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1502 TIME DOMAIN REFLECTOMETER

SERVICE MANUAL

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

070-1792-02
Product Group 22

First Printing SEP 1975
Revised AUG 1989

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OPERATOR 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 instrument itself.

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

SYMBOLS

In This Manual



This symbol indicates where applicable or 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 the 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 electric 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 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 the 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 Operator 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 VRMS 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.

GENERAL INFORMATION & SPECIFICATION

General Information

Product Description

The Tektronix 1502 Time Domain Reflectometer (TDR) is designed to precisely locate and analyze discontinuities in metallic cabling typically found in aircraft, ships, ground vehicles and installations. A discontinuity may be a fault, the end of the cable itself, or any irregularity that causes a change in the cable's conductivity.

The 1502 operates by transmitting an electronic pulse through the cable. When the pulse encounters a discontinuity, a portion of the pulse is reflected back to the instrument. The elapsed time between the transmitted pulse and reflected pulse measures the distance to the discontinuity, and the shape of the reflected pulse identifies the type of discontinuity.

This information is analogically displayed on the 1502's cathode-ray tube (CRT), and can be hard-copied to an optional chart recorder for later analysis. Detection of multiple discontinuities is possible with the 1502.

The 1502 has high resolution (to 0.6 inch) and a maximum useful range of 2000 feet (500 meters) on typical low-loss cables. Resolution, however, decreases as distance into the cable increases. It is a self-contained, ruggedized portable instrument that meets stringent MIL-T-28800 Type III, Class 3, Style A environmental requirements.

Battery Pack

The 1502 must be operated from a battery pack consisting of nine C-cells supplying a minimum of five hours operating time (see specification, *Table 1-1*).

Options

Options available for the 1502 are explained in the *Options* section of this manual.

Standards, Documents, and References Used

Terminology used in this manual is in accordance with industry practice. Abbreviations are in accordance with ANSI Y1.1-1972, with exceptions and additions explained in parentheses in the text. Graphic symbology is based on ANSI Y32.2-1975. Logic symbology is based on ANSI Y32.14-1973 and manufacturer's data books or sheets. A copy of ANSI standards may be obtained from the Institute of Electrical and Electronic Engineers, 345 47th Street, New York, NY 10017.

Change and History Information

Changes that involves manual corrections and/or additional data will be incorporated into the text and that page will show a revisions date (e.g. REV JAN 1986) on the inside bottom edge. History information is included in diagrams in grey.

Specification

The tables on the following pages list the characteristics and features that apply to this instrument.

The Performance Requirement column describes the limits of the Characteristic. Supplemental Information describes features and typical values or other helpful information.

The *Operating Instructions* contain a procedure that checks many of the functions of the 1502. This check is recommended for incoming inspections to verify that the instrument is performing properly. Procedures to verify the Performance Requirement are provided in the *Calibration* section of this manual.

Table 1-1

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information
Excitation step pulse		CABLE DIELECTRIC set to AIR
Reflected rise	⩽ 0.07 foot; ⩽ 140 ps (⩽ 2.1 cm)	10% to 90% risetime
(Option 2)	⩽ 0.16 foot; ⩽ 320 ps (⩽ 4.9 cm)	10% to 90 % risetime
Aberrations	± 5% peak during 1st 10 feet (300 cm) after rise	
	± 0.5% peak beyond 10 feet (300 cm)	NOISE FILTER OUT
(Option 2)	(*See Note Below*)	
Jitter	⩽ 0.1 foot; ⩽ 200 ps (⩽ 3 cm)	Multiplier set at X.1; CABLE DIELECTRIC set to AIR
	⩽ 0.02 foot; ⩽ 40 ps (⩽ 0.6 cm)	Multiplier set at X1; CABLE DIELECTRIC set to AIR
Deflection factor	5 mρ/div to 500 mρ/div	7 steps, 1-2-5 sequence
Accuracy	Within ± 3%	
Gain	At least 3.5:1 from calibrated point	Screwdriver control
Display noise	± 5 mρ or less peak	NOISE FILTER OUT
Low noise operation	± 2 mρ or less peak	NOISE FILTER IN

Note: Option 2 will introduce a capacitive aberration of nearly 300 mρ amplitude, located approximately 0.25 foot (7.6 cm) from the leading edge of the pulse, with a displayed width approximately equal to the system risetime. In addition, reflections from an open are clipped approximately 50 mρ.

Table 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
Distance controls		0 to 2000 feet total
DISTANCE dial		
At X.1 multiplier:		
Range	0 to 100 feet (0 to 25 meters)	
Accuracy	Within ± 2%, plus ± 0.05 foot (Within ± 2%, plus ± 0.5 meter)	From 2nd to 9th graticule lines (center eight divisions)
At X1 multiplier:		
Range	0 to 1000 feet (0 to 250 meters)	
Accuracy	Within ± 2%, plus ± 0.5 foot (Within ± 2%, plus ± 0.5 meter)	From 2nd to 9th graticule lines (center eight divisions)
FEET/DIV control		
At X.1 multiplier:		
Range	To 20 feet/div (To 5 meters/div)	
Scales	0.1 foot/div to 20 feet/div (0.025 meter/div to 5 meters/div)	8 steps,1-2-5 sequence 8 steps, 1-2.5-5 sequence
At X1 multiplier:		
Range	To 200 feet/div (To 50 meters/div)	DISTANCE dial disabled in 200 (FIND) position
Scales	1 foot/div to 200 feet/div (0.25 meter/div to 50 meters/div)	8 steps, 1-2-5 sequence 8 steps, 1-2.5-5 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 calibrated for AIR when fully clockwise
Accuracy	Within ± 2%	
External interface for X-Y recorders		
Horizontal	0.1 V/div	Source impedance 10 kΩ
Vertical	0.09 to 0.13 V/div (adjustable)	Source impedance 10 kΩ
Pen lift		
Mode 1 (source)	$V_s = 5$ V nominal with $R_s = 10$ kΩ	
Mode 2 (source)	$V_s = 5$ V nominal with $R_s = 10$ kΩ	(Inverted mode 1)

Table 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
Y-T Chart Recorder		
Horizontal	0.4 V/div	Source impedance 200 Ω (switched)
Vertical	0.2 V/div	Source impedance 200 Ω (switched) (Tektronix Y-T Chart Recorder available on Option 4 instruments only)
Line voltage	117 VAC ± 20%, 48 to 410 Hz 234 VAC ± 20%, 48 to 410 Hz	0.5 A fuse 0.3 A fuse
Battery pack		C size, 9 cell, rechargeable
Operation	5 hours (minimum)	+20 °C to +25 °C
Full charge time		16 hours
Typical battery capacities Charging temperature:		Using temperature:
0 °C		Capacity: 40% @ -15 °C; 60% @ +20 °C to +25 °C; 50% @ +55 °C
+20 °C to +25 °C		Capacity: 65% @ -15 °C; 100% @ +20 °C to +25 °C; 85% @ +55 °C
+40 °C		Capacity: 40% @ -15 °C; 65% @ +20 °C to +25 °C; 55% @ +55 °C
Temperature		
Operating	-15 °C to +55 °C	At temperatures other than 20 °C to 25 °C, battery efficiency is reduced.
Non-operating	-62 °C to +85 °C	With batteries removed. If stored with batteries, storage range is -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 min.

Table 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
Mechanical shock		
Pulse shock	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.	Case off
Transit drop	12-inch drop	
Water resistance		
Operating	Splash-proof and drip-proof with cover off and instrument operating.	
Non-operating	Watertight with three feet of water above top of case for 1 hour.	Front cover on
Salt atmosphere		
Structural parts	Withstands 48 hours exposed to 20% solution without corroding.	
Explosive atmosphere	Operation does not cause ignition of an ambient explosive gaseous/air mixture.	
Sand and dust	Operates after front cover removed and exposed to MIL-STD-810, Method 510, Proc. 1 dust test.	
Washability	Can be 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	

Table 1-2

PHYSICAL CHARACTERISTICS

Characteristic	Description
Weight	
With front cover and accessories	18.0 pounds (8.2 kg)
Without front cover and accessories	16.0 pounds (7.3 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)
Depth	
Including front cover	16.5 inches (41.9 cm)
Handle extended	18.7 inches (47.4 cm)

OPERATING INSTRUCTIONS

This section of the manual contains basic information on how to operate the 1502 TDR.

Handling Information

The 1502's front panel is protected by a watertight cover in which standard accessories are stored. Secure the front cover by placing it in the grooved slot that surrounds the front panel, then snap the side latches backward. If the instrument was inadvertently left on, installing the front cover will turn off the POWER switch automatically.

The carrying handle rotates 325° and serves as a stand when positioned beneath the instrument.

Inside the case at the back of the instrument is a moisture absorbing canister containing silica gel. In extremely wet environments it may be necessary to periodically remove and dry the canister. This procedure is explained in the *Maintenance* section of this manual.

The 1502 can be stored in temperatures ranging from -62°C to +85°C. However, if the temperature is below -40°C or exceeds +55°C, the battery pack should be removed and stored where the temperature is between the -40°C to +55°C range.

Battery Pack

Powering the 1502

The 1502 is powered by a rechargeable nickel-cadmium battery pack that is easily accessible at the back of the instrument without removing the case. When AC power is applied, the battery pack is charged at a continuous rate of approximately 150 mA.

CAUTION

Never plug the power cord into a power source without the battery pack connected to the 1502 because damage to the instrument will result. Do not use the 1502 with a power inverter because damage to circuitry may result.

The battery pack will operate the 1502 for a minimum of five continuous hours (including 20 chart recordings).

The five-hour operating time will decrease by about three minutes for each chart recording made beyond the specified 20.

Charging, Care Information

The battery pack will charge fully in 16 hours when connected, via the power cord, to an AC power source with the instrument turned off. The instrument may be turned on and operated while the batteries are charging, but this will increase the charging time accordingly.

CAUTION

The batteries will overcharge if left connected to the power source beyond the maximum charging time of 16 hours.

For longest battery life, a full charge is preferred over a partial charge. A one-hour partial charge will provide about 30 minutes of operating time.

For maximum capacity, the batteries should be charged within a temperature range of +20°C to +25°C. However, the batteries can be charged within a temperature range of 0°C to +40°C, and operated in temperatures ranging from -15°C to +55°C.

The battery pack should be stored within a temperature range of -40°C to +55°C. However, the self-discharge rate will increase as temperature increases.

If the instrument is stored, the battery pack should be charged every thirty days, or the battery pack removed. A fully charged battery pack will lose about 50% of its capacity in three to four months if stored between +20°C and +25°C.

The batteries can be damaged by reverse charging. This can occur when an individual cell becomes discharged before the others, and current from the other cells flow in a reverse direction through the discharged cell. Reverse charging may develop because of individual cell aging, partial charging of the pack or if a single cell has been replaced rather than the entire pack.

Protection circuits in the charger prevent deep discharge of the batteries during instrument operation. The circuits automatically shut down the instrument whenever battery voltage falls below approximately 10 V. If shutdown occurs, the batteries must be fully recharged before further use. *NOTE: turn the POWER switch off after instrument shutdown, to prevent continual discharge of the batteries.*

A 12 VDC power supply may be substituted for the battery pack by removing the pack from the instrument and connecting the power supply to the terminals inside the battery pack compartment.

CAUTION

When using a DC power supply, do not connect AC power to the instrument because damage to the charging circuit may result. When substituting a DC power supply or external battery for the battery pack, make sure the connector polarity is attached correctly (see Figure 2-1).

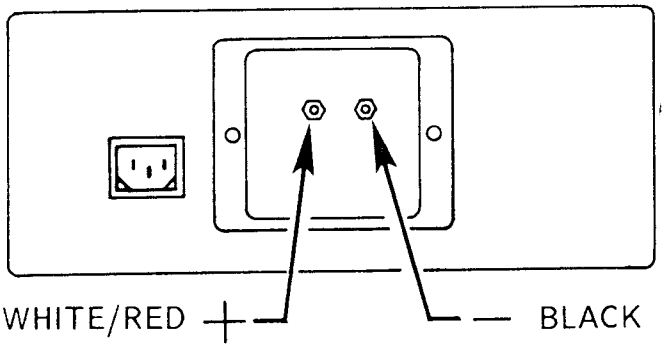


Fig. 2-1. Battery Connector Polarity

230-Volt Operation: The battery charger is factory wired for 115 VAC (or 230 VAC if power cord options A1, A2, A3, A4 or A5 are ordered). The standard 115 VAC charger can be changed to 230 VAC operation by rewiring the line transformer. Refer to *Maintenance* section for transformer rewiring procedure.

CAUTION

When rewiring for 230 VAC operation, make sure the two fuses located on the front panel are changed to 0.3 A, and the proper type of plug is installed on the power cord. Refer to Options *section for power cord options.*

FRONT-PANEL CONTROLS

(See Figure 2-2)

(1) **CABLE:** BNC connector for attaching test cable to instrument.

(2) **FOCUS:** Controls sharpness of display.

(3) **INTENSITY:** Controls brightness of display.

(4) **POSITION/FINE:** Controls vertical positioning of display. Outer control is coarse adjustment; inner control is fine adjustment.

(5) **mρ/DIV:** Sets amplitude of test and reflected pulses. Scale is calibrated in rho (ρ) which is used to calculate impedance of discontinuity (see Figure 2-5).

(6) **POWER:** Main power switch (pull on, push off). Does not affect battery charging circuits when power cord is plugged in.

(7) **GAIN:** Screwdriver adjustment for presetting reference amplitude of test pulse.

(8) **NOISE FILTER:** Use to increase clarity (reduce amount of noise) in display. Reduces sweep rate by a factor of 10.

(9) **BATTERY:** Indicates relative charge of battery pack.

(10) **ZERO REF (CHECK):** Use to verify horizontal reference position of leading edge of test pulse on CRT when DISTANCE dial is in use.

(11) **ZERO REF (SET):** Sets horizontal reference position of leading edge of test pulse on CRT (DISTANCE dial must be set at 000). Standard reference position is on the "vertical reference line" (vertical graticule line with arrow).

(12) **X.1-X1 Multiplier:** Two-position control that multiplies settings of both DISTANCE dial and FEET/DIV control by .1 and 1 respectively. Example: FEET/DIV set at 20 and multiplier set at X1 = 20 feet per each horizontal division on CRT. *Note: use the X1 multiplier whenever possible to lessen the effect of jitter.*

(13) **DISTANCE:** Allows more accurate measurement, especially if cable is over 1000 feet long. When DISTANCE dial is turned, display on CRT moves down cable. Disabled when FEET/DIV control is set at 200 (FIND).

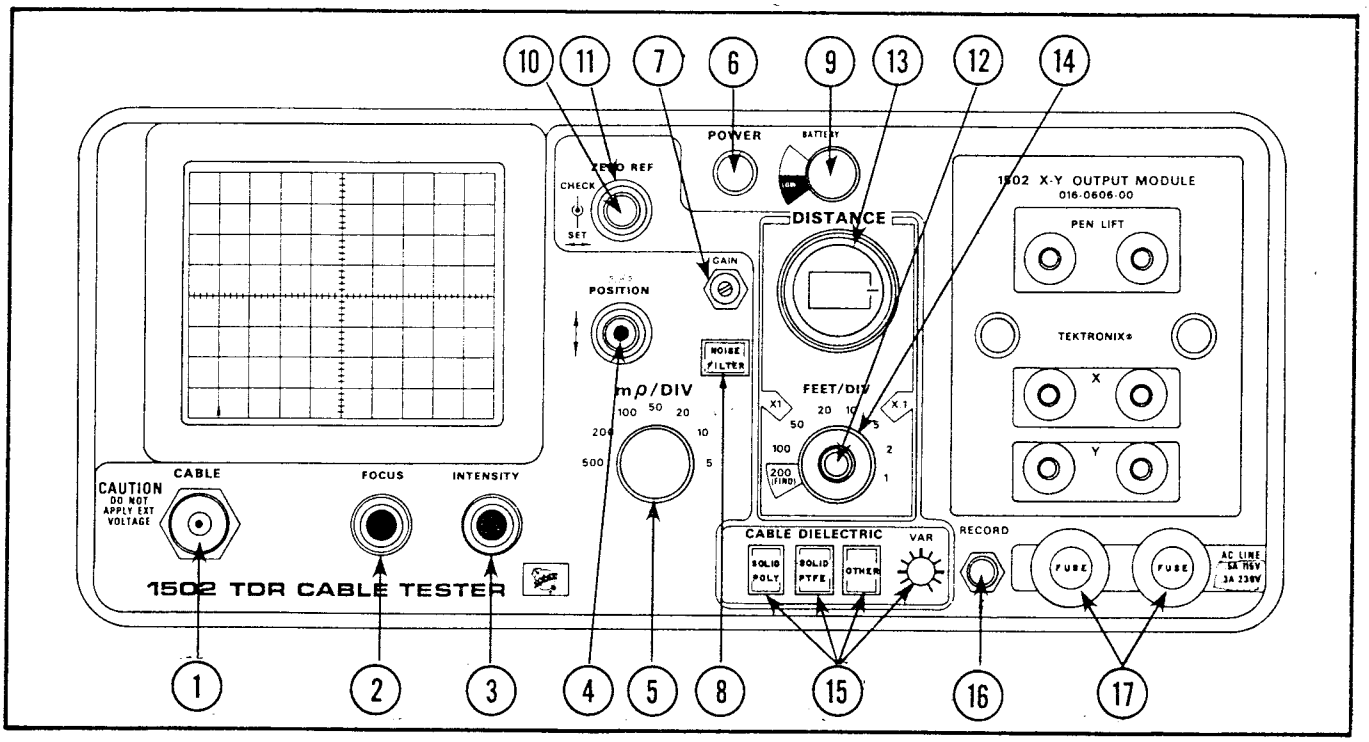


Fig. 2-2 Front Panel Controls

(14) FEET/DIV: Selects number of feet per horizontal division on display. Example: FEET/DIV control set on 20 and multipler set at X1 = 20 feet per each horizontal division on CRT. For greatest accuracy, FEET/DIV times multiplier times 10 (number of horizontal divisions on CRT) should total as near as possible to (but not less than) length of test cable.

(15) CABLE DIELECTRIC: The CABLE DIELECTRIC switches allow the 1502 to locate discontinuities in cables having various relative propagation velocity constants (V_p). Press SOLID POLY when working with solid polyethylene dielectric (V_p=0.66), or SOLID PTFE when working with solid polytetrafluoroethylene (Teflon®) dielectric (V_p=0.70).

When type of dielectric is unknown, the propagation velocity must be determined using the OTHER switch and the VAR control, which has a variable V_p of from 0.55 to 1.00.

Refer to Step 2 under *Locating a Discontinuity* in this section of the manual for procedure on how to use the VAR control. *Note: VAR is calibrated for air dielectric* (V_p=1.00) when in full clockwise position. Also, when all three CABLE DIELECTRIC switches are released, the instrument is calibrated for air dielectric by default.

(16) RECORD: Two-position toggle switch used to operate an external X-Y recorder or Tektronix Y-T Chart Recorder. Press switch either up or down and hold it momentarily to preheat stylus, then release to start recorder. Recorder turns off automatically a few seconds after record sweep has finished.

(17) FUSE: Protection fuses for AC line and battery charger circuits. Use 0.5 A fuses for 115 VAC; 0.3 A fuses for 230 VAC.

Plug-In Modules

X-Y Output Module

The Output Module is the standard interface for an external X-Y chart recorder. The X, Y and PEN LIFT jacks are used to supply horizontal, vertical and pen lift signals to the external recorder.

The Output Module is factory set for negative pen lift, but may be reset for positive pen lift. If positive pen lift is desired, reposition the jumper on the Output Module Board (see Figure 2-11 in this section).

Y-T Chart Recorder

An optional Tektronix Y-T Chart Recorder replaces the Output Module on Option 4 instruments. The STYLUS POSITION control on the recorder is used to adjust position of the stylus to the same level as the CRT display when the RECORD switch is activated.

Operating Procedure

Instrument Pre-Check

Use the following procedure to verify instrument operation prior to cable testing.

1. Set front-panel controls as follows:

POWER	Pull on
FOCUS	Midrange
INTENSITY	Midrange
ZERO REF(SET)	Full clockwise
POSITION/FINE	Midrange
mρ/DIV	500
DISTANCE	000
NOISE FILTER	Out
FEET/DIV	1
Multiplier	X1
CABLE DIELECTRIC	SOLID POLY

2. Adjust INTENSITY and FOCUS controls for a clear, bright display.

3. Adjust POSITION/FINE controls to position baseline of display two divisions below horizontal centerline of CRT.

4. Attach precision 50 Ω cable (012-0482-00) to CABLE connector. Leave loose end of cable open.

5. Adjust ZERO REF (SET) control counterclockwise until LEADING edge of test pulse is positioned on vertical reference line (vertical graticule line with arrow).

   The leading edge of the reflected pulse should be positioned on the horizontal centerline, three horizontal divisions to the right of the leading edge of the test pulse (see Figure 2-3).

