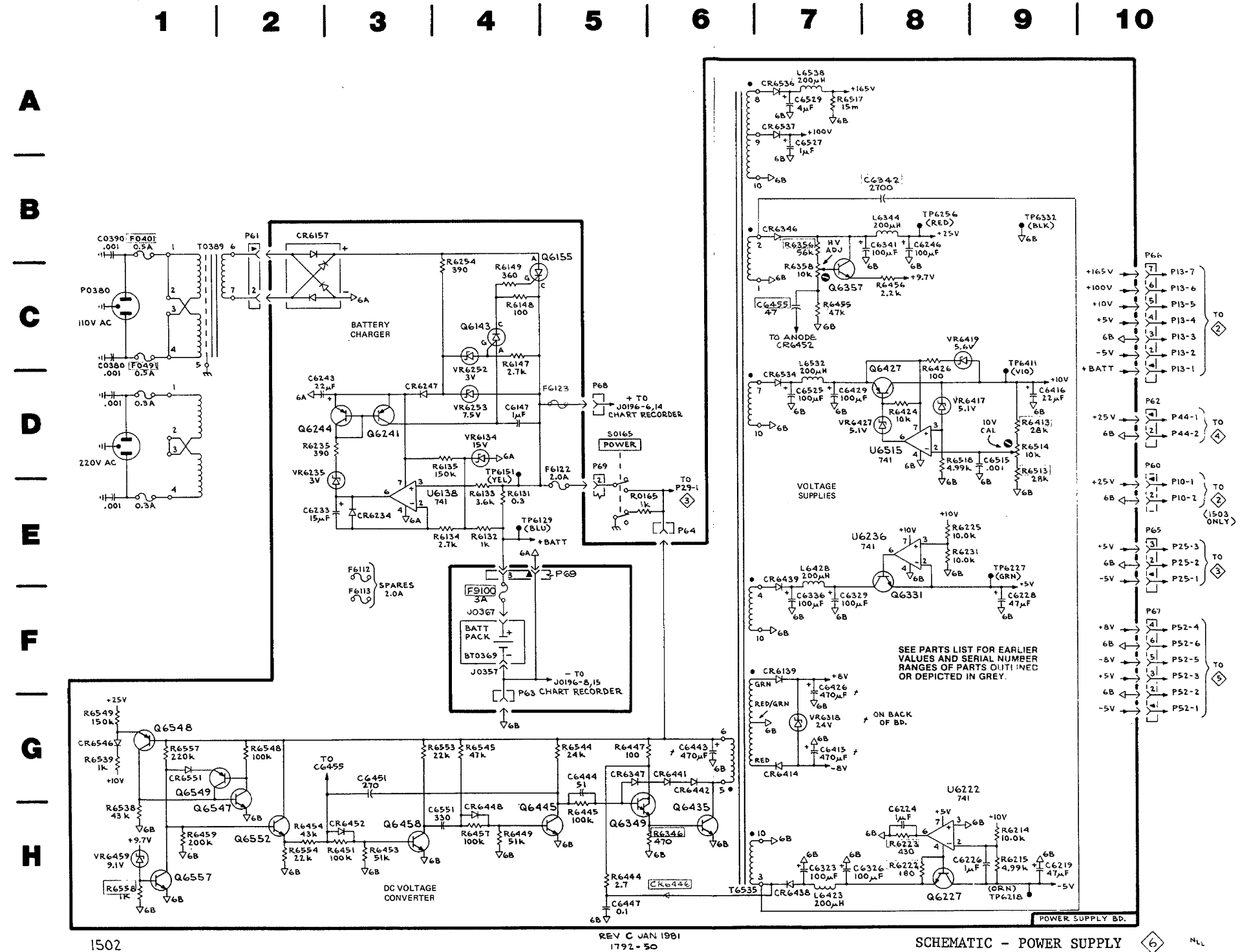
\*See Parts List for serial number ranges.