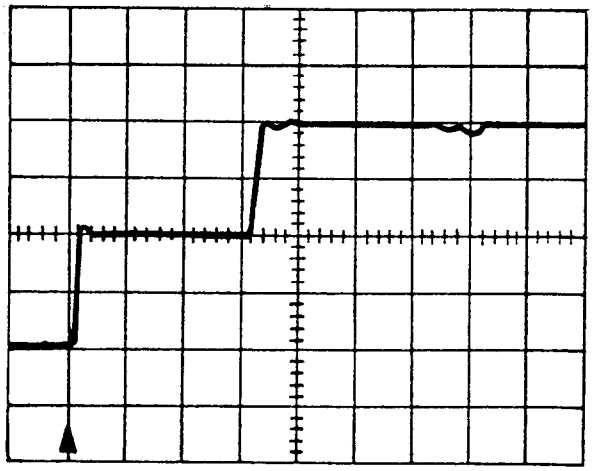


Fig. 2-3. Test Pulse

6. Adjust ZERO REF (SET) control back and forth slightly to make sure that leading edge of test pulse can be positioned on all vertical graticule lines. Then reposition leading edge of test pulse back on vertical reference line.

7. Set DISTANCE dial to 050 and press ZERO REF (CHECK) switch. Leading edge of test pulse should return to vertical reference line. Reset DISTANCE dial to 000.

8. Set mρ/DIV control to 50, and adjust POSITION controls so that step between test pulse and reflected pulse is positioned on horizontal centerline (display will be "noisy").

9. Press NOISE FILTER switch and check for a reduction in displayed noise (cleaner display) and slower rate of sweep. Then reset mρ/DIV control to 500 and release NOISE FILTER switch.

10. Press and release RECORD switch. A bright spot should appear at left edge of CRT, and slowly trace the waveform. When the record sweep is complete, the instrument will return to its normal scanning rate.

    The Instrument is now set up and verified for operation. If applicable, attach an external X-Y chart recorder to the X-Y Output Module.

Locating a Discontinuity

The basic cable-testing procedure assumes that the instrument has been set up and verified for operation per the pre-check procedure.

CAUTION

Do not connect live circuits to the CABLE connector of the 1502. Voltages exceeding 5 V can damage the sampling gate or tunnel diode. If both sampling gate and tunnel diode are destroyed simultaneously, the instrument will be considered misused and repairs will be charged to the customer regardless of warranty.

Bleed the test cable of any residual static discharge before attaching it to the instrument. To bleed the cable, connect the standard 50 Ω terminator and standard female-to-female BNC connector together, and temporarily attach both to the cable. Remove these connectors before attaching the cable to the instrument.

When testing receiving antenna cables, avoid close proximity to transmitters. Voltages may appear on the cable if the transmitter is in use, damaging the 1502's sampling circuits. Assure there are no RF voltages present, or disconnect the cable at both ends prior to testing.

1. Connect standard 50 Ω cable to test cable, and CABLE connector on instrument. The tables in the *Accessories* section lists all the optional connectors and adapters used for attaching the 1502 to a test cable.

2. Select dielectric (propagation velocity) of test cable using the CABLE DIELECTRIC switches. Press SOLID POLY for solid polyethylene dielectric or SOLID PTFE for solid Teflon® dielectric. Leave all three switches in "out" position for air dielectric.

   If type of dielectric is unknown, determine propagation velocity of cable by setting the VAR control as follows:

   a. Press OTHER switch.

   b. Set FEET/DIV and multiplier controls so that both test pulse and reflected pulse show on CRT.

   c. Adjust VAR control until number of horizontal divisions between leading edge of test pulse and leading edge of reflected pulse amounts to actual length of test cable when figured in with FEET/DIV and multiplier settings.

   d. Turn FEET/DIV control to a lower setting so that reflected pulse no longer appears on CRT.

   e. Adjust ZERO REF (SET) and POSITION controls so that leading edge of test pulse is positioned at center of CRT (where horizontal and vertical centerlines cross).

   f. Divide entire length of test cable by 10 and turn DISTANCE dial to the resulting figure. Example: Cable 50 feet long divided by 10 = DISTANCE dial setting of 005.

   g. Adjust VAR control to position leading edge of reflected pulse at center of CRT.

   h. Press and hold ZERO REF (CHECK) switch, and adjust the ZERO REF (SET) control to fine-tune leading edge of test pulse at center of CRT (POSITION control may also require slight fine-tuning).

   i. Repeat Steps g and h until leading edges of both test and reflected pulses align as close as possible at center of CRT. The VAR control is now set for the "unknown" propagation velocity.

   j. Reset DISTANCE dial to 000.

   Note: Changes in cable dielectric affect the cable's propagation velocity. Therefore, it is important to always reset the cable dielectric constant according to the type of cable being tested.

3. Set FEET/DIV control and multiplier to a setting that is longer than the length of the test cable when multipled times 10. Both test and reflected pulses should be displayed on CRT.

   Example: if length of cable is 50 feet, set FEET/DIV control to 10 and multiplier to X1 for a total of 10 feet per division (times 10 divisions = 100 feet).

4. Adjust ZERO REF (SET) control so that leading edge of test pulse is positioned on vertical reference line. If reflected pulse disappears off screen, use a higher FEET/DIV setting.

5. To determine approximate (± 2%) distance from instrument to discontinuity, count the number of CRT divisions (including fractions thereof) between leading edge of test pulse and leading edge of reflected pulse. Multiply number of divisions times FEET/DIV and multiplier settings.

   Example: 4.5 divisions on CRT times 10 FEET/DIV times X1 = approximately 45 feet from instrument to discontinuity.

NOTES

When taking measurements off the CRT display, better accuracy is obtained by basing your measurements from the same point on the leading edges of the incident and reflected pulses as shown in Figure 2-4.

Measurement includes length of standard 50 Ω cable (36 inches) plus optional connectors or adapters. Deduct the combined length of these items from your measurement for more accuracy. This is especially important when measuring short cables.

When measuring cables less than two feet long, the distance from the sampling bridge inside the instrument to the CABLE connector (2.5 inches or 6.35 cm) must also be deducted from the measurement to achieve more accuracy.

A distance measurement is the electrical length from instrument to discontinuity. To relate electrical length to actual physical length, such variables as cable loops and "snaking," different propagation velocities, etc., must be taken into consideration.

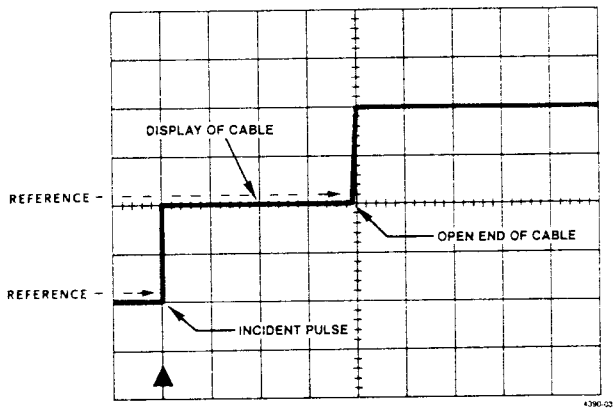


Fig. 2-4. CRT Display of Pulse

Use the following procedure for more accurate measurement of cables under 1000 feet long:

a. Set FEET/DIV control to a lower setting and multiplier to X1. Make sure that FEET/DIV setting, times multiplier, times 10 exceeds length of test cable. The reflected pulse need not appear on CRT.

b. Adjust ZERO REF (SET) control so that leading edge of test pulse is positioned on vertical reference line.

c. Turn DISTANCE dial clockwise until start of reflected pulse is positioned on vertical reference line. The reading off the DISTANCE dial is more accurate.

Use the following procedure for more accurate measurement of cables over 1000 feet long:

a. Set FEET/DIV control to 100 and multiplier to X1.

b. Adjust ZERO REF (SET) control so that leading edge of test pulse is positioned on vertical graticule line at far left.

c. Rotate DISTANCE dial clockwise past 998 to 000 (1000). Count the number of horizontal CRT divisions (including fractions thereof) from far left graticule line to start of reflected pulse, and multiply that figure times 100. Add the result to 1000.

NOTE: if a very precise measurement is necessary, test the cable from both ends and use the slide-rule calculator provided with the instrument. Instructions for its use are near the end of this section.

6. If a chart recorder is attached to instrument, and you want to record the display, press and hold the RECORD switch up or down momentarily to pre-heat stylus, then release switch to start recorder. Recorder will turn off automatically a few seconds after display sweep has finished.

Evaluating a Discontinuity

The reflected pulse always indicates a discontinuity in the cable. Basically, any discontinuity that causes an increase in cable impedance (an open circuit) will result in a positive (upward) signal. Any discontinuity that causes a decrease in impedance (a short) will result in a negative (downward) signal.

Multiple discontinuities can be observed simultaneously provided that sufficient energy remains to be reflected. Obviously, no discontinuity can be detected past a short, break or other major problem in the cable.

The mρ/DIV control sets the amplitude of the test and reflected pulses, and is calibrated to measure the ratio of reflected pulse to test pulse in rho (ρ). Rho is defined as the "voltage reflection coefficient". Since rho is dependent on the characteristic impedance of the cable under test, rho can be used to determine the impedance of a discontinuity.

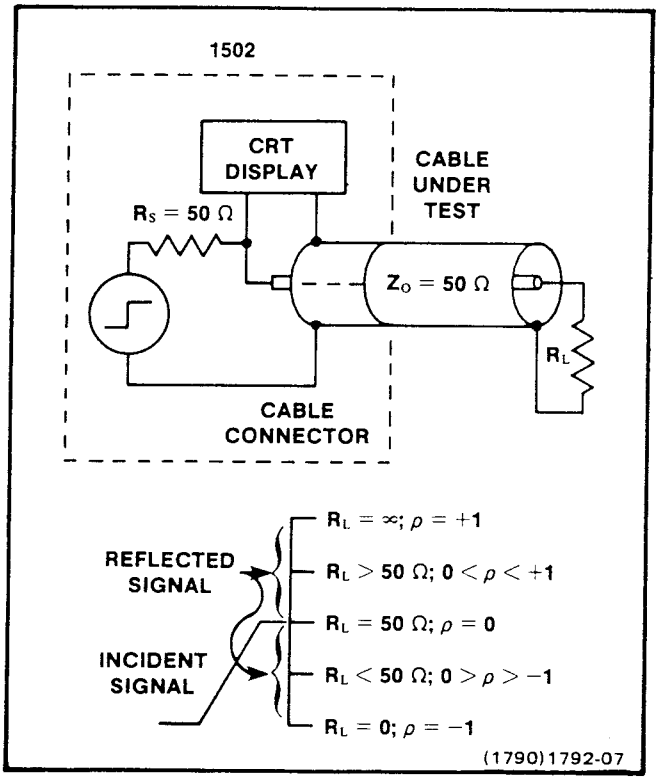


Fig. 2-5. Mathematical Derivation of TDR Display

Figure 2-5 shows a display identifying test and reflected voltage signals. When ρ=0, the test cable is terminated by a resistance equal to its characteristic impedance (Z_0) which, in this case, is 50 Ω. When ρ=+1, the cable has an open circuit. When ρ=-1, the cable has a short. If the cable's impedance is greater than 50 Ω, ρ is positive; If the cable's impedance is less than 50 Ω, ρ is negative. Use the chart in Figure 2-6 to convert rho to impedance, or use the slide rule supplied with the instrument.

Testing Cables with Impedance Other than 50 Ω

Cables with impedance other than 50 Ω can be tested by adjusting the GAIN control to correct the reflected pulse for +1ρ at the open end of the cable. When GAIN is changed, the test pulse will no longer be 1ρ.

To adjust GAIN for other than 50 Ω, either:

1. connect an impedance-matching adapter (50/75 Ω, 50/93 Ω, 50/125 Ω, etc.) to the CABLE connector, and then connect to the adapter a short length of cable with impedance the same as that of the adapter, or
2. connect the cable to be tested to the cable connector.

With the mρ/DIV control set at 500, use the ZERO REF (SET) control to position the display on the CRT. Then, adjust the GAIN control so that the reflected pulse is two divisions above the horizontal centerline of the CRT and proceed as normal. This sets the reflected pulse to +1ρ from the characteristic impedance.

Note: if an impedance adapter is not used, secondary reflections will reappear as discontinuities beyond the open end of the cable.

Measurement Examples

Different discontinuities are easily recognized with a bit of training and experience. A few of the cable problems that can be analyzed include opens, shorts, pinholes in the shield, opens in the shield, water, kinks, mismatched and corroded connectors. The following illustrations show typical cable problems.

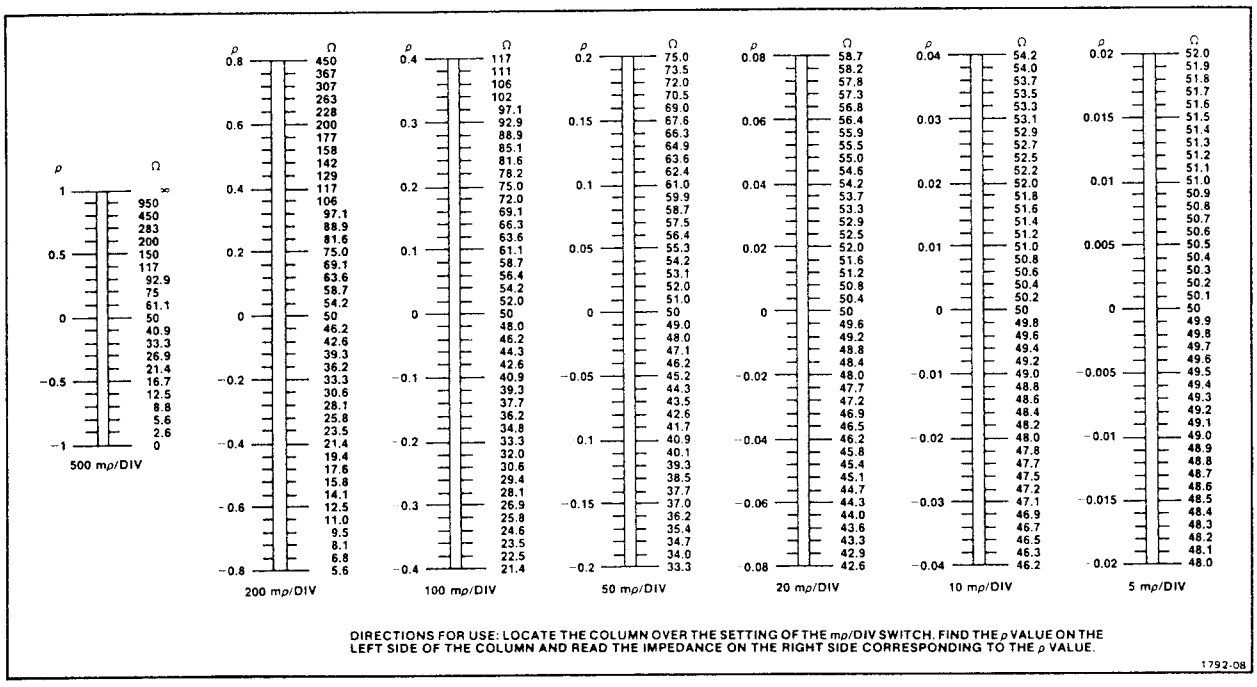


Fig. 2-6. Impedance Nomograph

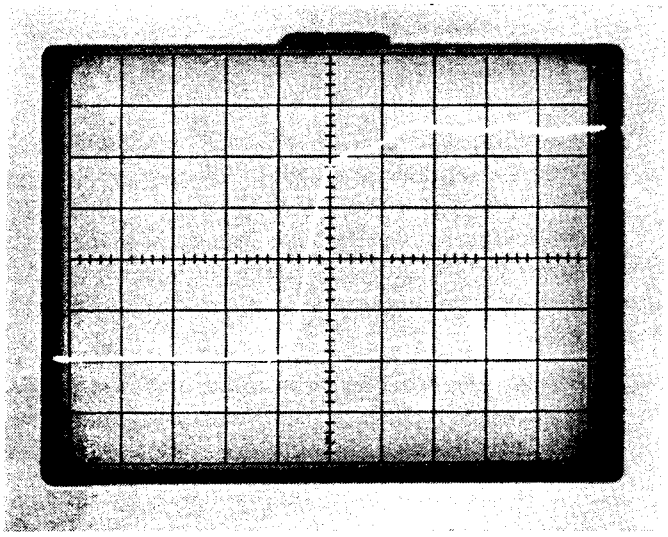


Fig. 2-7. Open Cable

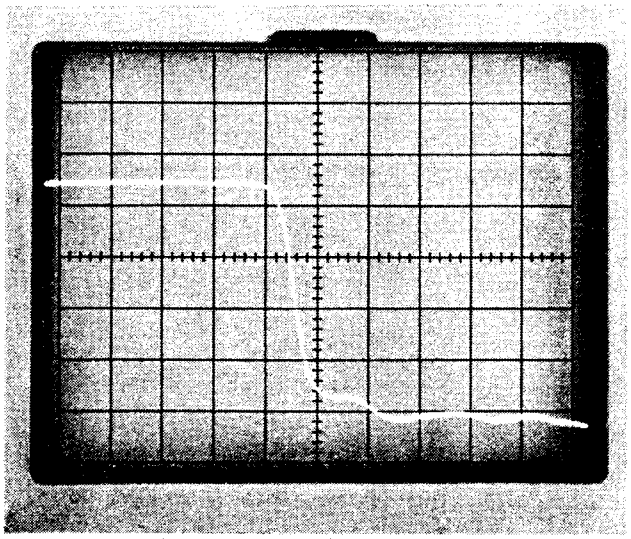


Fig. 2-8. Shorted Cable

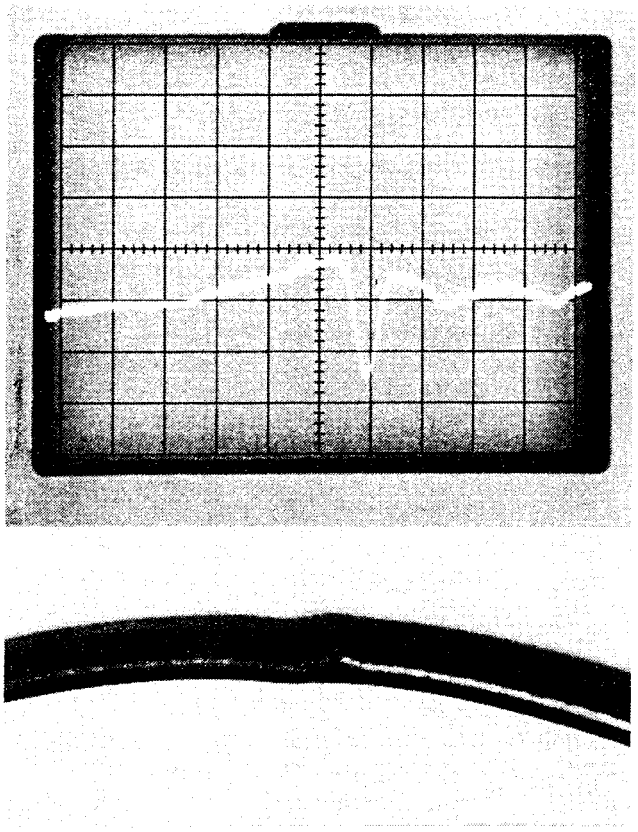


Fig. 2-9. Crimped Cable

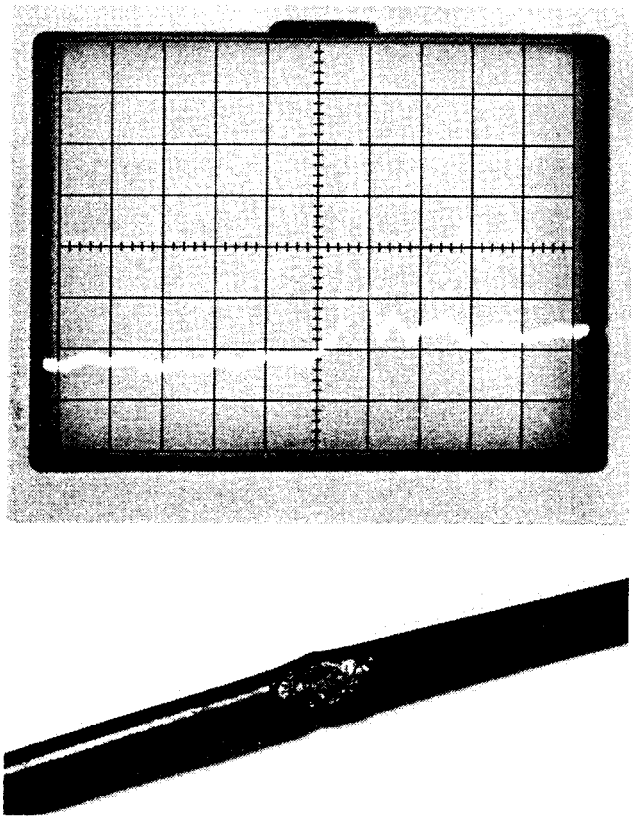


Fig. 2-10. Frayed Cable

ACCESSORIES

Mesh Filter

A Mesh Filter for the CRT is provided which makes viewing easier when instrument is being operated in direct sunlight. Place filter over CRT by sliding it into slots on CRT bezel.

Viewing Hood

Another accessory provided for shading excessive light is the Viewing Hood. Place hood over CRT by sliding it into slots on CRT bezel (Mesh Filter must be removed before hood can be installed).

Using a Camera

When the optional Camera Adapter is attached to the CRT, a Tektronix C-30B or C-31B camera to photograph the display.

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 printed circuit board is properly connected. Figure 2-11 shows the proper connection for either a positive or negative pen lift signal.

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 supplied with the X-Y recorder for further information on its use.

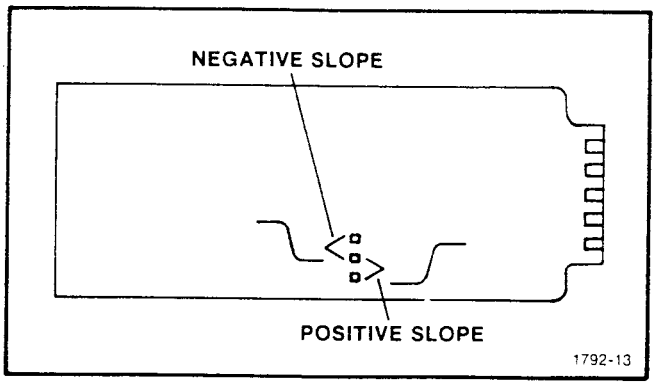


Fig. 2-11. X-Y Output Module Strap

Calculator Slide Rule

The calculator slide rule included with the 1502 expands the useful data obtained from the TDR display.

Effective Impedance: The center portion of the calculator is used to determine the effective impedance of a cable. It is similar in content to the nomograph in Figure 2-6. The scales on the stationary portion of the rule correspond to the instrument setting and the graticule lines on the CRT. If the reflective pulse is calibrated to measure loss (baseline centered), the effective impedance can be determined. For example the instrument setting is 100 mρ/DIV, the loss is measured at .1 rho (1 division). Use the .10 rho column on outer portion of the rule. The sliding portion of the rule is the load impedance. Set the slider so the 50 Ω mark is at 0 (mid-point on the scale). Then, reading the loss in rho from the CRT, match the number of divisions of loss on the CRT with the effective impedance of the cable. e.g. Loss of .1 rho yields an effective impedance of 60 Ω.

For another example, the instrument is set on 20 mρ/DIV, the baseline of the reflective pulse on the CRT is centered on the middle graticule line, and the loss is measured at -.04 rho (2 divisions on CRT). Make sure 50 Ω is set at mid-point (0). On the .02 ρ scale, find .04 rho. The loss will yield an effective impedance of approximately 46.2 Ω.

Note: A positive loss (capacitive) will show on the CRT display as an "open". A negative loss (inductive) will show on the display as a "short". Therefore, use the proper portion of the scale respective to the type of loss.

Velocity Factor/Round Trip Time: The bottom portion of the slide rule can be used to determine additional unknowns. For example, let's determine the Round Trip Time of a pulse. The cable is solid poly with a velocity factor (V_p) of .66. A discontinuity is found at 36 inches. By setting the one-way distance to 36 and looking at the V_p, the Round Trip Time is approximately 9.4 ns.

If a cable is 456 meters long, the dielectric is Teflon® (i.e. solid PTFE), again the Round Trip Time can be determined. Set the distance on the rule to 456 meters. Since the V_p of Teflon® is .70, the Round Trip Time is 7.5 ns.

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 in use, the accessories (including the Operator Manual) should be packed in the instrument cover and the cover latched on the front of the instrument.

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

CIRCUIT DESCRIPTION

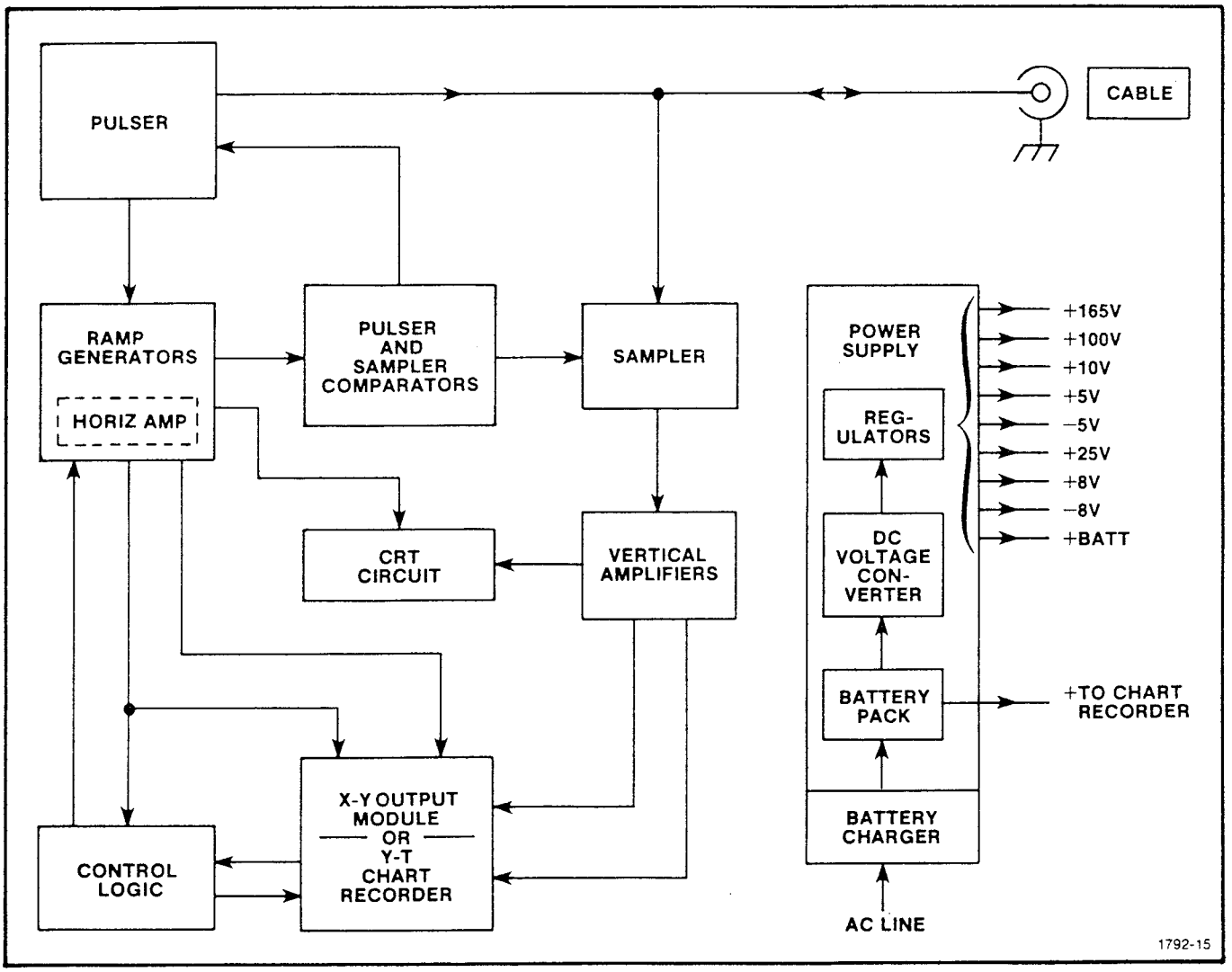


Fig. 3-1. Simplified Block Diagram - 1502

Introduction

This section of the manual describes circuitry in the 1502 (Figure 3-1 is a simplied block diagram of the primary circuitry). When using this section, please refer to detailed circuit schematics and component lists in the *Diagrams and Circuit Board Illustrations* section.

The 1502 uses electronic pulses to check a cable's condition. Test pulses to the test cable are generated by pulser circuits. Sampler circuits then "sample" the reflected pulses and compare them to the test pulses to create the vertical trace on the CRT.

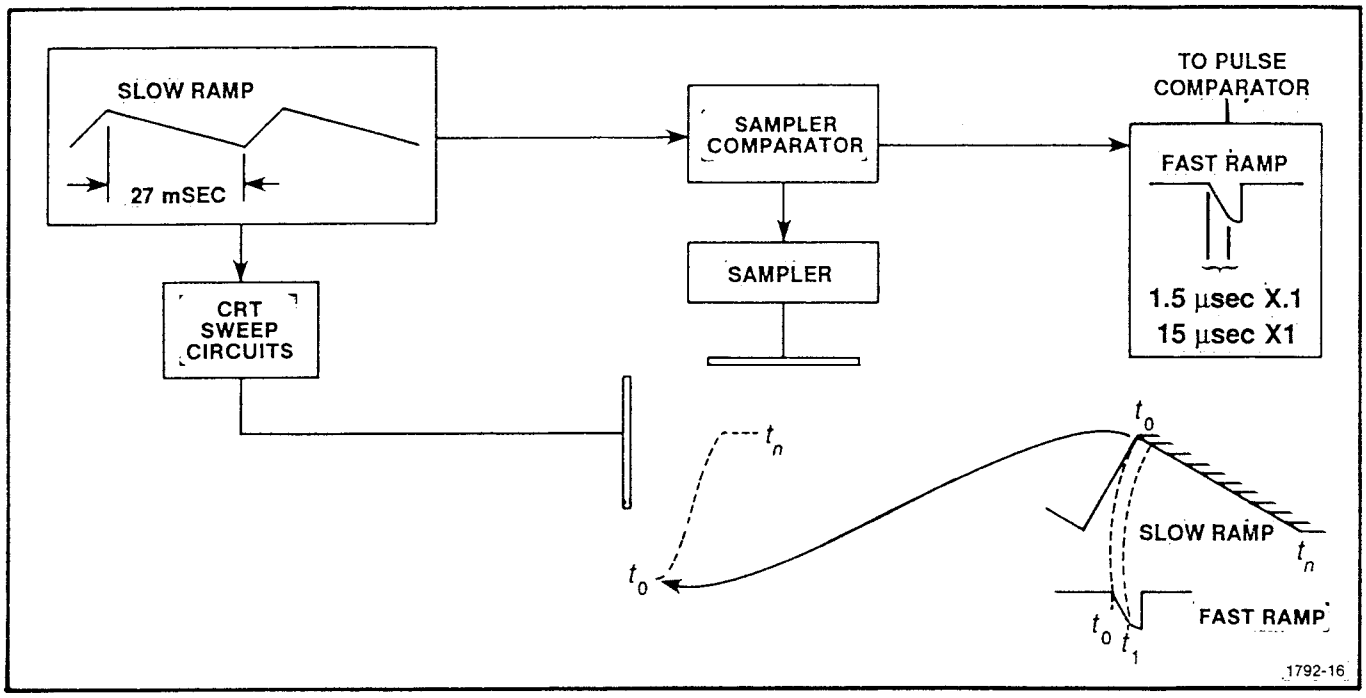


Fig. 3-2. Sampling Diagram

Trigger pulses in the pulser and sampler comparators circuits are provided by a fast-ramp signal and a slow-ramp signal. After the pulser transmits a test pulse into the cable, a trigger in the sampler comparator "holds" the voltage level that has been reflected back at that moment. This voltage sample is amplified and sent to the CRT vertical amplifier.

Voltage samples taken during the trigger pulse sequence are combined with the horizontal sweep created by the slow-ramp signal to create the CRT display (see Figure 3-2).

The sampling signals are also sent to the X-Y Output Module where, together with a pen-lift control signal, they provide the information necessary to drive an external chart recorder.

If a Tektronix Y-T Chart Recorder is used, the amplified vertical signals are applied to the writing stylus drive circuits. Speed of the chart paper is controlled by a logic circuit which matches the speed of the slow-ramp signal so that the display on the chart recording matches the display on the CRT. Then, when the horizontal scan on the CRT is complete, the input signal is automatically disconnected and the slow-ramp signal is released to scan at its own rate. This causes the chart paper to continue to run until all recorded data exits from the recorder.

CIRCUIT DETAIL

Pulser/Sampler Circuits (Schematic 1)

Pulser

The pulser consists of three circuits: clock generator, logic programmer and pulse generator. These circuits provide the signal for the fast-ramp generator, plus timing for tunnel diode CR1703 which transmits the test pulse through the cable.

A complete pulse cycle consists of six equal time slots (clock pulses) derived from the clock generator (see Figures 3-3a and 3-8). These clock pulses are used by the logic programmer to control bias timing on the tunnel diode, and duration of the fast-ramp signal.

The pulse generator employs a two-step process to generate the test pulse. The first step checks peak current in the tunnel diode and stores the diode's firing voltage in capacitor C1596. The second step uses the voltage in C1596, plus the TD TRIGGER pulse from the pulse comparator, to fire the tunnel diode. A current check is performed at each pulse cycle to correct for diode aging, thermal effects and loading variations. The pulse cycle is described as follows:

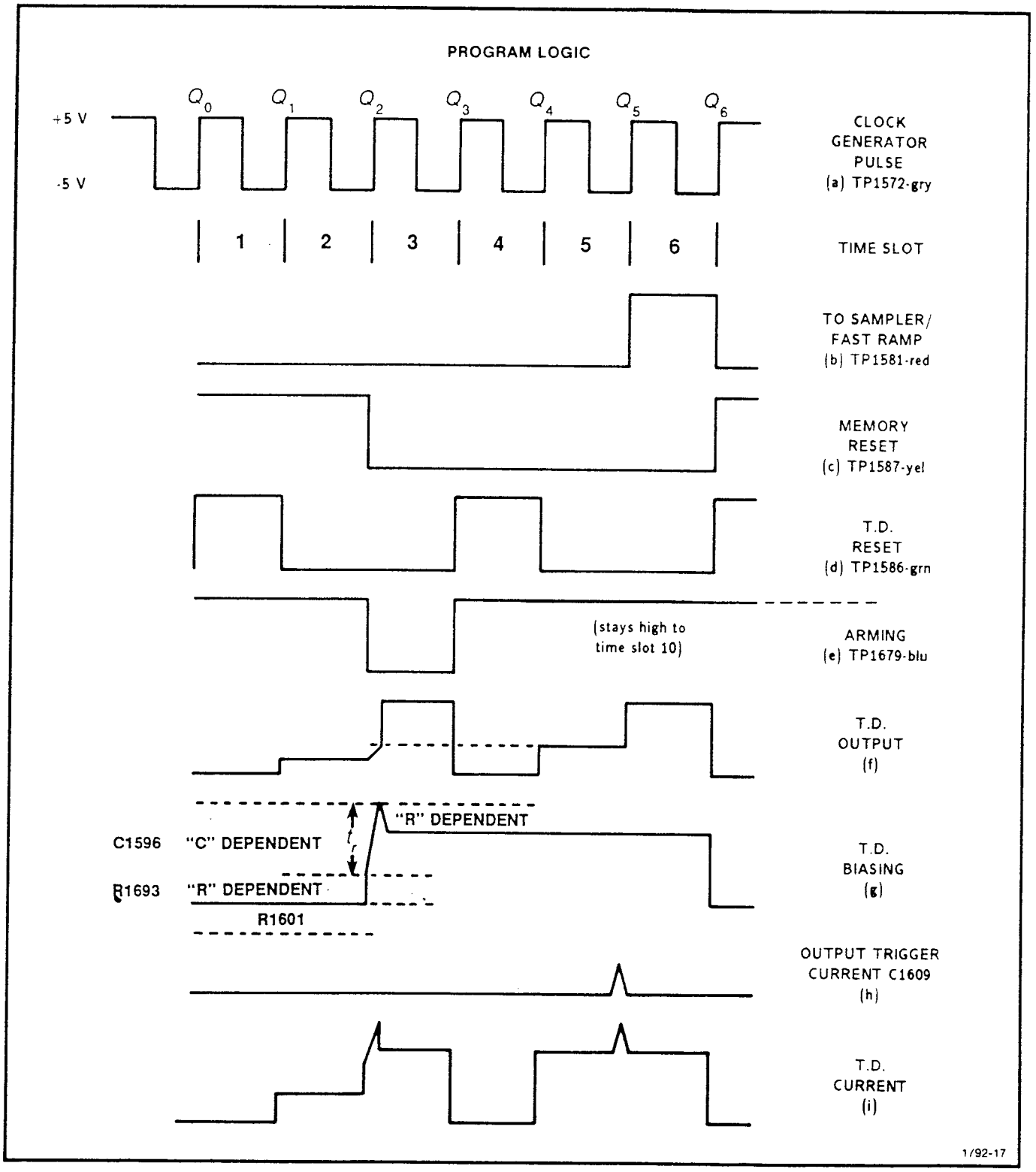


Fig. 3-3. Program Logic Cycle

1. During time slot 1, all current is removed from the tunnel diode which resets it to low. Low is on the low voltage side of the peak current point (see Figure 3-4).

2. During time slot 2, bias current is applied to the diode, raising it to just below the minimum peak current point (minimum peak current point depends on diode characteristics).

3. During time slot 3, a current ramp is added to the bias until the diode fires. After firing, the current falls to a predetermined level where it stays for the remainder of time slot 3.

4. During time slot 4, all current is removed from the diode which resets it to low. This completes the first pulse. The firing level of the diode is now just above the voltage level stored in C1596.

5. Time slot 5 is a waiting period in which current is allowed to stabilize.

6. During Time Slot 6, the diode is fired by the TD TRIGGER circuit from the pulse comparator. The fast ramp does its sweep and the sampler takes its sample at this time.

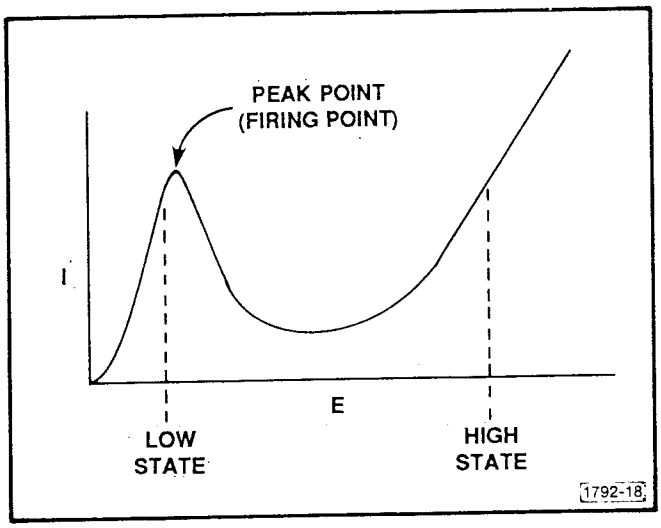


Fig. 3-4. Tunnel Diode Voltage/Current Curve

Clock Generator: The clock generator consists of inverters U1575A and U1575B which act as an astable multivibrator. The generator's output signal is an ~60 KHz square wave determined by C1572 and R1574. The square wave is applied to a six-step counter in the logic programmer. R1577 protects input to U1575B.

Logic Programmer: The logic programmer provides tunnel diode biasing, and sampler synchronization. The programmer consists of a six-step counter, U1569, and gates U1575C, U1575D and U1671. A pulse cycle is completed after every six clock inputs (see Figure 3-3a).

Output Q1 of the counter goes high at the start of the clock pulse sequence, remains high for three clock pulses, then goes low for the remaining three clock pulses.

Outputs Q1, Q2, Q3, Q4 and Q5 of the counter go to gates U1575C, U1575D and U1671. Output of U1575C (FAST-RAMP START) controls duration of the fast-ramp generator, and is low for the first five clock pulses, then high for the sixth clock pulse (see Figures 3-3b and 3-9).

Output of U1575D (MEMORY RESET) resets the biasing level of tunnel diode CR1703. By turning Q1597 on, charging current to C1596 is shunted to ground and voltage on C1596 is removed. This occurs during the first two clock pulses (see Figures 3-3c and 3-10).

Output of gate U1671D resets the tunnel diode during time slots 1 and 4 by diverting current to ground through Q1602. This causes the diode to turn off. Reset occurs each time the diode is fired (see Figures 3-3d and 3-11).

Output of U1671C enables comparator Q1688 and Q1695, which senses when tunnel diode CR1703 goes high during time slot 3 (see Figures 3-3e and 3-12).

Pulse Generator: The pulse generator generates test pulses to the CABLE connector on the 1502 front panel. The generator consists of high-speed 20 mA tunnel diode CR1703, and the diode's bias control circuits.

Voltage across CR1703 is 400 V with an ~ 50 ps rise-time. Low impedance of CR1703, combined with R1701, form a source impedance of 50 Ω. This circuit provides the 200 mV step pulse to the CABLE connector.