Power Supply  
SCHEMATIC-POWER SUPPLY  
10-14

1792-49

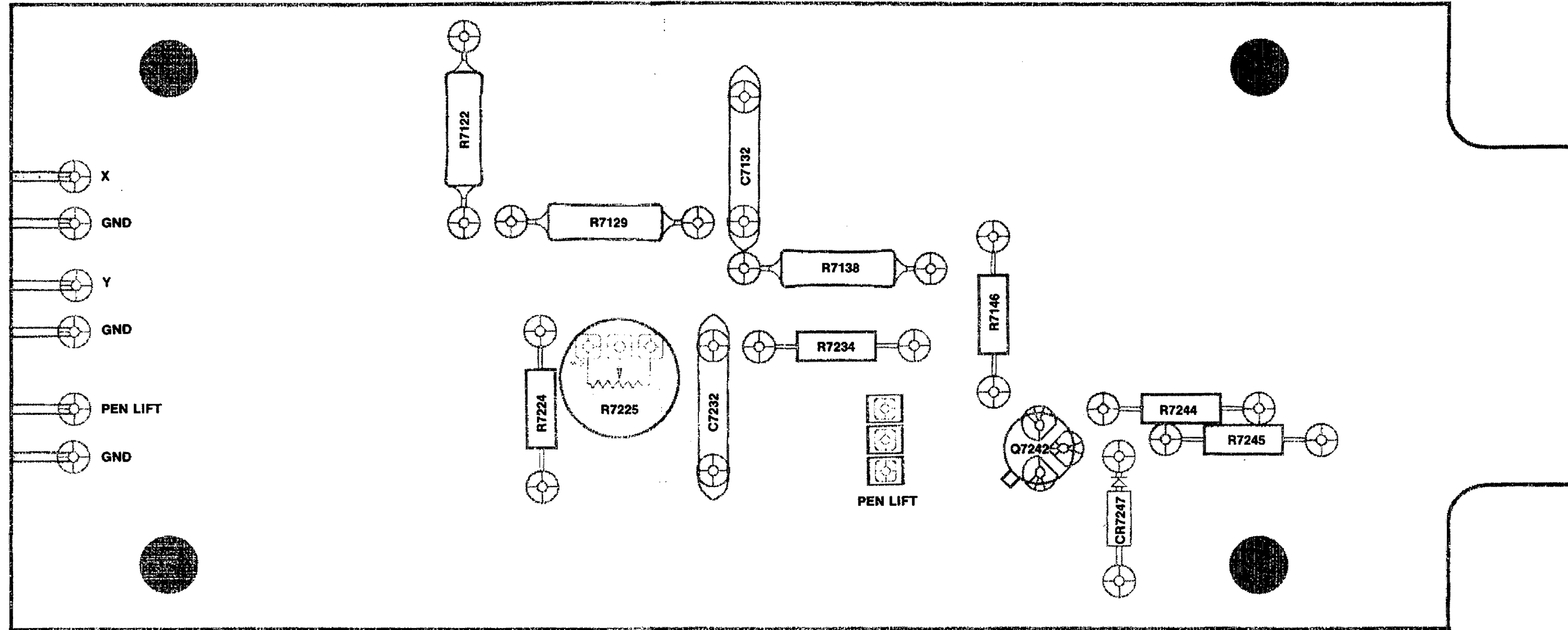


CKT NO	GRID LOC	CKT NO	GRID LOC
BT0369	F4	Q6458	H3
		Q6547	H2
C0380	D1	Q6548	G1
C0390	C1	Q6549	G2
C6147	D5	Q6552	H2
C6219	H10	Q6557	H1
C6224	H8		
C6226	H9		
C6228	F9	R6131	E5
C6233	E3	R6132	E4
C6243	D3	R6133	E4
C6246	B8	R6134	E4
C6323	H7	R6135	D4
C6326	H8	R6147	C5
C6329	F8	R6148	C5
C6336	F7	R6149	C5
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