Bias current for CR1703 is provided by R1601 and R1693. Transistors Q1602 and Q1603 act as a switch to either direct the current through CR1703 via Q1603, or divert the current to ground via Q1602. U1671D output (TUNNEL DIODE RESET), which is high during time slots 1 and 4, switches 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. This turns Q1602 on (through Q1502) and turns Q1603 off (through Q1504). Tunnel diode CR1703 is then off. *NOTE: Q1589 eliminated effective S/N B029999.*

During time slots 1 and 2, Q1597 discharges memory capacitor C1596. At the beginning of time slot 3, Q1597 cuts off, allowing current to pass through CR1691 and R1691. This charges C1596 via R1692 and R1594 (C1596, R1692 and R1594 comprise the memory circuit). The gate voltage of Q1693 steps up to a value determined by voltage divider R1691, R1692 and R1594, and then increases at a constant rate determined by R1691, R1692, R1594 and C1596 (see Figure 3-3g).

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

The comparator has a negative reference level except during time slot 3 when it is 300 mV positive. The reference input voltage (voltage at the base of Q1695) equals the tunnel diode voltage which is always above ground level. This causes Q1683 to saturate and remove the memory charging current.

At the beginning of time slot 3, when the tunnel diode is still low, the comparison voltage is 300 mV. Q1683 is not conducting, and the memory charge current flows to the memory capacitor. When the tunnel diode fires, the comparator input voltage goes above 300 mV. Q1683 becomes saturated and the memory charge current is removed. The comparison reference levels are set by R1682, R1683, R1681 and Q1675. Resistors R1702 and R1707, together with capacitors C1701 and C1706, compensate for the diode's thermal time constants.

Tunnel diode CR1609 is used to reduce jitter on the output pulse. Q1608 conducts when the TD TRIGGER pulse is received from the pulser comparator during time slot 6. The current through Q1608 causes tunnel diode CR1609 to go high, producing a fast spike pulse through C1609 and R1701 to tunnel diode CR 1703. This fires CR1703, sending the test pulse to the CABLE connector on the front panel. DC balance network R1753, R1659 and C1655 provides zero output when no test pulse is being generated.

Sampler

The sampler circuitry uses fast positive and negative strobes (100 ps) to sample the test and reflected pulses. This creates the vertical display on the CRT. The sampler consists of a sampling gate, sampling preamplifier, strobe generator and blow-by compensator.

Sampling Gate: Dual-diode sampling gate CR1732 allows signals from the output terminal to briefly appear at the preamplifier input. Risetime of the sampler is proportional to conduction time of the diodes, which is controlled by width of the strobe generator.

Sampling Preamplifier: The sampling preamplifier consists of Q1648, Q1556 and Q1643. While strobing is occurring, a 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. C1646 and C1647 provide positive feedback to optimize sampling efficiency, while R1543 adjusts sampling efficiency.

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

A negative-going signal from the sampler comparator is amplified by Q1553, and 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 become saturated, at which time TP1534 (VIOLET) is at ground. It will stay at ground level as long as C1543 remains charged. When the charge is depleted, the circuit resets and TP1534 returns to -5 V.

The positive edge of TP1534 feeds through C1534 into transformer T1538 which drives the avalanche circuit. When avalanche transistor Q1537 activates, the collector voltage drops and emitter voltage rises rapidly (300 ps). These opposing signals are fed to the snap-off circuit through C1631 and C1632. Snap-off diode CR1632 is normally forward biased by current from R1625 and R1633, which 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 diode's cathode to reverse-bias the diode in less than 50 ns.

The fast-rising pulse from CR1632 is applied to the shorted striplines, and the width of the strobes is determined by the physical length of the striplines. The strobe that is generated, differentiated by capacitors C1635 and C1636, strobes the sampling diodes.

Avalanche voltage amplitude is controlled by R1525, with Q1529 serving as an emitter-follower.

Blow-By Compensator: The blow-by 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.

Comparators

There are two comparators: a pulser comparator that provides the TD trigger signal to the pulse generator, and a sampler comparator that provides the sampling trigger signal to the strobe generator.

The comparators have different amplifiers: Q1347 and Q1348 for the pulser comparator, and Q1336 and Q1325 for the sampler comparator. Both comparators operate alike, therefore only sampler comparator component numbers are used in the following description.

Inputs for the sampler comparator are the bases of Q1336 and Q1325. Depending on which input is higher, voltage at TP1324 (GREEN) will be either +5 V or -5 V. If the base of Q1336 is high, Q1336 conducts and Q1325 turns off.

Current for Q1336 comes from Q1329 which turns on Q1328. This puts the voltage at TP1324 +5 V high. When the base of Q1336 is below that of Q1325, Q1325 conducts and Q1336, Q1329 and Q1328 turn off. The output voltage drops to the level of the 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, and 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 signal controlled by R0151 (ZERO REF SET control). R1132 (X.1 multiplier) compensates for unequal delays in the comparator when the speed of the fast ramp is changed from X1 to X.1.

Ramp Generators

There are two ramp generators: a fast-ramp generator for setting the X1 and X.1 multiplier, and a slow-ramp generator for creating the CRT sweep and (when combined with the fast ramp) slewed strobes for the sampler.

Fast-Ramp Generator (Schematic 2)

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. The fast-ramp signal is supplied to the sampler and pulser comparator.

Q1337 provides a constant current source for developing a linear voltage ramp across timing capacitors C1325, C1327 and C1332. The magnitude of the current can be precisely set using R1435 (FEET/DIV CAL). Q1339 is needed for thermal tracking. The timing capacitors are reset at the end of time slot 6 by ramp clamp Q1338 controlled by the pulse generator programmer through Q1338 and Q1357. C1332 is timing adjustment for the X.1 multiplier ramp.

Slow-Ramp Generator (Schematic 3)

The slow-ramp generator consists of an integrator, bi-level comparator, retrace switch and retrace signal amplifier, and positive and negative current sources. (see Figure 3-5).

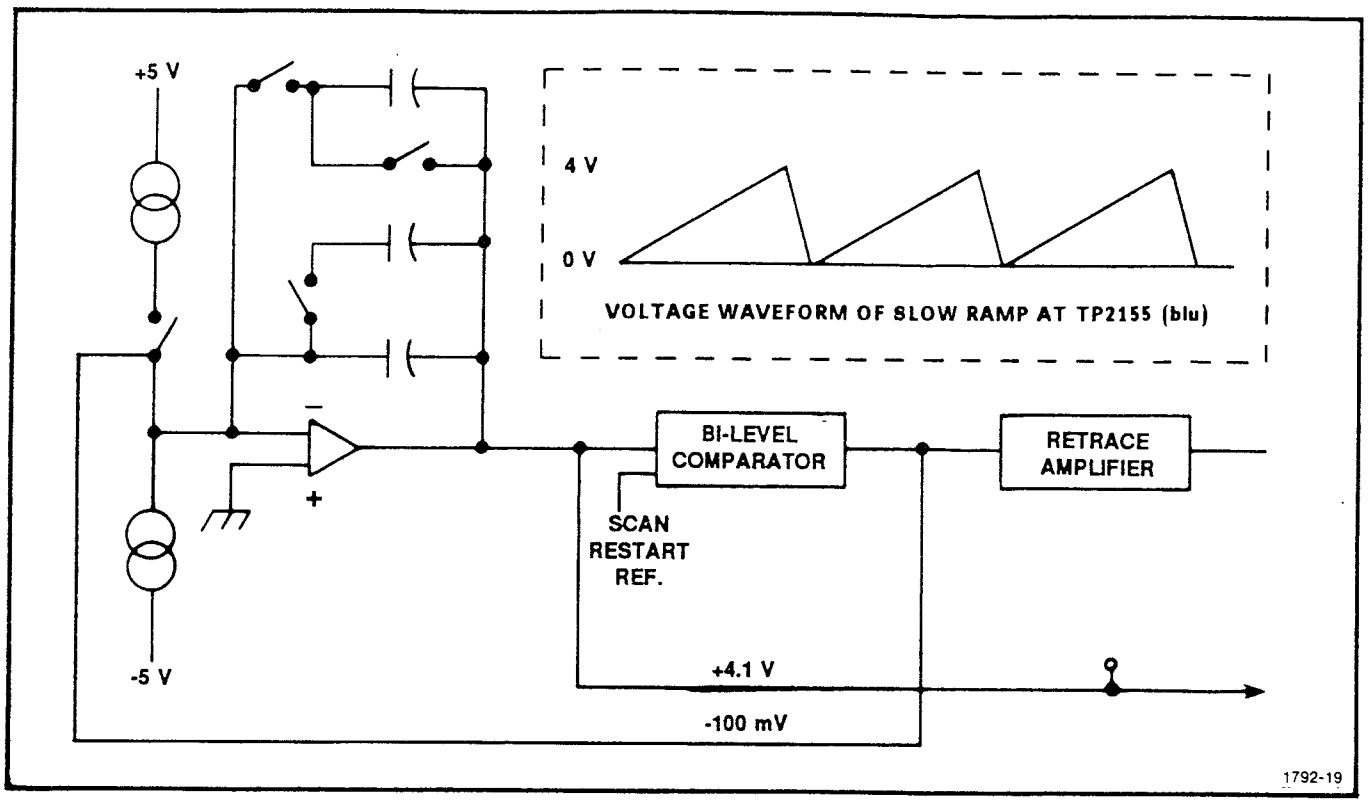


Fig. 3-5. Functional Diagram of Slow Ramp Generator

Integrator (see Schematic 3): The integrator consists of an inverting amplifier with FET input. Integrator capacitor C2356 is connected between the collector of Q2345 and the inverting-input gate of Q2246A. A negative current applied to the inverting-input gate through R2353 results in linearly rising voltage on the output. This output voltage continues to rise until it reaches the internal comparison level of 4.1 V. The bi-level comparator output then switches to a higher output level to close FET switch Q2257, and changes its comparison level to -0.1 V. This allows positive current to be applied to the input of the integrator. The positive current is several times larger than the negative current, and causes output voltage of the integrator to decrease linearly. As output voltage approaches -0.1 V, positive current into the integrator turns off. The comparator level switches back to 4.1 V and the cycle starts over.

Risetime and falltime of the slow ramp can be varied by changing the integrating capacitance values. In normal scan, a value of 0.0013 μF is used.

When S2254 (NOISE FILTER) is activated, scan frequency is reduced approximately 7 times by paralleling a capacitance value of 0.01μF to the original 0.0013 μF. For X-Y recorder or Y-T chart recording purposes, a value of 1.0 μF is used (Q2248 acts as a FET switch and is controlled by the recorder logic circuits).

Bi-Level Comparator (see Schematic 3): During the positive-going sequence of the slow-ramp generator, Q2261 is saturated and Q2262 is off. Emitter voltage of Q2261 and Q2262 is 4.1 V, controlled by resistor divider R2267 and R2158. The collector of Q2262 is -5 V because the transistor is not conducting. The anode of CR2161 has to rise to 4.1 V in order to turn off Q2261. When Q2261 turns off, its collector level decreases. This causes Q2262 to turn on and saturate. Emitter voltage output switches to -0.1 V and Q2261 remains off until the anode voltage of CR2161 goes to -0.1 V, which restarts the cycle.

The comparator is forced into the scan cycle when the recorder logic circuits turn on CR2262.

Retrace Signal Amplifier (see Schematic 3): The retrace signal amplifier uses input FET (Q2258) to drive amplifier Q2259. Output voltage is +5 V during retrace and -5 V during scan. Output is used for recorder logic circuits.

Current Sources (See Schematic 3): The positive and negative currents for the retrace sweep are generated by applying +5 V and -5 V to resistors R2251 and R2353.

Time Base Generator Circuits (Schematic 2)

Inverter/Attenuator

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

Operational amplifier U1344 is an inverter. Its input voltage is determined by the position of FEET/DIV switch S1222F whose input signal is the 4 V slow-ramp generator signal. The FEET/DIV control is selectable from 1 to 200 feet per division in a 1-2-5 sequence. Output of the FEET/DIV control is fed to the sampler comparator by way of voltage offset resistors R1342 and R1239.

Resistor R0472 is the variable range adjustment for the OTHER switch. OTHER is for any cable whose dielectric is other than solid polyethylene or solid polytetrafluoroethylene (Teflon®).

Distance Offset

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

The constant current of Q1413 is fed into the wiper of R0271. The variable current of R0271 is fed into the summing junction of operational amplifier U1344. This occurs in all FEET/DIV control settings except 200.

When pressed, ZERO REF CHECK switch S0151 disables the offset current so that a reference check can be made. R1315 (DISTANCE CAL) provides adjustment for Q1317.

Vertical Amp/Slow-Ramp Circuits (Schematic 3)

X-Y Recorder Logic

Recorder logic circuitry consists of bi-stable multivibrator U2332B and U2332D; gates U2332A and U2332C; and multiplex switches U3223A and U3223B (U3223A and U3223B are on Schematic 4).

During normal operation, output of the multivibrator at TP2157 (PEN LIFT) is low and Q2248 is not conducting. Pin 10 of gate U2332C is low and Q2249 is not conducting. Pressing S0481B (RECORD switch) makes the RECORD line go high, the multivibrator change level, and TP2157 go to +5 V. Output of U2332A (pin 3) goes low and output of U2332C (pin 10) goes high. This turns on Q2249 which keeps C2356 discharged. The slow-ramp signal remains at 0 V.

By releasing the RECORD switch, output of U2332C goes low which turns Q2249 off. At the same time, Q2248 is on which starts the slow-ramp generator scanning at a slower rate due to C2252 being added to the circuit. When the scan cycle ends, output of retrace amplifier Q2259 goes high causing multivibrator U2332B and U2332D to reset the recorder logic circuit to normal operation.

CR2324, R2324 and C2325 ensure that the recorder logic is in normal operating mode when the POWER switch is on.

Vertical Amplifier

Vertical amplifier circuitry consists of selectable-gain amplifier U2136, vertical-trace positioning control, variable-gain amplifier U2143 for calibrating the instrument for different cable impedances, retrace logic and a vertical output amplifier.

Selectable-Gain Amplifier: This circuit consists of amplifier U2136 and a bank of resistors for selecting gain via S2126 (mρ/DIV control).

U2136 is a voltage follower. Its non-inverting input receives a signal from the preamplifier through R2138, and a positioning signal from amplifier U2131 through R2137. High-frequency noise is filtered by capacitor C2137 (0.001 μF). Additional noise filtering can be gained by pressing S2254 (NOISE FILTER switch) which adds capacitor C2241 (0.1 μF) to the circuit.

Vertical-Trace Positioning: Vertical-trace positioning is done by offsetting the DC level of the vertical signal. Operational amplifier U2131 provides the DC offset voltage, and is controlled by R0251A and R0251B (POSITION and FINE controls).

Gain Amplifier: The gain amplifier consists of U2143. Variable gain is provided by R0263. Incoming voltage is attenuated approximately 20% by R2228 and R2144. Output voltage is approximately 200 mρ per division. The variable-gain control has a range of approximately five times and is set by R0263 and R2142. Output goes through the retrace logic circuit to the vertical output amplifier.

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

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

During forward scan of the slow ramp, the retrace signal and pin 2 of U3123A are negative. This causes 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 retrace, output of U3123D is high, but pin 6 of U3223C is low and pin 12 of U3223D is high. This allows 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 (see Schematic 4): 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, gain is approximately 80. Capacitor C3233 is added to increase high-frequency response.

Output Amp/High-Voltage Circuits (Schematic 4)

Horizontal-Output Amplifier

The horizontal-output amplifier consists of Q3221, Q3118, Q3113 and Q3114. It amplifies the 0- to 4 V slow-ramp signal into a differential voltage of approximately 150 V and shifts the output level to an average of 85 V. A gain of approximately 37 times is achieved with differential transistor amplifier Q3221 and Q3118. Gain is controlled by the ratio of resistance in R3122 and R3121, 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 Q3113 and Q3114 as a current mirror source. The thermally stable current is set by R3112, R3114 and R3115. R3213 is used for horizontal positioning.

CRT Display Circuits

The CRT high-voltage supply circuit provides voltage necessary for the FOCUS and INTENSITY controls, CRT cathode and biasing network.

High Voltage: The high-voltage circuit consists of: an oscillator formed by Q4149 and Q4145; transformer T4141; high-voltage multiplier circuit consisting of CR4323, CR4314, CR4311 and CR4211; a resistor divider string consisting of R4114, R4126, R4222, R4129 and R4221; R0442 (INTENSITY control); and R0432 (FOCUS control).

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

Windings 7 and 8 of the transformer provide a 0.6 V RMS signal for the CRT filament. This winding is high-voltage insulated. Windings 4 and 6 provide a 500 V square wave used to generate the high voltage. The high-voltage multiplier circuit converts the 500 V to 2000 V. A resistor divider string is connected between the 2000 V and 1000 V taps of the multiplier circuit. This provides voltages for correct biasing of the CRT. The FOCUS and INTENSITY controls are included in this divider string. A 150 V zener (VR4117) is used to stabilize cathode voltages.

CRT: In order to optimize the CRT display, internal controls for astigmatism, geometry and trace rotation are provided. These controls, located on the Output Amps Board, are: R3148, R3149, R3242 (ASTIGMATISM); R3249, R3248 (GEOMETRY), and R3142/R3143 (TRACE ROTATION).

Logic Circuits for Y-T Chart Recorder (Schematic 5)

The Logic Board is used only to control the Tektronix Y-T Chart Recorder (Option 4 instruments only). The Logic Board can be removed from the instrument without affecting operation of the instrument. However, if the board is removed, the harmonica connector from the RECORD switch must be connected to point P28 on the Vertical Board (see Schematic 3, location 1-C).

The logic circuits consist of: pulse shaper circuit; binary counter circuit; horizontal correction network circuit; logic circuit for controlling the chart paper drive motor; stylus heat circuit; Chart Recorder power switch; and an anti-bounce record circuit (see Figure 3-6).

Pulse shaper circuit

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 punched holes in the paper passing between a light-emitting diode and a photo-sensitive transistor. The resulting pulses are shaped to a clean square-wave by trigger circuit U5166B and U5166C. The output signal is capacitor-coupled by C5167 to one-shot multivibrator U5166A and U5166D. This produces an output signal at TP5145 (VIOLET) that is a positive-going 10 ms clock pulse. This pulse is connected to binary counter U5147, and to the end of the paper-motion sensor R5148.

Binary counter circuit

U5147 is a seven-stage binary counter whose outputs are connected to a resistor ladder network. This network forms a digital-to-analog converter. Outputs Q1 and Q7 are connected to the AND gate of U5252B so that it can recognize a count number of 65. Output Q2 clocks multivibrator U5127B at a count number of 2 (U5127B starts the slow-ramp signal).

Horizontal Correction Network

The horizontal correction network compares output of digital-to-analog converter U5147 with the slow-ramp signal inverted by U5227. The digital-to-analog output and inverted slow-ramp signal are connected to inverting amplifier U5117 which performs summation and amplification functions simultaneously. This signal is fed to the slow-ramp generator by way of R5118, and will either speed up or slow down the slow-ramp generator to synchronize it with the paper speed of the Chart Recorder.

Chart Recorder Logic Circuit

The logic control signal, received through pin 2 of P53, is shaped into a narrow, negative-going impulse by U5156B and U5156C. This impulse occurs at the trailing edge of the logic control signal and latches bistable multivibrator U5252A and U5252C. Pin 9 of U5252A goes positive and turns on Q5266, which pulls the paper-drive motor control signal to ground and starts the motor rotating. The motor is turned off at a count of 65 by U5252B. A second signal turns the motor off when the end of the paper is reached and output from the pulse shaper is stopped. This forces 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 from pin 10) disables reset of the counter and turns on Q5144. This locks out the logic control input line.

Stylus heat is controlled by 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, brings the flip-flop back to its original state (pin 1 low). The "Q" output of U5127A also controls the chart-pen motor power switch, and provides "J" input to flip-flop U5127B.

U5127 controls the start of the slow-ramp generator, the horizontal correction signal disable network (Q5112), and the power switch to the chart pen drive. The slow-ramp generator starts when Q2 of counter U5147 goes high. The "Q" output of U5127A allows U5127B to be clocked by Q2 of the counter. And when clocked, pin 15 output of U5127B raises the horizontal control line, while pin 14 output enables the horizontal correction circuit via Q5112. The "Q" output of U5127A enables the heat and pen drive power when high.