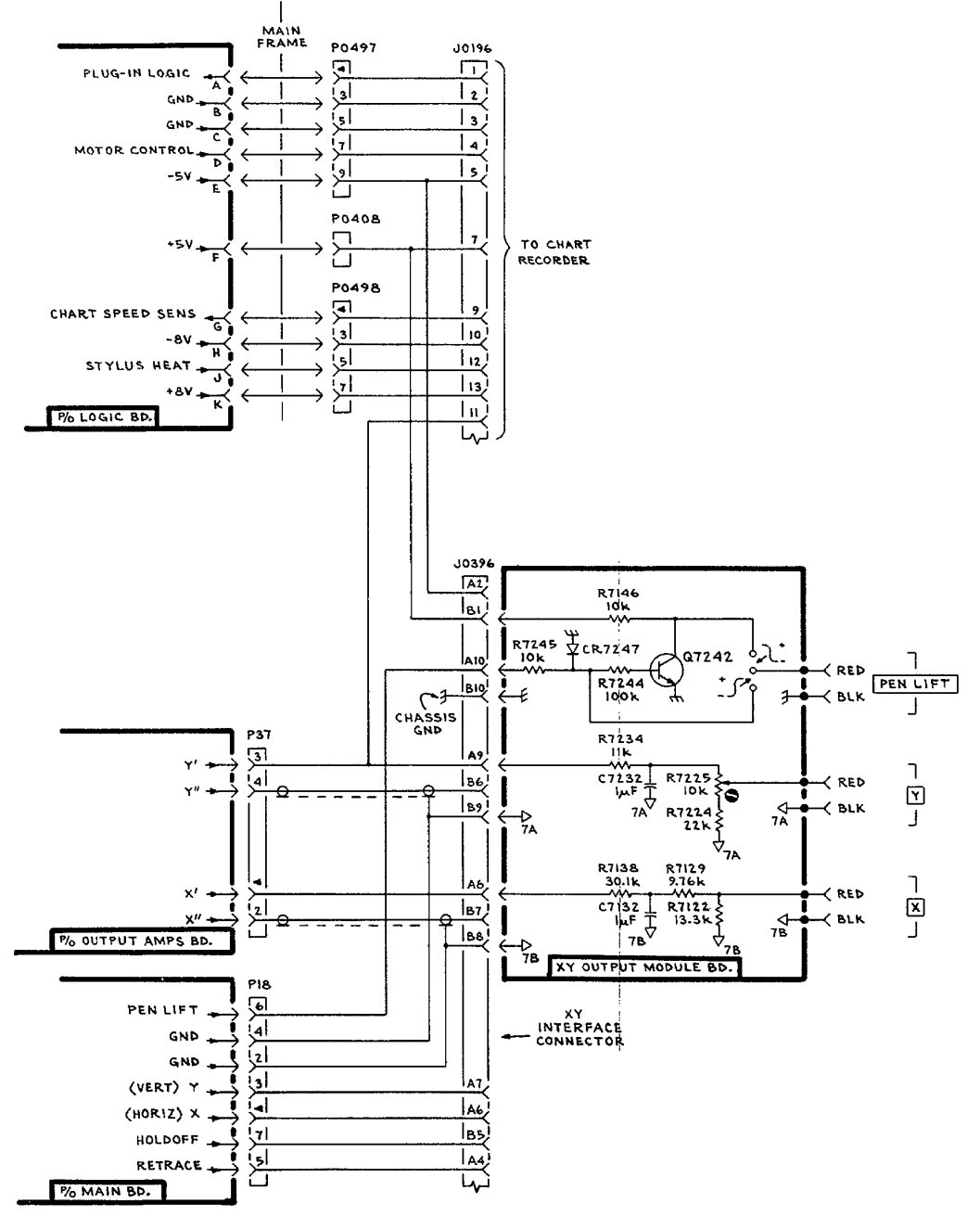
### X-Y Output Module

SCHEMATIC-POWER SUPPLY COMPONENTS

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

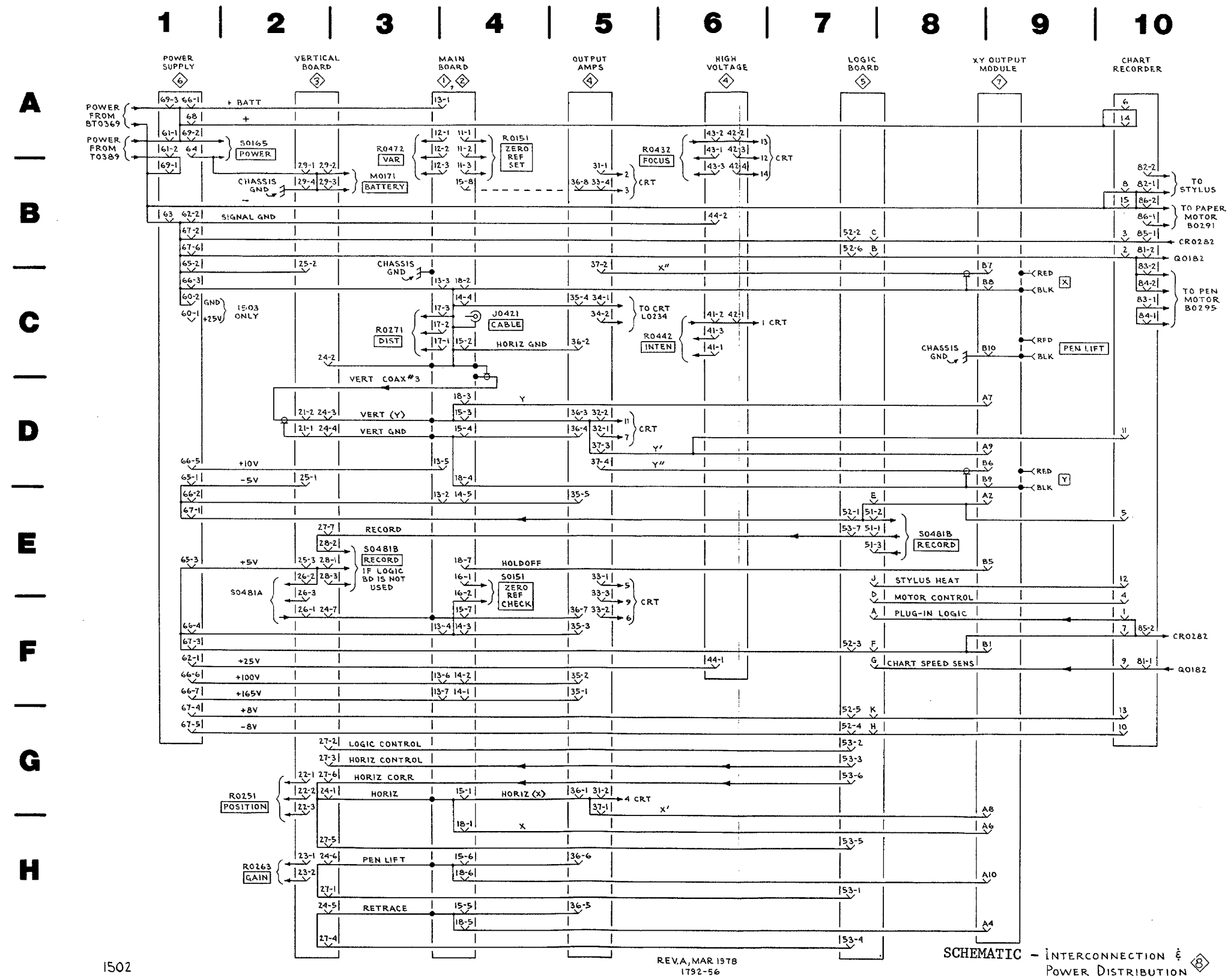
CKT NO	GRID LOC
C7132	F6
C7232	E6
CR7247	D6
Q7242	E7
R7122	F7
R7129	F7
R7138	F6
R7146	D6
R7224	E7
R7225	E7
R7234	E6
R7244	E6
R7245	E6

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1502

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



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1502

REV. A, MAR 1978  
1792-56

10-19/(10-20 blank)