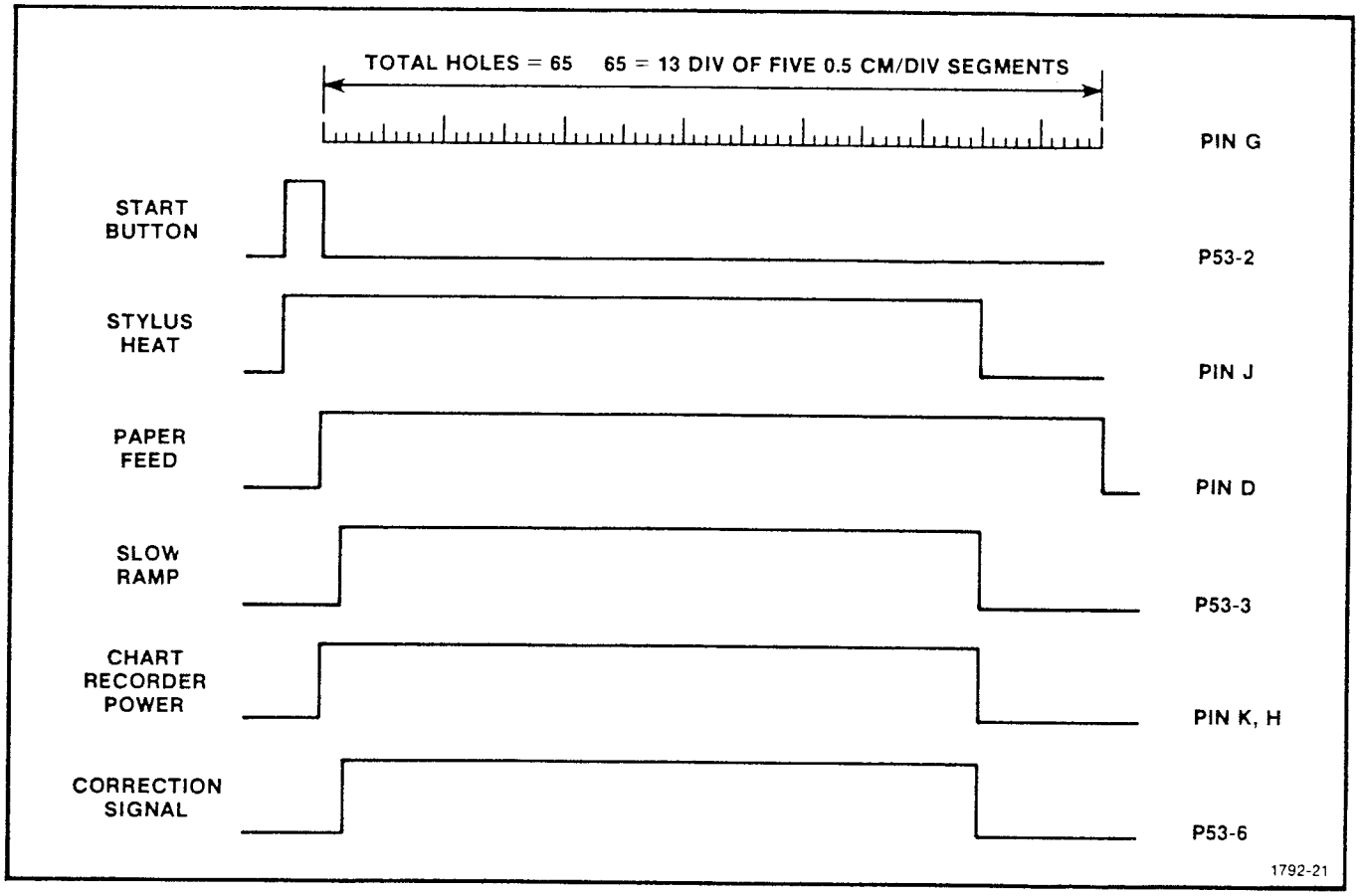


Fig. 3-6. Chart Recorder Logic

Q5226 will conduct only when the Chart Recorder is plugged into the instrument. Q5237 and Q5229 act as a DC-level shift amplifier between flip-flop U5127B and the slow-ramp generator.

Chart Recorder Power Switch

Two switches, Q5273 and Q5227, provide the +8 V or -8 V needed to drive the stylus movement. Q5179 parallels Q5273 to provide more current in the +8 V line. These switches are driven by the same signal that controls stylus heat switch Q5239. The signal is passed to the switches through Q5173 and Q5279.

Anti-bounce Record Circuit

This circuit, consisting of U5156A and Q5156D, removes transient voltages from the RECORD switch. Output of this circuit goes to the Vertical Board to control the Chart Recorder logic. The recorder 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 instrument, the harmonica connector leading from the RECORD switch should be connected to P28 on the Vertical Board.

Power Supply Circuits (Schematic 6)

The power supply consists of an AC line selector, transformer T0389, battery charger, battery pack BT0369 and DC voltage converters (see Figure 3-7).

The battery charger consists of SCR switch Q6155; SCR triggering circuit Q6143, Q6244 and Q6241; operational amplifier U6138 and current reference resistor R6131).

The DC voltage converters consist of anti-deep-discharge circuit Q6548, Q6549 and Q6547; primary regulator Q6552, Q6557 and VR6459; controllable oscillator Q6458, Q6445, C6551 and R6545; 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 power supplies. The +10 V, +5 V and -5 V supplies have secondary regulation circuits.

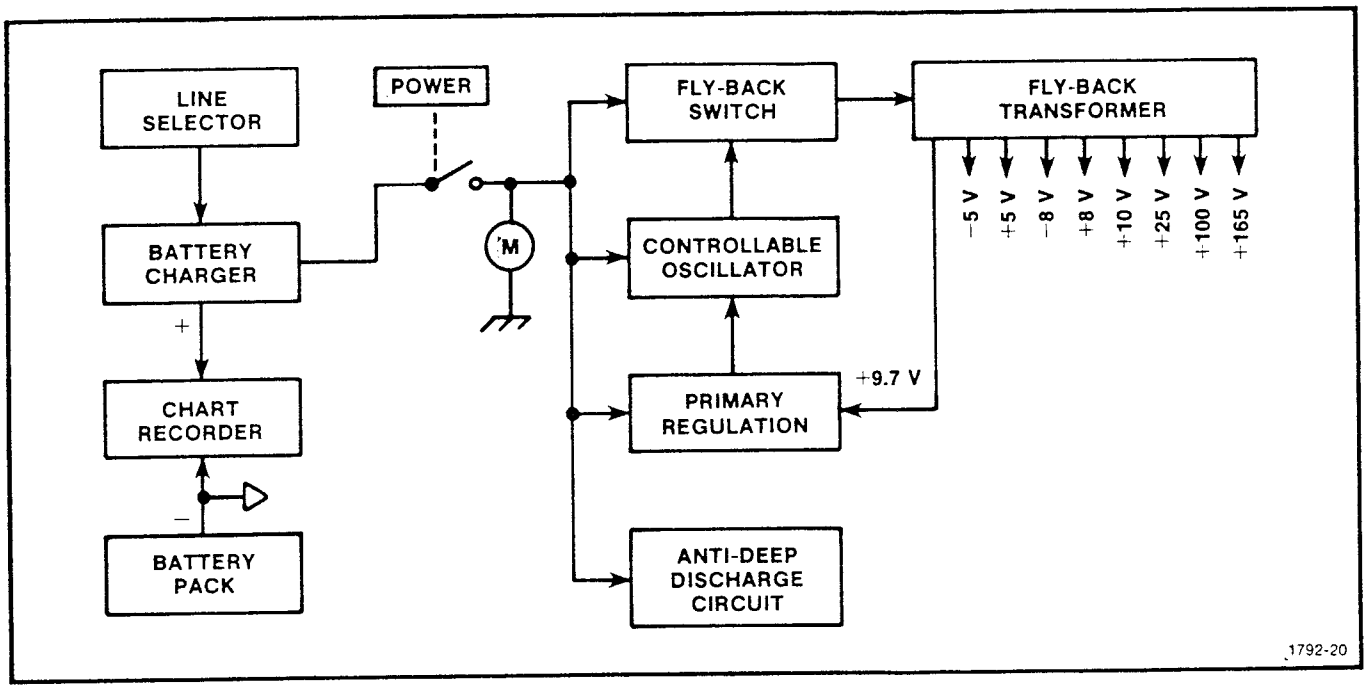


Fig. 3-7. Diagram of Power Supply

Line Selector

The AC line selector, consisting of the power transformer terminals, is factory wired for customer preference, but may be wired for 230 VAC or 115 VAC. If a different configuration is desired, refer to the procedure described in the *Maintenance* section of this manual.

Battery Charger

T0389 provides the battery charging current which is regulated for an average of 150 mA independent of battery load.

A reference voltage of approximately 50 mV is created across R6132 by R6135 and VR6134. The battery load and charge current are fed through R6131 and the charger will maintain an average 150 mA into the battery. This is done by comparing the voltages across R6132 and R6131 using U6138.

With each new cycle, a current of the same magnitude as the input current is released by Q6241 to C6147. Full-wave rectification is provided by CR6157. Voltage across C6147 builds up until it reaches the firing threshold of programmable unijunction transistor Q6143. At that moment, a triggered occurs at the cathode of Q6143 which fires Q6155. When this occurs, a portion of CR6157 output provides charge current for the battery during the remainder of the cycle, and C6147 becomes discharged through the anode of Q6143. The point at which triggering occurs is determined by how fast C6147 is charged to the 4.5 V reference voltage; the charging speed is determined by the average current to the battery.

Because the charge and load currents are pulses, averaging is performed at the output of U6138 by C6233 (15 μF). VR6134 provides protection in case the instrument is plugged into an AC power source while the battery pack is disconnected from the instrument.

CAUTION

For proper operation, the battery pack MUST be connected to the instrument whenever the instrument plugged into an AC power source.

DC Voltage Converter

The controllable oscillator is an astable multivibrator (Q6458 and Q6445) whose output voltage is high for 8 μs and low during the remainder of the period. The 8 μs is set by C6551 and R6545 in parallel with R6449 and R6457. The low voltage duration is controlled by Q6552, R6454 and C6451. CR6452, R6451 and R6453

protect against base-emitter reverse breakdown voltage.

Output of the controllable oscillator 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 that a magnetic field builds up in windings 5-6 of fly-back transformer T6535 during the 8 μs period.

When Q6435 turns off, the magnetic field collapses and the stored energy transfers to the secondary windings. 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 that of the battery pack is used. This is supplied from terminal 3 of T6535.

The +25 V supply is used for primary regulation and 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 VR6459 (9.1 V) and the base-emitter junction of Q6557. Depending on the voltage level of the +25 V supply, Q6557 increases or decreases. 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 controllable oscillator.

Anti-deep-discharge Circuit

The anti-deep-discharge circuit prevents the battery pack from discharging totally which could permanently damage the battery pack. Q6549 and Q6547 are connected as an SCR network. When fired, both transistors fully conduct and forces the collector of Q6557 to ground. This turns off the controllable oscillator and disables the DC voltage converter.

The SCR network is triggered when Q6548 conducts. This happens when the battery voltage drops below 10 V. The +25 V and +10 V power supplies are used as reference voltages by way of R6549, CR6546 and R6539a. To reset the SCR network, the battery voltage must be removed by turning off the front-panel POWER switch. The battery pack must be recharged or replaced (unless AC power is used) before the instrument can be operated.

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 V reference for the +5 V and -5 V regulators.

VR7416 (5.1 V) is used in a bridge to provide reference voltage for the +10 V supply. R6518, R6513, R6413 and R6514 are part of this bridge network. The bridge outputs are fed into U6515 which drives Q6427. VR6419 is used as a start-up circuit. C6416 provides additional power supply filtering. In order to reduce energy or power losses, Q6427 has only a 2 V collector-to-emitter drop.

Q6331 is a series regulator for the +5 V power supply. The +5 V is referenced against +10 V by U6236. 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.

X-Y Output Module Circuitry (Schematic 7)

The X-Y Output Module provides an electrical interface between the instrument and an external X-Y chart recorder. Three signal outputs (PEN LIFT, X output and Y output) are provided for the external recorder.

The switches for the outputs are solid-state devices and care should be taken when attaching loads to them (see Table 1-2 in the *Instrument Specifications* section of this manual for performance characteristics).

Pen Lift

The level of the pen-lift signal changes when the RECORD switch is activated. If the Output Module Board jumper is in the negative slope position (See Figure 2-10), the normal (quiescent) voltage is +5 VDC, ± .5 V. In the RECORD mode, the level will be 0 VDC, ± .5 VDC, returning to the +5 VDC level when the record sweep is finished.

If the Output Module Board jumper is in the positive slope position, the normal (quiescent) level will be -.6 VDC. ± .5 VDC. In the RECORD mode, the level will be +4.6 VDC. ± .5 VDC. returning to the -.6 VDC level when the record sweep is finished

CR7247 clamps the negative voltage swing to -0.6 V. Q7242 provides the capabilities for operating the Module with a positive pen-lift or a ground return path.

X Output

The X output is proportional to the horizontal position of the trace. The signal is a ramp of approximately 20 ms duration that rises at a rate of 0.1 V per horizontal division. This per-division scale factor is set by a voltage divider network consisting of R7138, R7129 and R7122. C7132 reduces noise in the circuit. Source impedance is less than 13 kΩ (9.4 kΩ minimum).

Y Output

The Y output is proportional to the vertical deflection on the CRT. The scale factor (output volts per vertical CRT division) is adjustable from 0.09 V to 0.13 V by variable resistor R7225 (factory setting is 0.1 V). Source impedance is less than 11 kΩ (8 kΩ minimum) as determined by R7234, R7224 and R7225. C7232 reduces noise in the circuit.

Test Points

Test Points located throughout the 1502 provide the means to monitor key waveforms and voltages. The illustrations and table are representative of nominal signals present at the Test Points, although in some cases timing and amplitude may vary. It's important to take into account the circuit involved with each Test Point. A waveform may show a higher or lower amplitude than the one pictured and still be correct, e.g. TP5272 may vary in amplitude from 1 VDC to several volts and still be a proper pulse. Or a timing pulse could have a slightly different amplitude and not effect the instrument's performance, but a difference in frequency would effect performance dramatically.

All Main Board Test Points were observed with the large cavity shield removed (providing access to the Test Points), but the narrower stripline shield left on (exception is "20 mA TD Out"). All examples were obtained with a Tektronix 7000 Series scope with X10 probe. The 1502 and test scope should be allow to warm up at least 20 minutes.

Waveform Test Points

The 1502 front panel controls *must* be set as follows:

mρ/DIV	200
FEET/DIV	20
METRES/DIV	*5*
MULTIPLIER	X1
DIELECTRICS	All Out
VAR	Fully Clockwise
DISTANCE	000
NOISE FILTER	Out
ZERO REF SET	Center Display
POSITION	Center Display
CABLE	50Ω Terminator
AC	AC Power Connected

Note: the first few waveforms are dual trace, with the first trace being the clock pulse, TP1572 (gry). This exemplifies the relationship among the various pulses during the program logic cycle (see Figure 3-3).

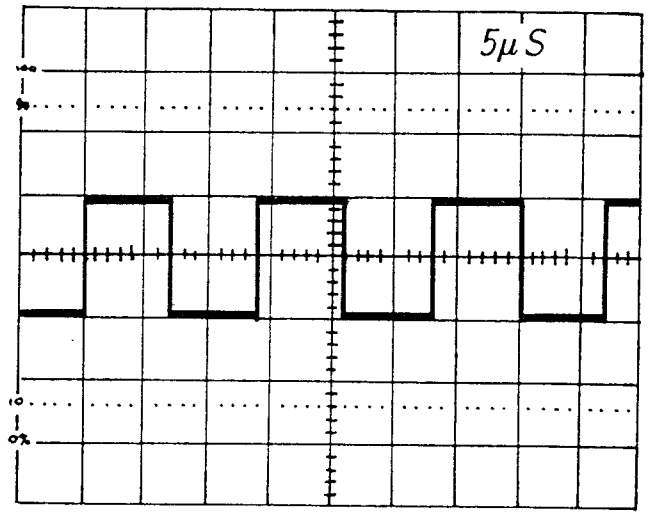


Fig. 3-8. TP1572 (gry)

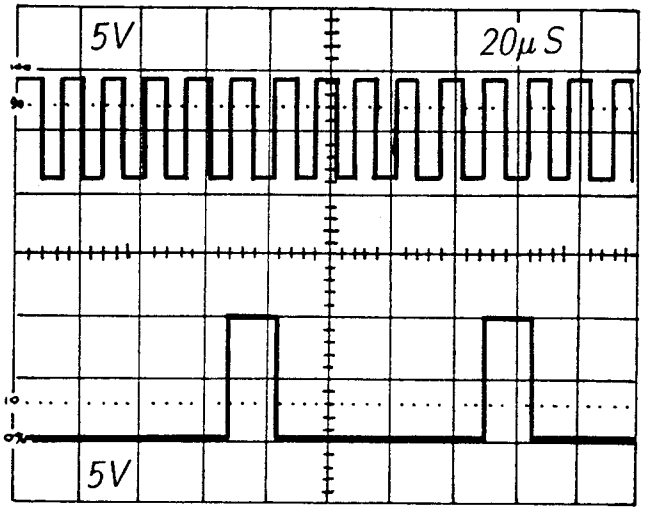


Fig. 3-9. TP1581 (red)

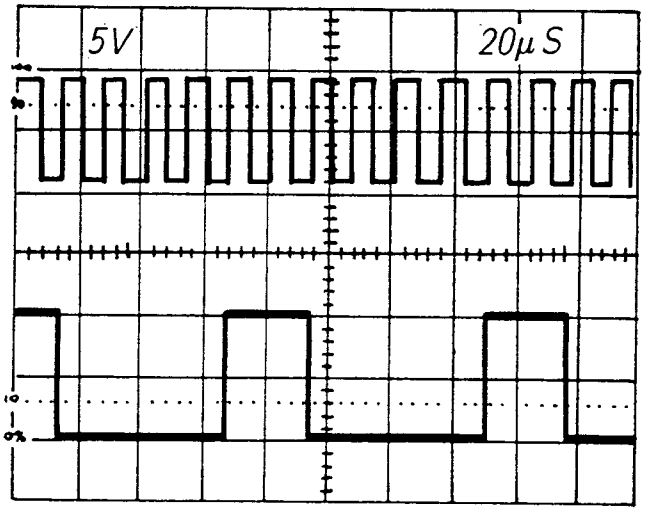


Fig. 3-10. TP1587 (yel)

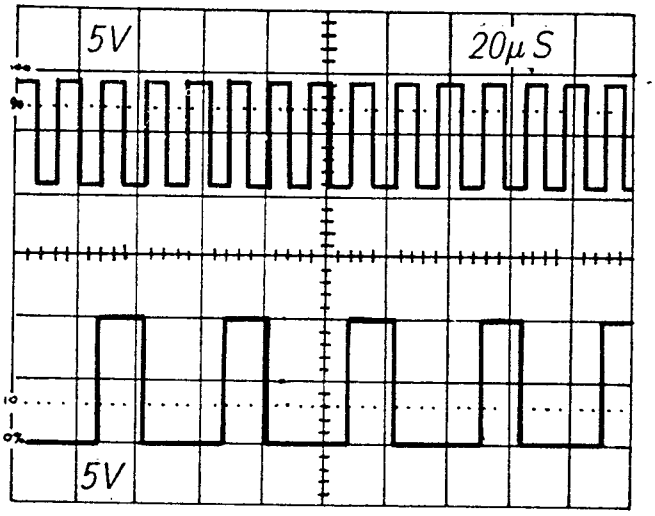


Fig. 3-11. TP1586 (grn)

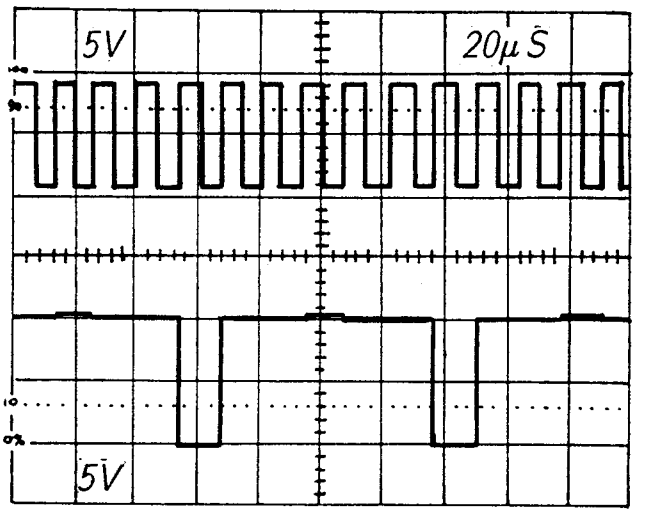


Fig. 3-12. TP1679 (blu)

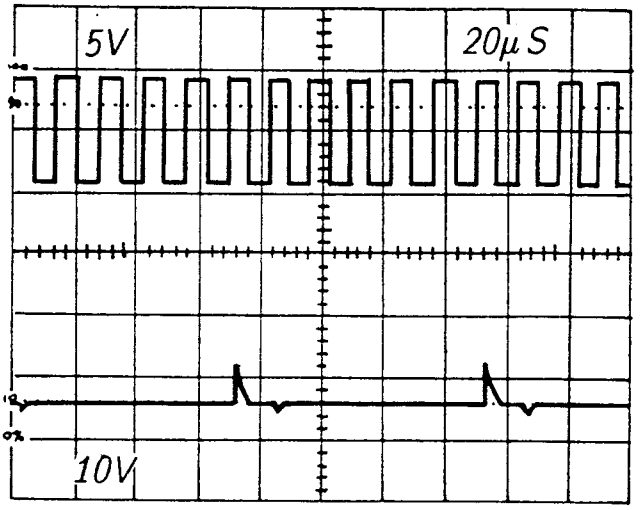


Fig. 3-13. TP1534 (vio)

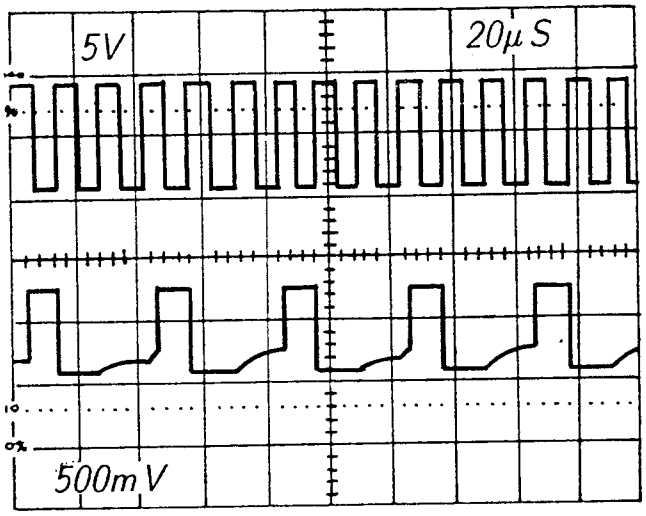


Fig. 3-14. 20 mA TD Output

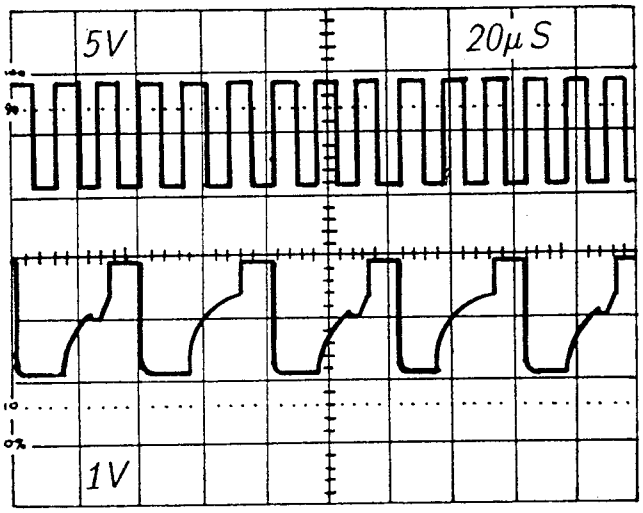


Fig. 3-15. TP1604 (orn)

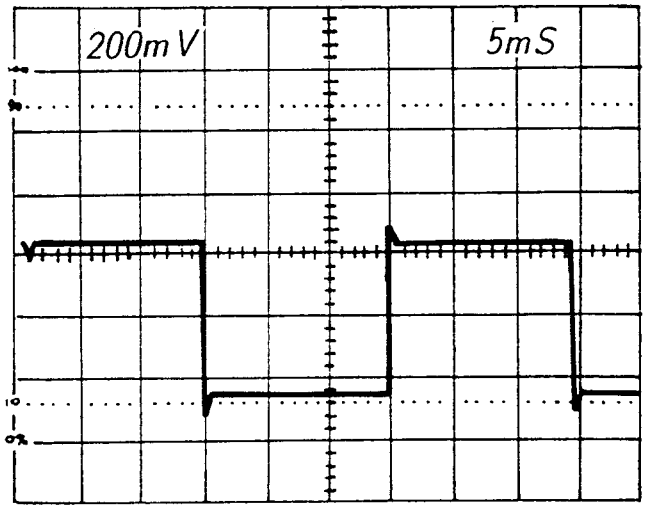


Fig. 3-16. TP1642 (red)

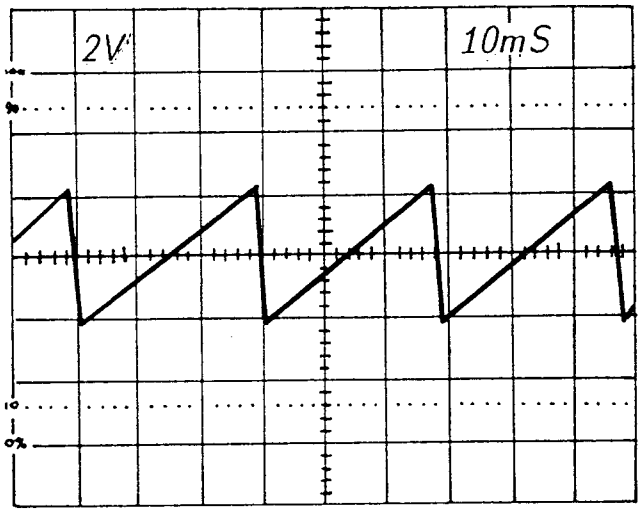


Fig. 3-17. TP1446 (blu)

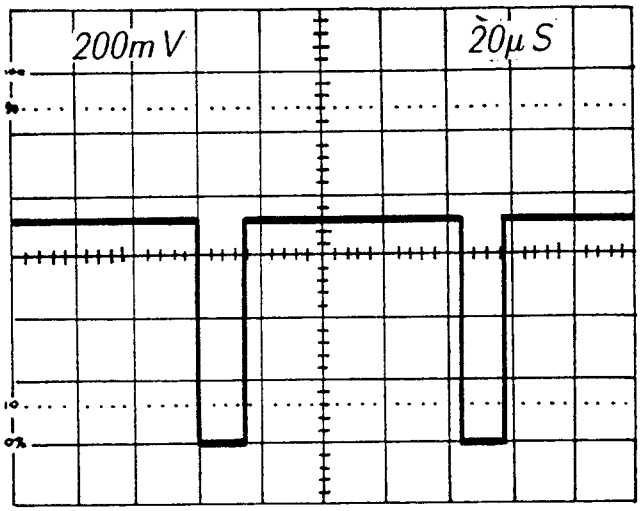


Fig. 3-18. TP1324 (grn)

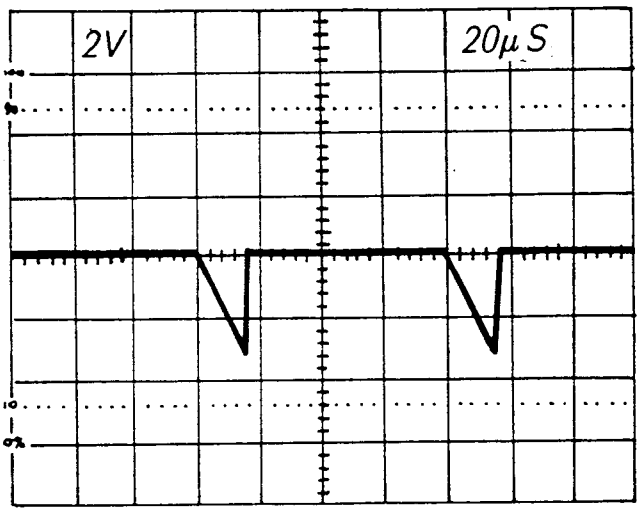


Fig. 3-19. TP1339 (red)

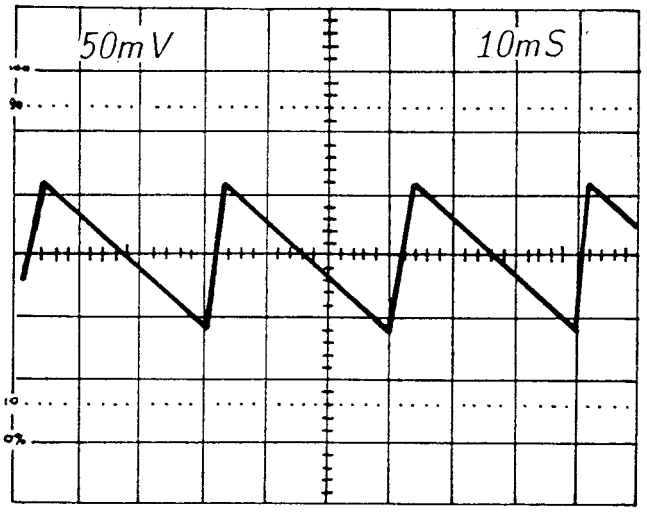


Fig. 3-20. TP1341 (brn)

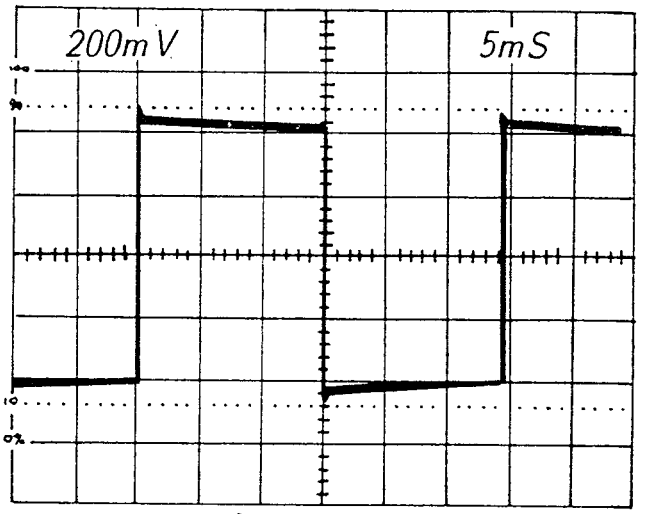


Fig. 3-23. TP2151 (vio)

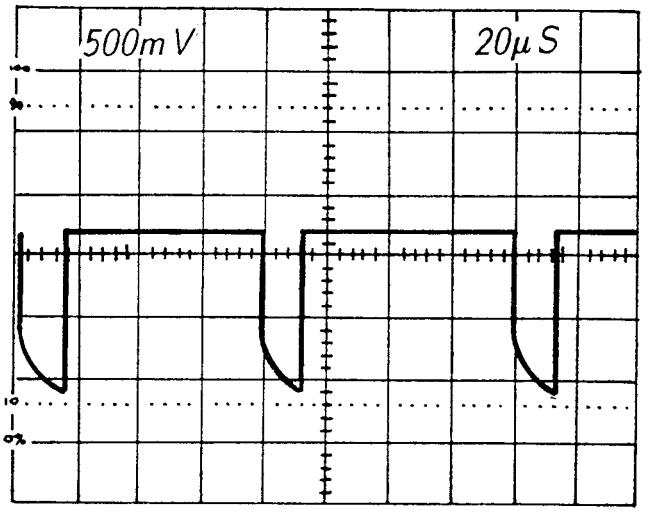


Fig. 3-21. TP 1349 (yel)

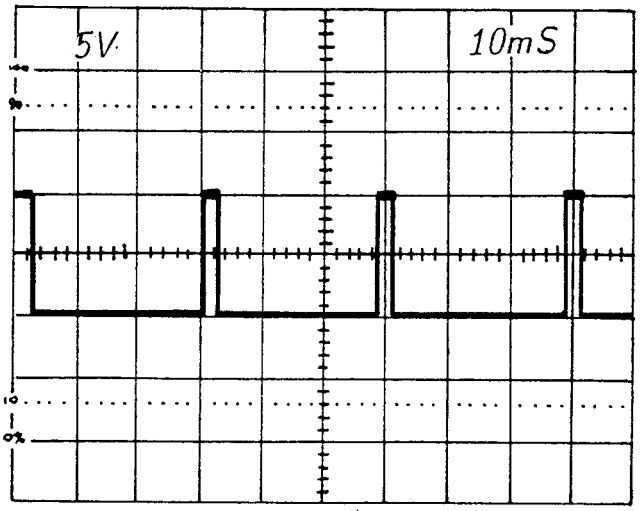


Fig. 3-24. TP2154 (grn)

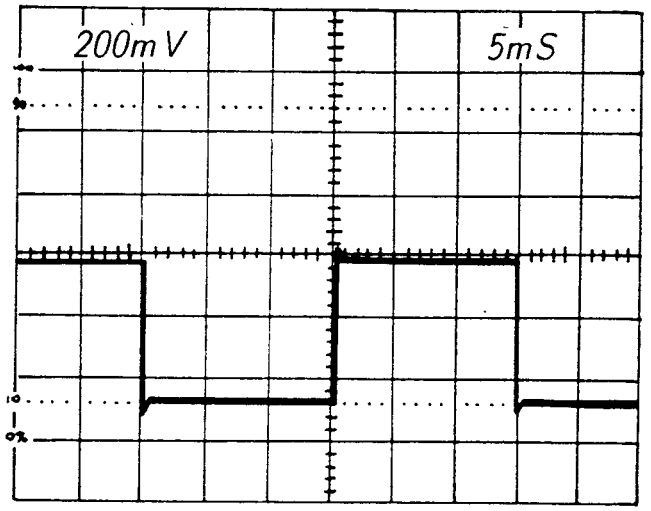


Fig. 3-22. P21, Pin 2

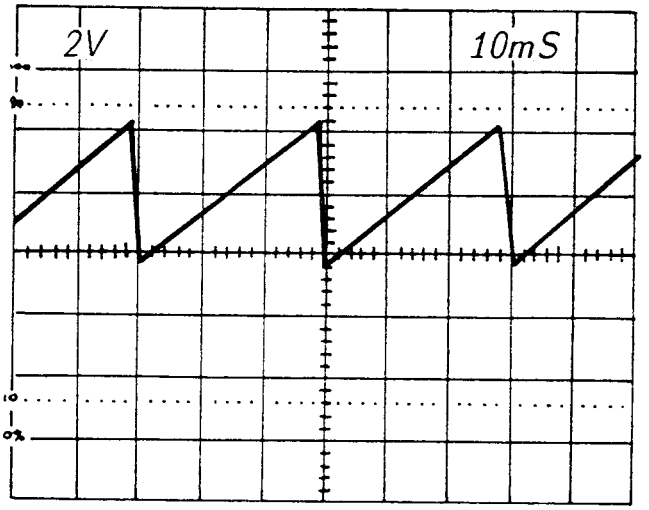


Fig. 3-25. TP2155 (blu)

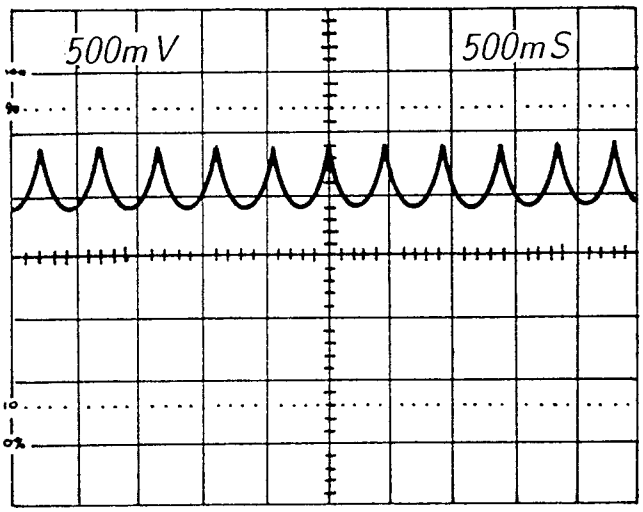


Fig. 3-26. TP5115 (yel)

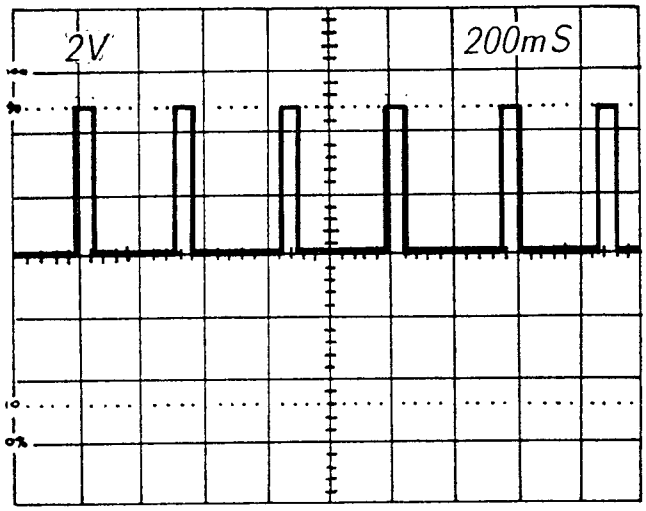


Fig. 3-27. TP5145 (vio)

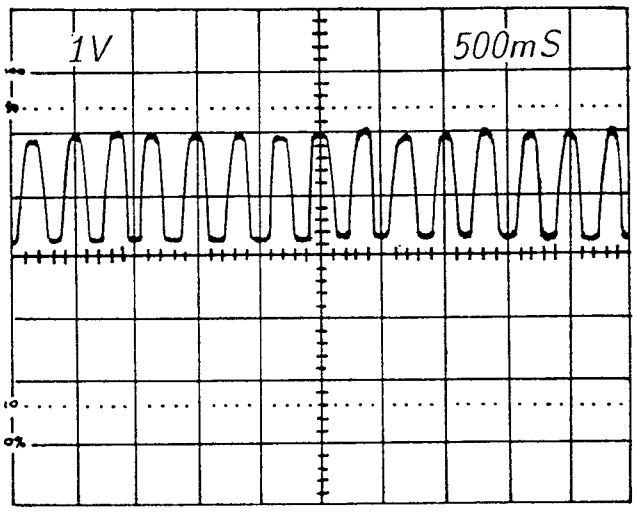


Fig. 3-28. TP5272 (red)

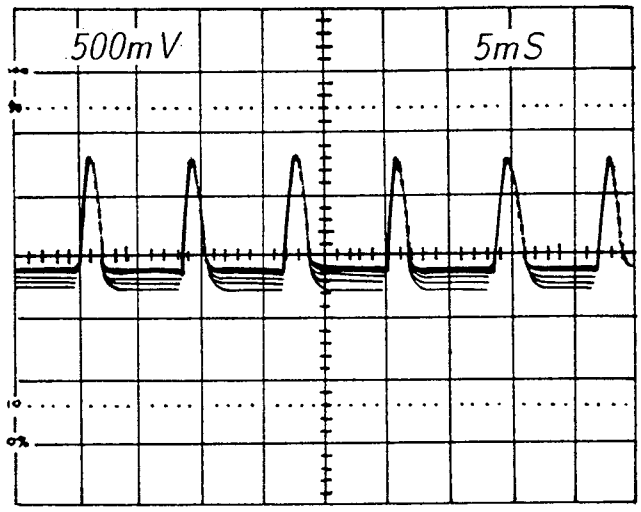


Fig. 3-29. TP6151 (yel)

Voltage Test Points

The following readings may be obtained using a DMM.

Table 3-1

Test Point Voltages

TEST POINT	CONDITIONS	READINGS
TP5124 (orn)	Chart Recorder No Run Chart Recorder Run	0 V +5 VDC
TP5168 (blu)	Chart Recorder No Run Chart Recorder Run	+2 VDC 0 V
TP5169 (grn)	Chart Recorder No Run Chart Recorder Run	+12 VDC 0 V
TP5253 (blk)	None	0 V (Common)
TP2134 (red)	Vary POSITION control	-3 VDC to +2.5 VDC
TP2157 (yel)	RECORD Switch Off/On	-5 VDC to +5 VDC
TP2158 (blk)	None	0 V (Common)
TP4243 (blu)	Instrument On	100 mVDC
TP4251 (blk)	None	0 V (Common)
TP6129 (blu)	Instrument On	+12 VDC (Battery)
TP6218 (orn)	Instrument On	-5 VDC
TP6227 (grn)	Instrument On	+5 VDC
TP6256 (red)	Instrument On	+25 VDC
TP6332 (blk)	None	0 V (Common)
TP6411 (vio)	Instrument On	+10 VDC

NOTE: These are nominal values. For exact specifications, refer to the text or the appropriate schematics.

CALIBRATION PROCEDURE

Table 4-1

TEST EQUIPMENT REQUIRED FOR CALIBRATION

NOTE: Calibration Procedure assumes use of Tektronix test equipment

Equipment	Performance Requirements	Example
Power Module Mainframe		Tektronix TM 504
Digital Multimeter	Range 0-200 VDC	Tektronix DM 502
Pulse Generator	50 µs period 2.5 µs pulse Variable DC level 5 V pulse	Tektronix PG 502
Time-Mark Generator	5 µs to 10 ns markers	Tektronix TG 501
50 Ω Terminator	50 Ω ±2%	Tektronix Part No. 011-0123-00
Adapter, BNC Female-to-Female (2 required)		Tektronix Part No. 103-0028-00
Adapter, BNC Male-to-Dual Binding Post		Tektronix Part No. 103-0035-00
Adapter, BNC Female-to-Dual Banana Plug		Tektronix Part No. 103-0090-00
Coaxial Cables (3 required)	50 Ω, 36-inch, BNC	Tektronix Part No. 012-0482-00
Adapter, BNC Male-to-Probe		Tektronix Part No. 013-0130-00
Adapter, BNC-to-Precision Short	Known impedance	Tektronix Part No. 017-0064-00
Precision (GR) Short	Low inductance	Tektronix Part No. 017-0087-00
1X Probe		Tektronix P6101A
10X Attenuator	50 Ω BNC	Tektronix Part No. 011-0059-02

PERFORMANCE CHECK

Introduction

To ensure accuracy of the 1502, performance should be checked after every 1000 hours of operation, or every six months if used infrequently. The battery pack should be inspected after every 500 hours of operation, or every six months, whichever occurs first. If the battery pack shows evidence of venting or corrosion, replace the entire battery pack rather than individual batteries.