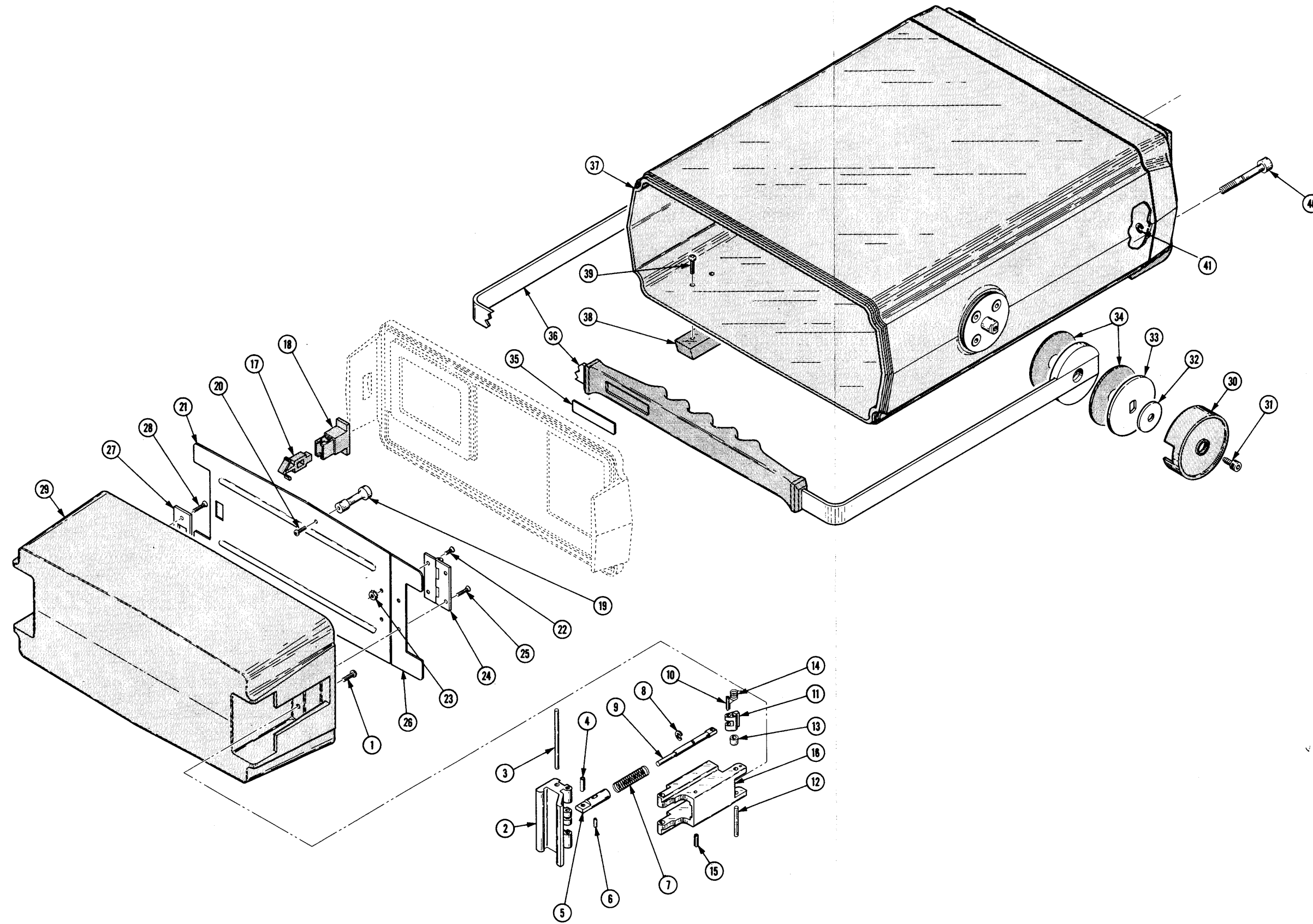


Figure 1. Cabinet and Access Box  
10-21