We recommend that the basic performance check be done before attempting calibration. The performance check should identify most conditions that call for repair and calibration.

Tektronix provides complete repair and calibration services at its Service Centers. Contact your Tektronix representative for further information.

NOTES

The 1502 standard instrument is described in the performance-check/calibration procedures. Deviations affecting the Metric version (Option 5) are printed in italics and enclosed in parentheses following standard version entries.

When using the more sensitive ranges of the FEET/DIV *(METRES/DIV) control, the 0.3 foot between the CABLE connector and sampler inside the instrument should be deducted from your measurement to achieve more accuracy.*

Circuit schematics pertaining to the performance check and calibration procedures are in the Diagrams and Circuit Board Illustrations *section of this manual.*

PERFORMANCE CHECK PROCEDURE

1. Set-up

A. Make sure battery pack is attached to instrument. Connect instrument to a properly grounded AC power source. *Do not operate instrument unless battery pack is in place.*

B. Pull POWER switch on and set INTENSITY midrange. **Allow instrument to warm up for at least 20 minutes before proceeding with the performance check.**

C. Set front panel controls as follows:

CABLE	50Ω Terminator
INTENSITY	Midrange
ZERO REF (SET)	As needed
POSITION	Midrange
mp/DIV	500
DISTANCE	000
NOISE FILTER	Out
FEET/DIV	200
(METRES/DIV)	*(50)*
Multiplier	X1
SOLID POLY	In
SOLID PTFE	Out
OTHER	Out
VAR	Fully clockwise

2. Vertical Gain

A. Adjust FOCUS and INTENSITY controls for a clear, bright trace. Adjust POSITION and GAIN controls for a four division high pulse (see Fig. 4-1). *NOTE: If this specification cannot be met, check performance of gain amplifier or vertical amplifier circuits on Vertical Board.*

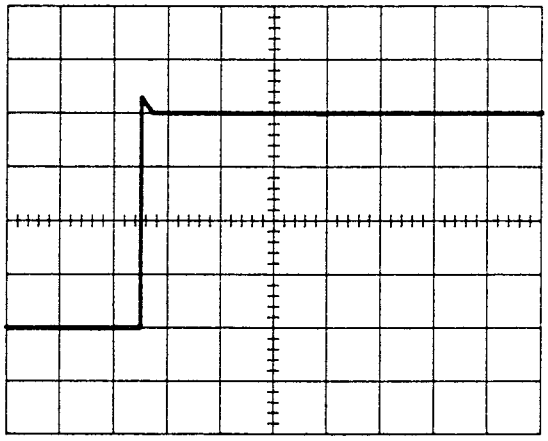


Fig. 4-1. Correct Pulse Display

B. Set the FEET/DIV control to 20 *(METRES/DIV to 5)*. Adjust the ZERO REF (SET) control to move the pulse to center screen.

C. Turn the GAIN control fully counterclockwise, then fully clockwise. The amplitude of the pulse in the clockwise position should be at least 3.5 times greater than the amplitude in the counterclockwise position (example: if the height of the pulse with the GAIN control fully counterclockwise is 2 divisions high, the height of the pulse with the GAIN control fully clockwise must be 7 divisions (3.5 x 2) high or greater).

3. Loop Gain

A. Set front panel controls as follows:

mρ/DIV	200
FEET/DIV	20
(METRES/DIV)	*(5)*
ZERO REF (SET)	Pulse midscreen
Multiplier	X1

B. Adjust the GAIN control for a pulse exactly five divisions high.

C. Check that the over-shoot on the upper front corner of the pulse is no higher than 1 minor division and no less than a square corner (see Fig. 4-2).

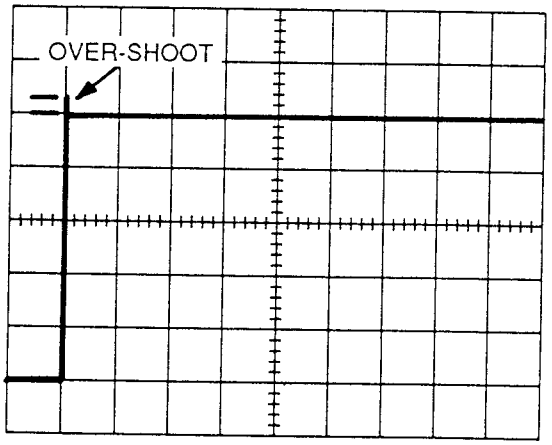


Fig. 4-2 Loop Gain

4. Double Strobing

A. Set front panel controls as follows:

mρ/DIV	500
FEET/DIV	1
(METRES/DIV)	*(0.25)*
Multiplier	X.1

B. Remove the 50 Ω terminator from the CABLE connector and attach the BNC probe adapter. Center the pulse with the POSITION and ZERO REF (SET) controls (see Fig. 4-3a).

C. Verify that the leading edge of the pulse DOES NOT have double strobing (see Figs. 4-3a and 4-3b).

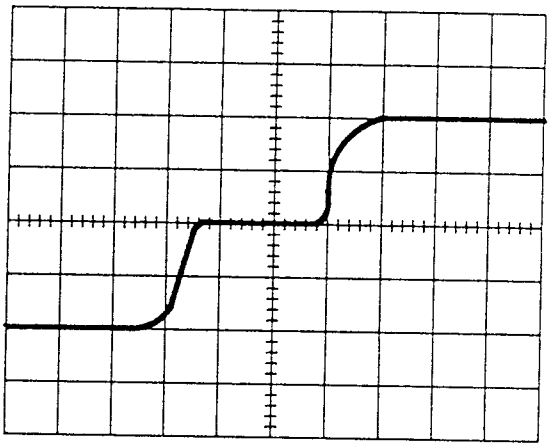


Fig. 4-3a. Pulse Without Double Strobing

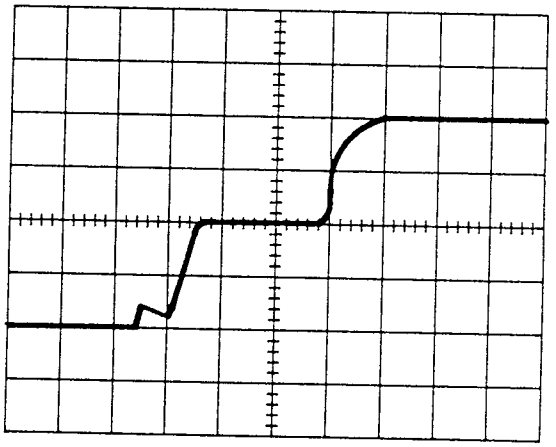


Fig. 4-3b. Pulse With Double Strobing

5. X.1/X1 Positioning

A. Set the Multiplier control to X1. Adjust the ZERO REF (SET) control to place the leading edge of the test pulse on the center vertical graticule line of the CRT.

B. Set the Multiplier control to X.1. The leading edge of the test pulse should stay within one major division of the center vertical graticule line.

6. Distance Cal

A. Set front panel controls as follows:

FEET/DIV	5
Multiplier	X.1
(METRES/DIV)	*(0.25)*
(Multiplier)	*(X1)*

B. Remove the BNC probe adapter from the front panel CABLE connector. Adjust the ZERO REF (SET) control to place the *trailing* edge of the pulse on the vertical reference graticule line (the one with the arrow, see Fig. 4-4a).

C. Attach the three (3) foot precision 50 Ω coaxial cable (Tek part number 012-0482-00) to the front panel CABLE connector.

D. The *leading* edge of the reflected pulse (second rising edge) should be 6.0 major divisions, ±1 minor division, from the vertical reference graticule line (Metric - 3.66 divs ±1 minor div). See Figs. 4-4a and 4-4b.

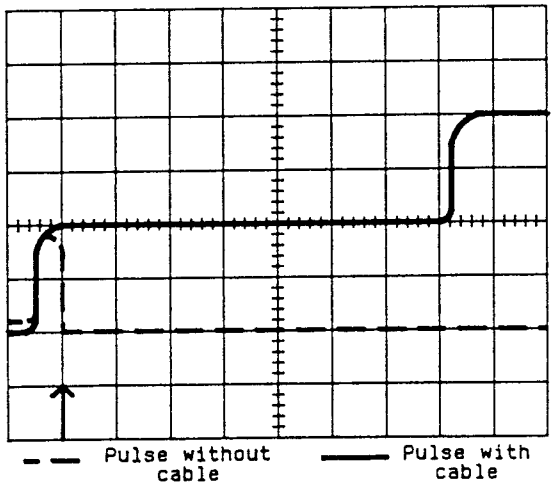


Fig. 4-4a Distance Cal - Std

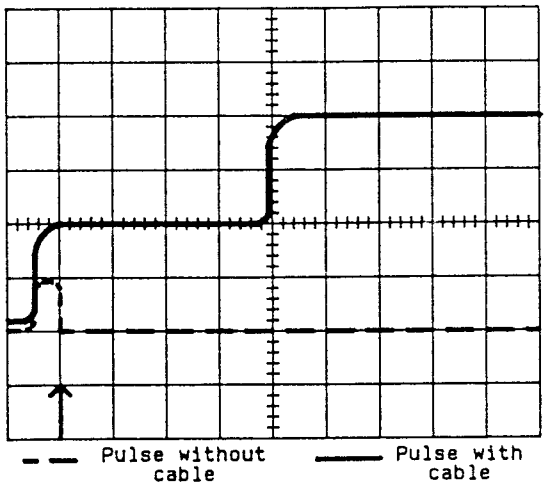


Fig. 4-4b Distance Cal - Metric

7. ZERO REF (CHECK)

A. Turn the DISTANCE dial control until the start of the *reflected* pulse is located on the vertical reference line.

B. Press the ZERO REF (CHECK) switch. The test pulse should return to the position it was at before the DISTANCE dial was turned. If the ZERO REF (CHECK) switch does not perform properly, check the performance of the distance offset, the fast ramp and the pulse comparator circuitry on the Main Board.

8. **Distance Dial**

A. Set the front panel controls as follows:

mρ/DIV	200
FEET/DIV	20
(METRES/DIV)	*(5)*
Multiplier	X1
DISTANCE	000

B. Adjust the ZERO REF (SET) control so that the reflected pulse is located on the 8th vertical graticule line from the vertical reference line (one major division away from the right graticule edge).

C. As the DISTANCE dial is turned, the readout of the reflected pulse on each descending vertical graticule line should be as shown in Table 4-2.

If the readings are different from the table, check the performance of the distance offset, the fast ramp and the sweep inverter circuits on the Main Board.

D. Return the DISTANCE dial to 000, set the Multiplier at X.1 and reset the reflected pulse to the 8th graticule line. With the DISTANCE dial control, move the reflected pulse to the vertical reference line. The dial should read 160 ±6.9 (Metric - 040 ±2.1).

E. Press the SOLID PTFE switch and repeat step D above.

F. Press the OTHER switch (VAR control must be fully clockwise) and repeat step D once again.

If readings are different from step D above, check the performance of the sweep inverter circuitry on the Main Board.

Table 4-2

DISTANCE DIAL READINGS

GRATICULE LINE	DISTANCE DIAL READING	
	Standard	Metric
8	000	000
7	020 ±1.3	*005 ±0.7*
6	040 ±2.1	*010 ±0.9*
5	060 ±2.9	*015 ±1.1*
4	080 ±3.7	*020 ±1.3*
3	100 ±4.5	*025 ±1.5*
2	120 ±5.3	*030 ±1.7*
1	140 ±6.1	*035 ±1.9*
0	160 ±6.9	*040 ±2.1*

9. **Horizontal Jitter**

A. Set the FEET/DIV control to 1 *(METRES/DIV at 0.25)* and the Multiplier to X1. Release the OTHER button (all push buttons should be out). Disconnect the cable from the CABLE connector and connect the 50 Ω terminator. Adjust the ZERO REF (SET) and POSITION controls so that the pulse is on screen. Check that the horizontal jitter is not greater than 0.2 division (see Fig. 4-5).

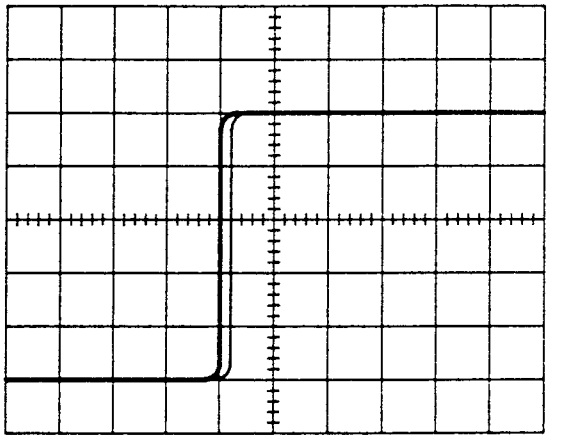


Fig. 4-5. Horizontal Jitter

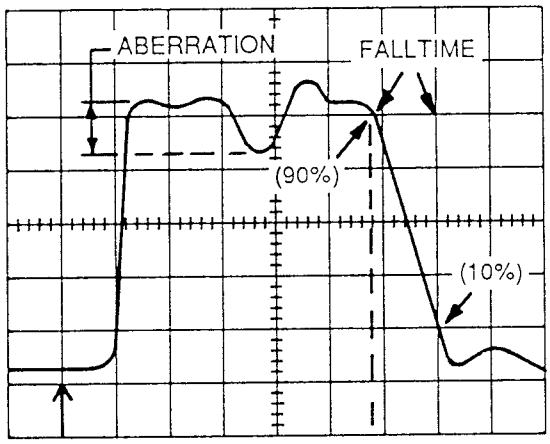


Fig. 4-8. Opt 02 Falltime/Aberration

If instrument failed any performance check, proceed with calibration procedure. Entire calibration procedure must be done in sequence starting with Power Supply Check.

CAUTION

STATIC DISCHARGE CAN DAMAGE MANY SEMI-CONDUCTOR COMPONENTS USED IN THIS INSTRUMENT.

Many semiconductor components can be damaged by static discharge. Damage may not be catastrophic, therefore not immediately apparent. Before proceeding to the Calibration Procedure, observe the following precautions:

1. *Make sure work station, test equipment, and instrument are connected to earth ground.*
2. *Hold IC devices by the body rather than the terminals.*
3. *Use containers made or filled with conductive material for storage or transportation of static sensitive devices.*
4. *When replacing static sensitive components, wear a wrist strap connected to earth ground.*

CALIBRATION PROCEDURE

Introduction

Use the calibration procedure to restore the 1502 to its original performance if the instrument failed any performance check, does not meet electrical standards listed in Table 1-2 of Instrument Specifications section, or has undergone repairs involving component removal and replacement.

1. Case Removal

A. Remove battery pack from back of instrument. Remove instrument's front cover.

B. Loosen the four screws on back of case and set instrument face up on flat surface. Swing handle out of way of front panel. Break chassis seal by pushing downward on handle pivots on each side of case with both hands.

C. Grasp case with one hand, and lift chassis out with other hand. Lift by grasping outside perimeter of front panel. Do not lift on front-panel controls.

D. Remove EMI shields from top and bottom of chassis by carefully prying from the chassis slots.

E. The instrument is made so that its interior is protected from dust. However, dust may enter the instrument if it is operated in dusty environments with the plug-in compartment left empty. If interior of instrument is dusty, first blow off any accumulated dust with low-pressure air. Then remove the dirt that remains with a soft brush, cotton swab or pipe cleaner dipped in isopropyl alcohol.

CAUTION

Avoid using cleaning agents that contain benzene, toluene, xylene, acetone or similar solvents because they may damage plastics in the instrument.

2. Visual Inspection

A. Visually inspect circuitry for obvious defects such as broken connections and components, unconnected cables, improperly seated transistors, frayed wires, heat-damaged components and damaged boards. Correct the visible defects before proceeding with the calibration.

If boards, transformers or the CRT must be replaced, refer to Maintenance section of this manual.

Heat damage usually indicates a circuitry problem that must be corrected before proceeding with the calibration. *NOTE: electrical checks of individual semiconductors is not recommended. Electrically defective semiconductors will show up during instrument operation.*

DANGER

Use extreme caution when operating instrument with case removed. Up to 170 V may be present in exposed areas.

3. Power Supply Check

A. Check that the instrument POWER switch is in the off position (pushed in).

B. Connect a female banana jack connector to a coaxial cable via a 2 ended female BNC connector.

1. Plug the banana jack onto the battery terminals from the back of the instrument with the black ("–" or negative) side closest to the CRT.
2. Connect the other end of the coaxial cable to the variable power supply (Ground to the "–" or black side).

C. Set the DM502 range switch to 20 DC VOLTS.

D. Connect the HI lead (red) from the DM502 to the yellow test point (TP6131) on the power supply board (see Fig. 4-9).

E. Connect the LO lead (black) from the DM502 to the black test point (TP6332) on the power supply board (see Fig. 4-9).

F. Adjust the variable power supply for an output voltage indication on the DM502 of 12 volts.

G. Set the variable power supply front panel to measure current.

H. Apply power to the 1502 by pulling out the POWER switch.

I. Check that the current, as indicated by the meter on the variable power supply, is about 250 mA. The current should never exceed 300 mA. If the current drawn is high, immediately remove the power by pushing the POWER switch in.

J. Connect the HI (red) lead from the DM502 to the violet test point (TP6411 - see Fig. 4-9).

K. Adjust R6514 (+10 ADJ - see Fig. 4-9) for an indication of +10.0V on the DM502.

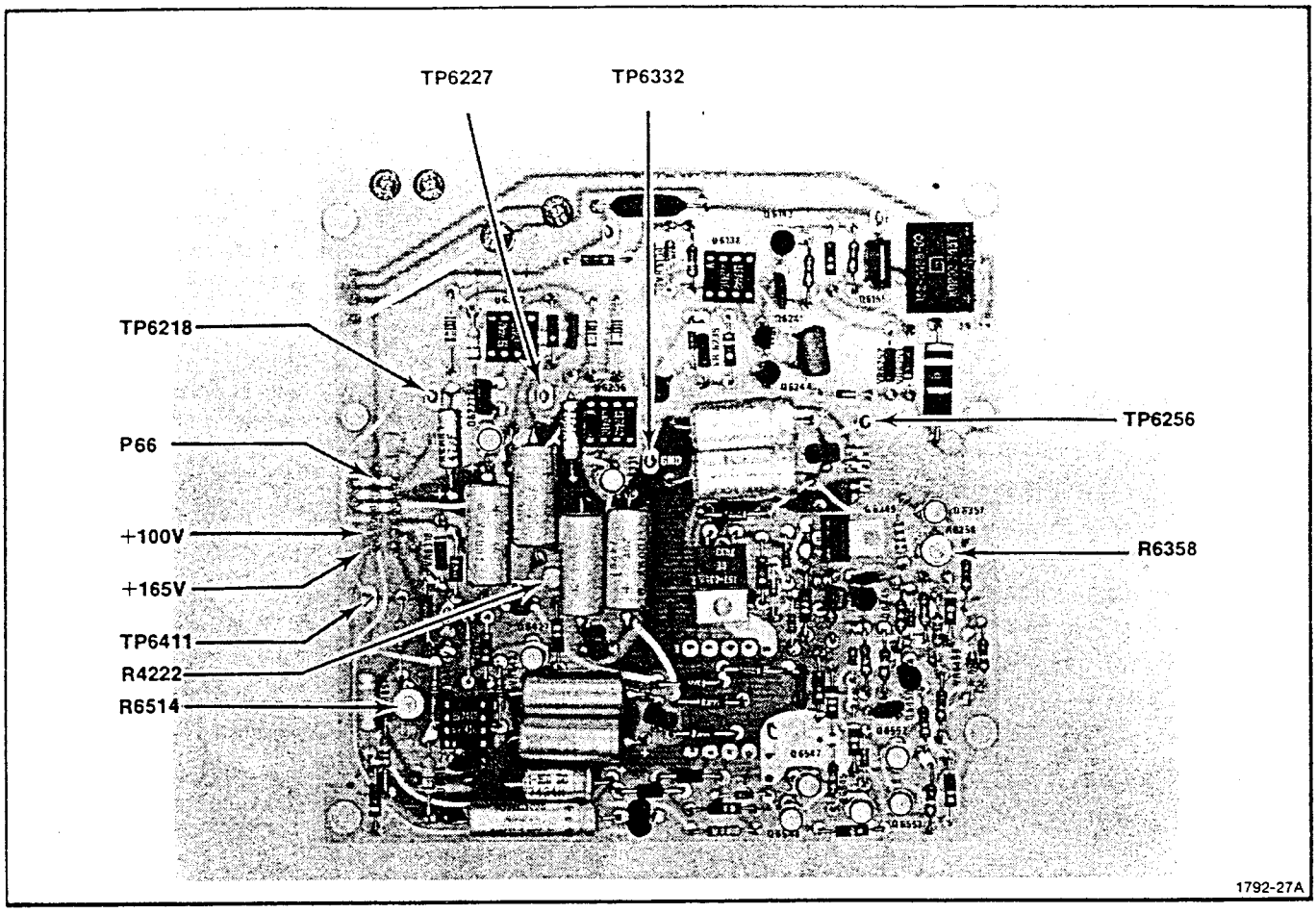


Fig. 4-9. Power Supply Test Points

L. Connect the HI (red) lead from the DM502 to the red test point (TP6256, +25).

M. Set the DM502 range switch to 200 DC VOLTS.

N. Adjust HV ADJ (R6358) for an indication of +25.0V on the DM502. Check the power supplies as per the table below.

SUPPLY	TEST POINT	DM502 DISPLAY
+5V	TP6227 (GRN)	4.75 to 5.25
-5V	TP6218 (ORN)	-4.75 to -5.25
+100V	+end of C6527	90 to 110
+165V	+end of C6529	155 to 175

4. Battery Meter

A. Set the DM502 range switch to 20 DC VOLTS.

B. Connect the HI (red) lead from the DM502 to the yellow test point (TP6131).

C. Place the 1502 in a horizontal position.

D. Adjust the variable power supply until the BATTERY meter needle (1502 front panel) is pointing to the line separating the red and green areas on the meter face.