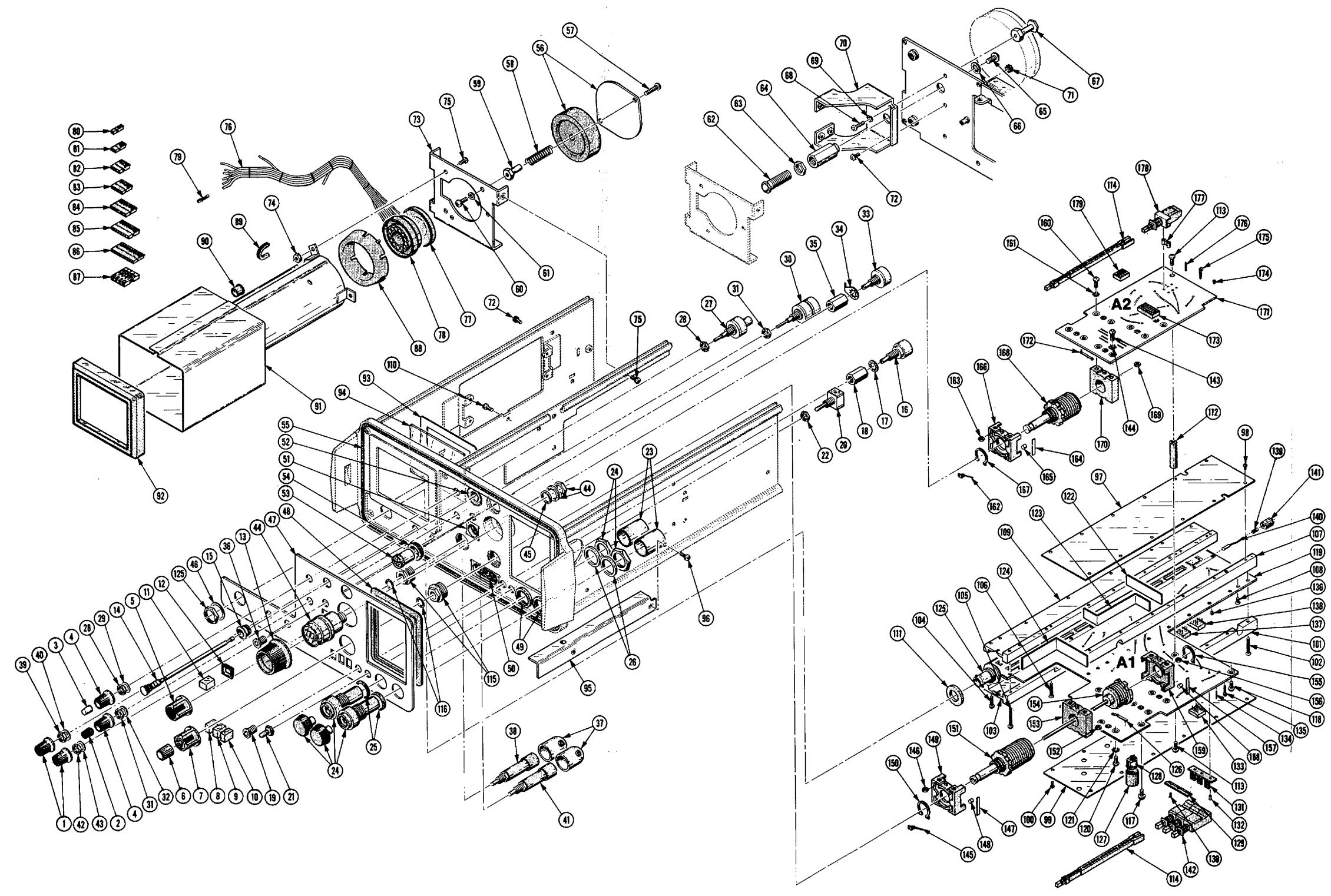
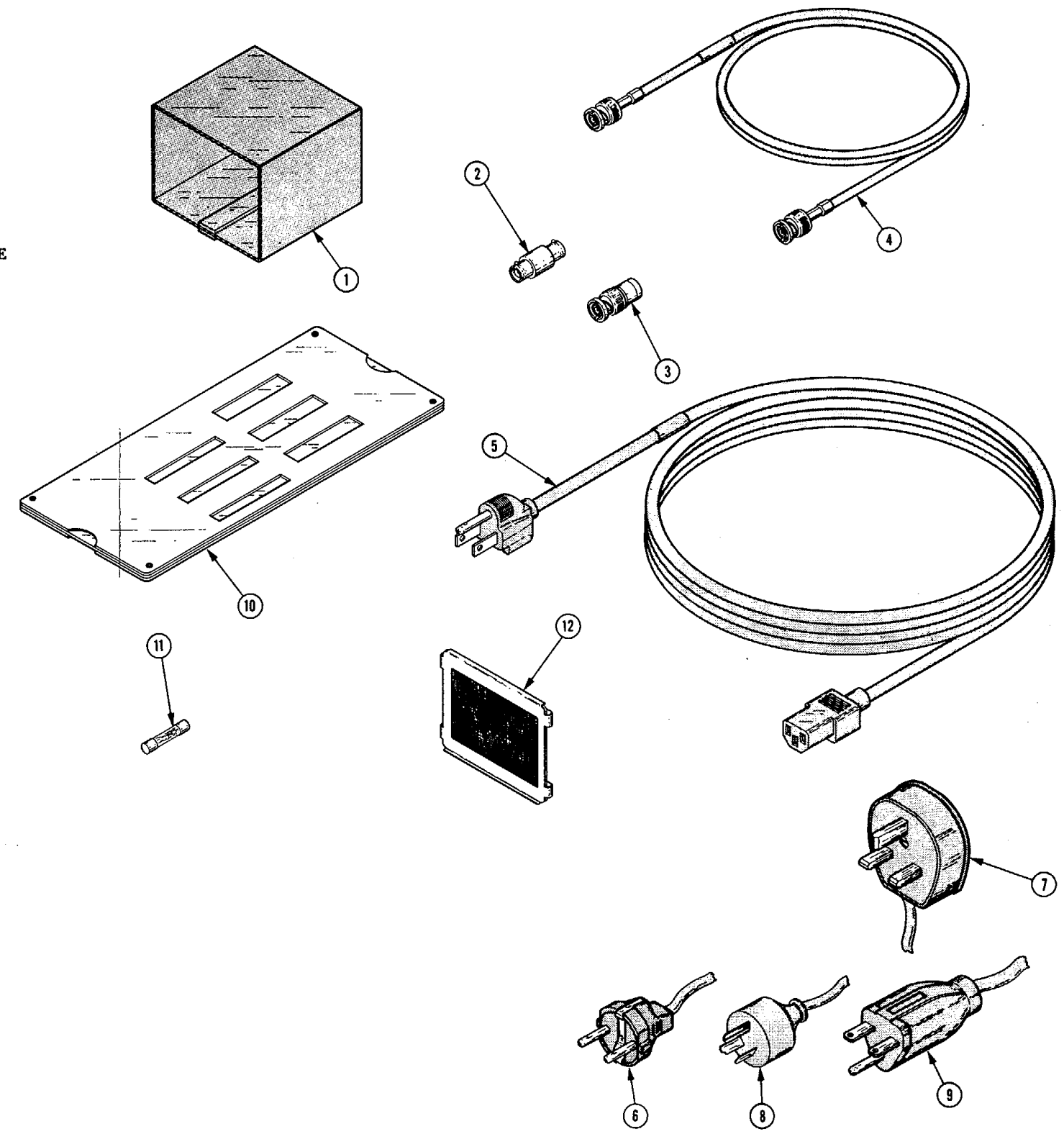


Figure 2.. Chassis

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
<b>STANDARD ACCESSORIES</b>												
-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
<b>OPTIONAL ACCESSORIES</b>												
	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 TON 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

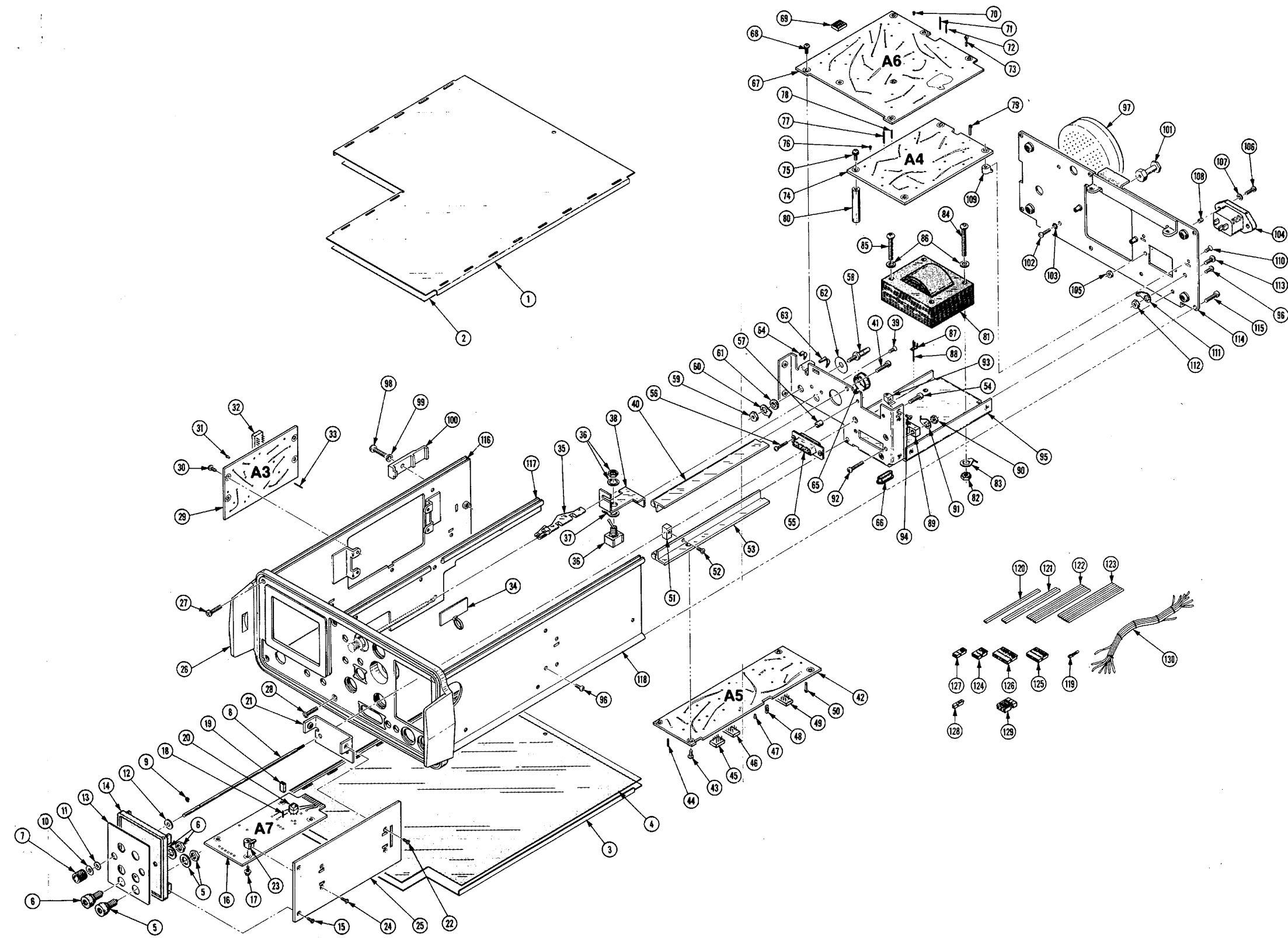


Figure 3. Front and Frame

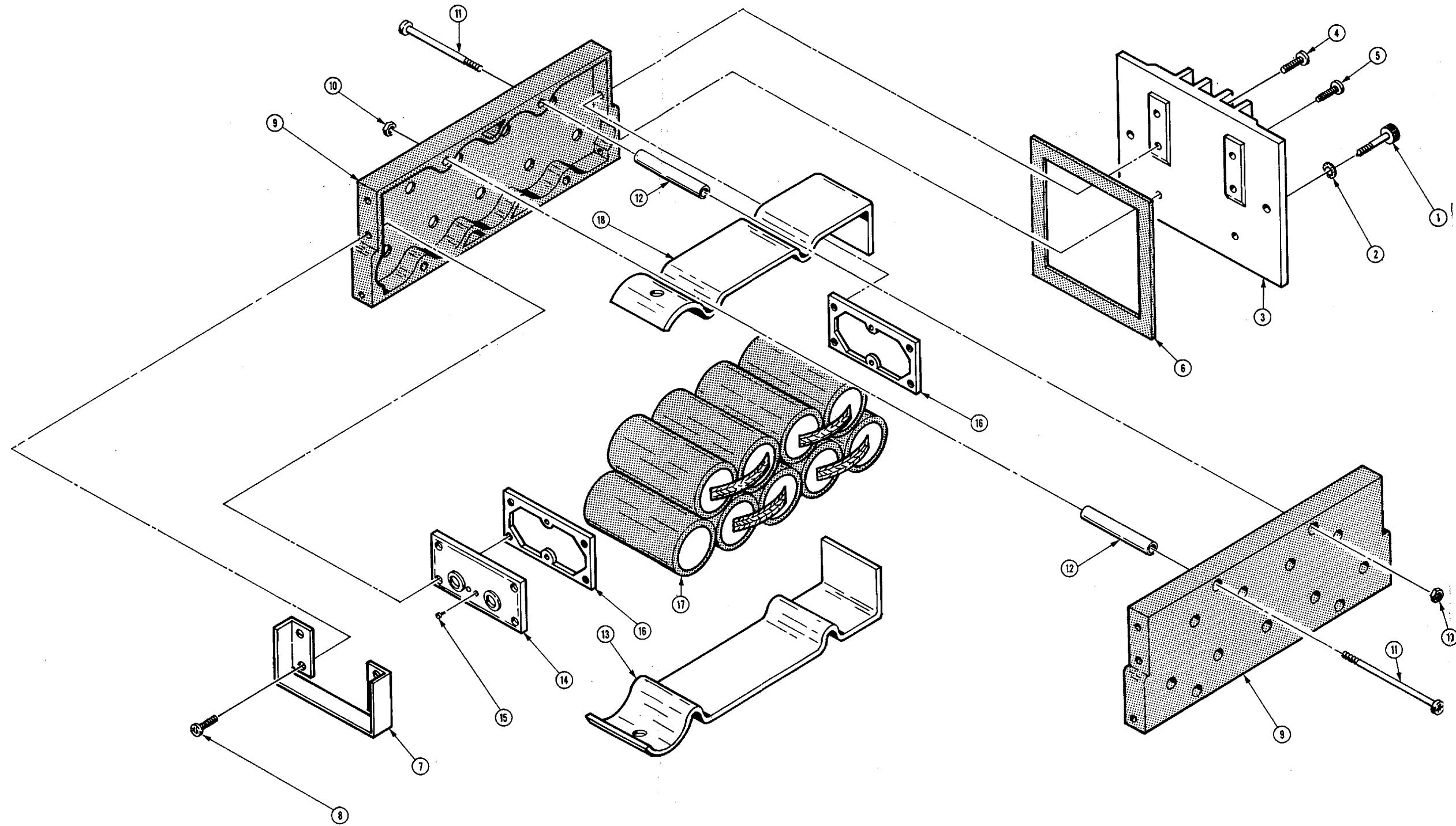


Figure4. Battery Pack