E. Check that the input voltage to the instrument, indicated by the DM502, is from +10.60 to +11.00 (10.8V ±0.2V).

5. Battery Deep-Discharge Circuit

The NiCad battery pack used in this instrument can be damaged if allowed to discharge below a certain voltage. To prevent this, a circuit is incorporated in the power supply to shut the instrument off when the battery voltage drops to a certain level, approximately +9.5 VDC.

A. Slowly decrease the voltage of the variable power supply to a point where the 1502 stops working (no trace on the CRT).

B. Check that the input voltage to the instrument, indicated by the DM502, is greater than 9.5 volts.

C. Increase the voltage of the variable power supply until a reading of +12.0 volts is indicated by the DM502.

D. Check that the trace has not returned to the 1502 CRT. Turn off the instrument, wait 5 seconds then turn on and make sure the trace returns. Turn off the 1502.

E. Remove the DM502 test leads.

6. Battery Charging Circuit

A. Unplug the coaxial cable from the variable supply and attach it to a banana plug. Plug in the banana plug so the GRD side is connected to the negative side of the battery.

B. Set the DM502 range switch to 200mV, DC VOLTS.

C. Connect the black lead from the DM502 to the blue test point (TP6129).

D. Connect the red lead from the DM502 to the yellow test point (TP6131).

E. Plug the instrument into the appropriate AC power source (115 or 230 V).

F. Check that the voltage as indicated by the DM502 is from +30.0 to +60.0 mV.

G. Turn 1502 POWER on and re-check Step F above.

7. Check Intensity Limit

A. Set the front panel INTENSITY control fully on (clockwise). Turn the FOCUS full clockwise to defocus the trace.

B. Connect the LO (black) lead from the DM502 to the black test point (TP6332).

C. Connect the HI (red) lead from the DM502 to the blue test point (TP4243) on the bottom of the high voltage board (see Fig. 4-10).

D. Check Intensity Limit for a reading of 90 - 100mV as indicated by the DM502. Adjust R4222 if necessary. R4222 is on the H.V. board and is accessible through a hole in the power supply board (see Fig. 4-9).

E. Return the INTENSITY and FOCUS controls to normal viewing levels.

F. Remove the DM502 test leads.

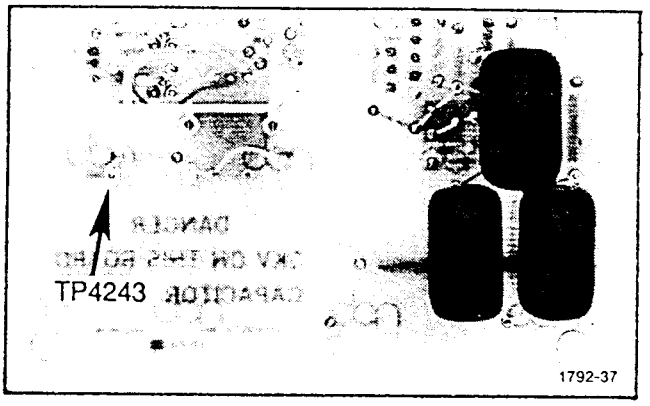


Fig. 4-10. 2000V Test Point

8. CRT Checks and Adjustments

A. Set front panel controls as follows:

NOISE FILTER	out
mp/DIV	500
POSITION	trace on screen

B. Adjust INTENSITY for normal viewing level.

C. Adjust front panel FOCUS and R3242 (ASTIGMATISM, Output Amp board) for a sharply focused trace. This can be checked with a pulse for the best focus.

D. Set the trace to the center graticule line with the POSITION control. Move the pulse off screen with the ZERO REF (SET) control.

E. Adjust R3143 (TRACE ROTATION, Output Amp board) so the trace is parallel to the center graticule line. Check that there is no deviation greater than .1 division (see Fig. 4-11).

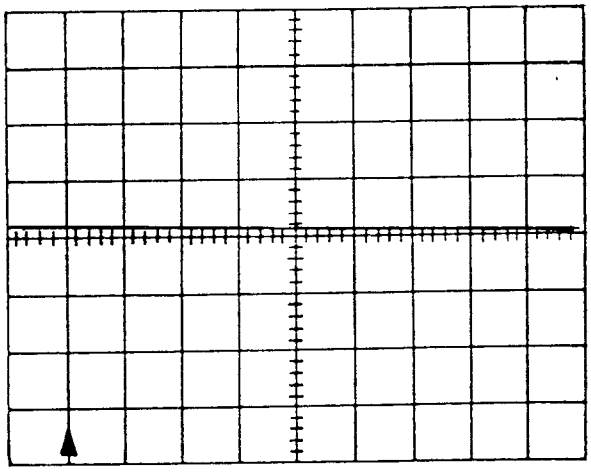


Fig. 4-11. Trace Rotation

F. Set the trace to the bottom graticule line on the CRT with the POSITION control. It will probably be necessary to readjust the FOCUS.

G. Adjust R3248 (GEOMETRY, Output Amp board) for less than 0.2 divisions of deviation from the graticule line (see Fig. 4-12).

NOTE: The adjustment will probably be near the counterclockwise stop.

H. Check the trace at the top and bottom graticule lines for no deviation greater than 0.2 divisions (one minor marking).

NOTE: The mp/DIV may need to be changed to 100 to check the trace at the top of the screen.

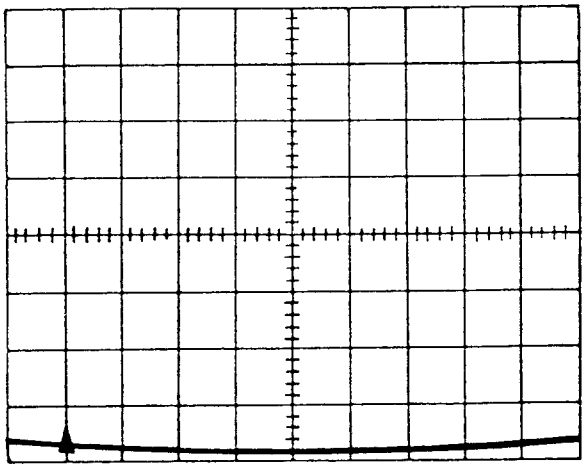


Fig. 4-12. Horizontal Geometry

9. Horizontal Calibration

A. Horizontal Gain and Offset

1. Set mp/DIV control to 500. Adjust POSITION/FINE controls to position baseline of display on horizontal centerline of CRT.
2. Turn R3217 (HORIZ GAIN) on Output Amps Board fully counterclockwise.
3. Adjust R3213 (HORIZ POSITION) on Output Amps Board to center trace midscreen.
4. Press and hold RECORD switch while adjusting R3217 (HORIZ GAIN) so that dot at start of sweep is on or just to left of graticule area on CRT. Release RECORD switch. Sweep should cover all ten divisions of CRT before returning to normal sweep mode.

B. Timing Set-Up

1. Turn 1502 POWER switch off. Turn 1502 upside down and remove the shield that covers the sampling circuits on the Main Board. Remove U1575 from its socket on Main Board (see Schematic 1).
2. Attach 50Ω coaxial cable from MARKER OUT terminal on time-mark generator to the X5 attenuator, then connect the attenuator to CABLE connector on 1502 front panel. Attach a second 50Ω coaxial cable between the +TRIGGER OUT terminal on time-mark generator and +TRIG/DURATION INPUT on pulse generator.

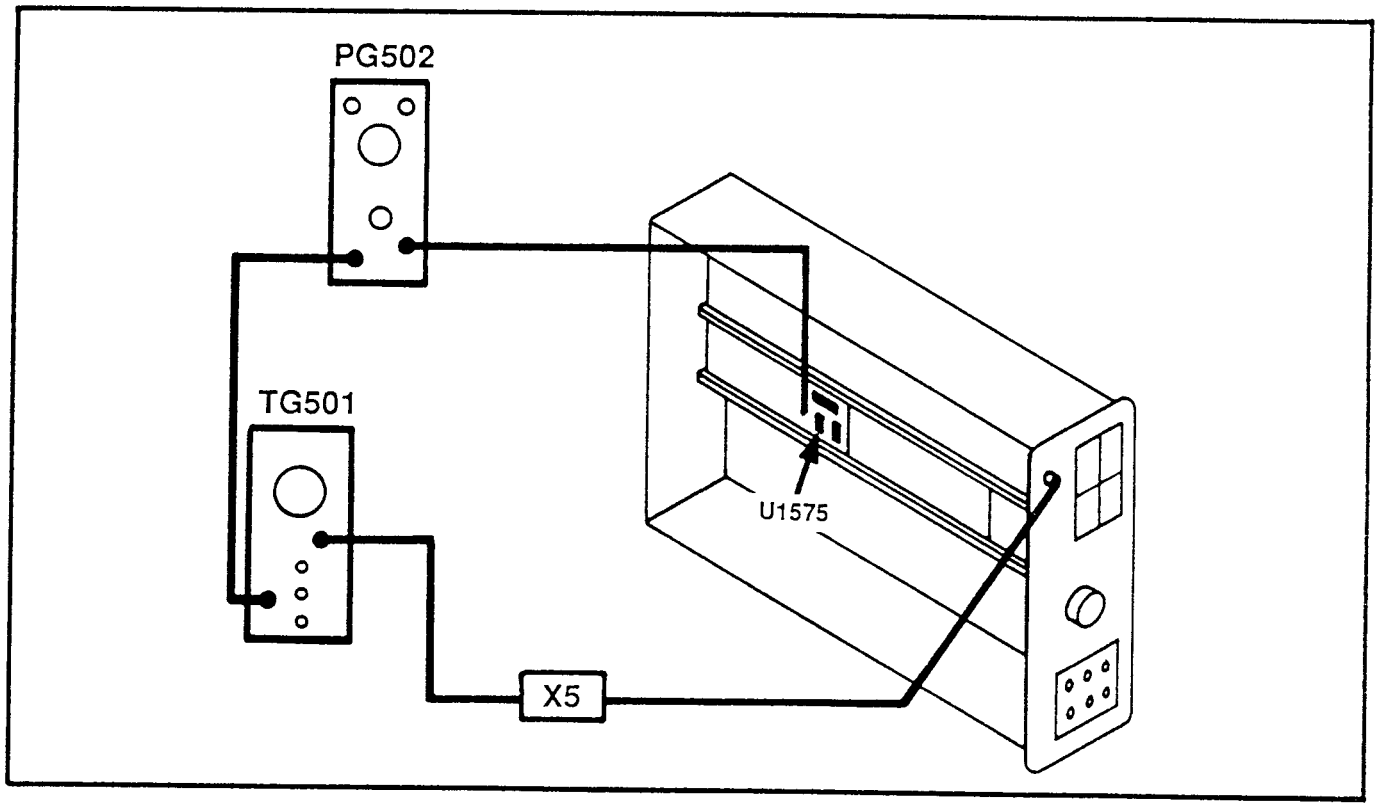


Fig. 4-13. Set-Up Configuration.

3. Set front panel controls as follows:

mρ/DIV	200
FEET/DIV	100
(METRES/DIV)	*(25)*
Multiplier	X1
DIELECTRIC	Switches out
DISTANCE	000

4. Set pulse generator controls as follows:

PLS DURATION	50 µs
PLS VARIABLE	Full ccw
PERIOD	Ext Trig
LOW OUTPUT	-1.5
HIGH OUTPUT	2.0
(Metric)	*(2.5)*
BACK TERM	Out
Pushbuttons	Out

5. Set time-mark generator for 0.2 µs *(0.5 µs metric)* marks. Connect 1X probe from OUTPUT cable on pulse generator to RED test point (TP1581) on Main Board (see Schematic 1). Turn 1502 POWER switch on.

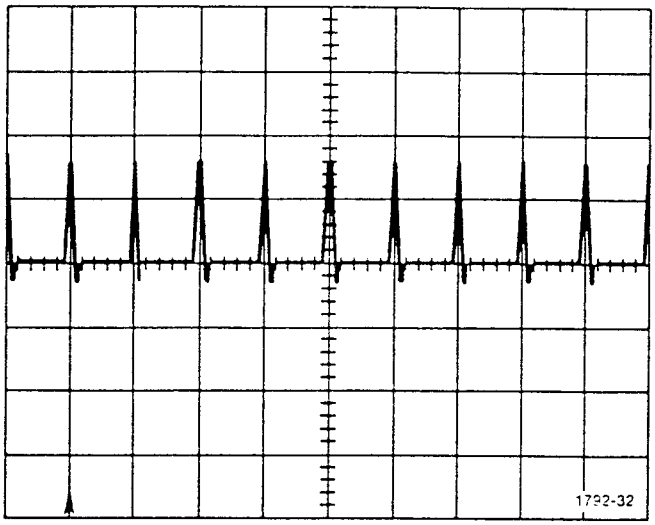


Fig. 4-14a. Standard Time Marks

6. Adjust 1502 front-panel controls until a waveform similar to that in Figure 4-14a (Figure 4-14b metric) appears on CRT. Adjust OUTPUT VOLTS (Low Level) on pulse generator and DISTANCE dial on 1502 so that time marks are aligned with vertical graticule lines. *NOTE: time marks must not exceed 0.85 V amplitude to keep tunnel diode in low state.*

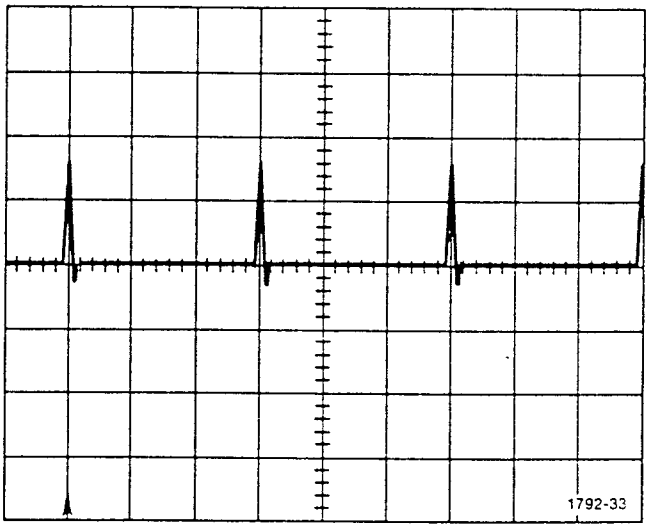


Fig. 4-14b. Metric Time Marks

7. If the instrument will be used with a Tektronix Y-T Chart Recorder (Option 04), proceed as follows. If not, skip to Step 11.

C. Chart Recorder Check

1. Pull the Chart Recorder paper out of the Chart Recorder to align the red mark, visible through the holes on the left of the paper, with a major (dark) line on the paper.

NOTE: If the paper isn't protruding from the chart recorder, push the RECORD switch up and release. This will start the chart running. Wait until about 1 inch of paper is out, then push the POWER switch in to shut off the Chart Recorder. Wait about 5 seconds and pull the POWER switch out.

WARNING

The design of the 1502 is such that if the power switch is turned OFF and back ON rapidly, the 1502 will stop working (latch up). If this should happen after the last step, turn POWER OFF, wait a full 5 seconds and re-apply power.

2. Push the RECORD switch up, hold and adjust STYLUS POSITION to position the stylus mark to about the same position as the baseline of the trace on the CRT. Hold 2 seconds (to heat the stylus), and release the RECORD switch.

3. After the chart is completed, tear off the paper and check that the chart is the same as on the CRT, ±1 minor div. The marks must fall within 0.2 div (1 minor) of the major markings. If they do not, readjust the timing using the following steps:

   A. Use the horizontal gain (R3217, output board) to match the CRT to the chart. Example: If the chart has 8 marks per 7.8 divs, adjust R3217 until the CRT shows 8 marks per 7.8 divs.

   B. Readjust ft/div (R1435, main board) to bring the CRT display back to 8 marks per 7.9 divs (3/6 for metric).

   C. Run another chart and examine it for accuracy. The specification for chart recorder timing is ±1 minor division, but it can usually be brought much closer than that. Repeat steps A and B if necessary.

   D. Make the above adjustment without regard to where the lines fall in relation to the major marks (dark lines) on the chart paper.

4. After a chart has been obtained that matches the CRT display for horizontal gain, note how far the second pulse on the chart is away from a major (dark) line. Adjust, if necessary, R3213 (Horizontal Position) on the Output Amplifier board to match the CRT display to the chart and make sure that the dot at the beginning of the Record Sweep is to the left of the first graticule line.

   A. Use the Horizontal Position (R3213, output board) to match the CRT to the chart. Example: If the chart is 1/2 minor (one of the lightest lines) from the major line when the CRT display is on a major graticule line, use R3213 to move the CRT display over 1/2 minor to the right. Use the DISTANCE dial to return the display to the major line.

D. Timing Adjust and Check

1. Adjust R1435 (FT/DIV CAL) on the Main Board so that there are 8 time-marks over the center 7.9 divisions, not counting the reference time-mark one division in from the left (see Fig. 4-13a). Adjust the DISTANCE dial to keep the reference time-mark aligned with the first graticule line in from the left.

   (Metric: Adjust R1435 (FT/DIV CAL) on the Main Board so that there are 3 time-marks over the center 5.9 divisions (see Fig. 4-13b).

2. Check the remaining FEET/DIV settings as per Table 4-3 (METRES/DIV as per Table 4-4).

Table 4-3

Feet/Division Time-Marks

FEET/DIV	TG 501	MARKS PER 7.7-8.1 divs
200	.2µs	16
50	.1µs	8
20	20ns	16
10	20ns	8
5	10ns	8
2	10ns	4/10 divs
1	10ns	2/10 divs

Table 4-4

Metres/Division Time-Marks

METRES/DIV	TG 501	MARKS PER 5.7-6.1 divs
50	1µs	3
10	.1µs	5
5	.1µs	3
2.5	50ns	3
1	20ns	3
0.5	10ns	3
0.25	10ns	1

3. Set FEET/DIV control to 100, Multiplier to X.1 and time-mark generator to 20 ns.

   (Metric: Set METRES/DIV control to 50, Multiplier to X.1 and time-mark generator to .1 µs).

4. Adjust C1332 (X.1 CAL) on the Main Board so that there are 8 time-marks over the center 7.9 divisions, not counting the reference time-mark one division in from the left.

   (Metric: Adjust C1332 (X.1 CAL) on the Main Board so that there are 3 time-marks over the center 5.9 divisions.)

E. DISTANCE Dial

1. Set front panel controls as follows:

FEET/DIV	100
(METRES/DIV)	*(25)*
Multiplier	X1
DISTANCE	000
DIELECTRIC	Switches out

2. Set the time-mark generator for 5µs.

3. Select a time-mark and adjust the OUTPUT (VOLTS) (Low Level) control on the pulse generator to place the mark on the first graticule line in from the far right edge.

4. Set the DISTANCE dial to 808 (metric to 202) while following and noting the position of the time-mark from step 3.

5. After 808 (metric 202) is reached, adjust R1315 (DIST.CAL) on the Main board to move the time-mark to the first graticule line in from the far left edge.

6. With the time-mark on the first graticule line in from the left, depress the ZERO REF CHECK pushbutton and check that the time-mark returns to the first graticule line in from the right.

7. Check the DISTANCE dial as per Table 4-5.

NOTE: The numbers in Table 4-5 are the correct reading ±2% + .5ft/.5m. During active use in the field, the DISTANCE readings will be affected by any error or drift in the horizontal timebase.

Table 4-5

DISTANCE Dial Check

Graticule Line From Left Edge	Standard	Metric
1	784 - 816	196 - 204
2	686 - 714	171.5 - 178.5
3	588 - 612	147 - 153
4	490 - 510	122.5 - 127.5
5	392 - 408	98 - 102
6	294 - 306	73.5 - 76.5
7	196 - 204	49 - 51
8	98 - 102	24 - 26

8. Turn off the 1502 and disconnect all test equipment. Reinstall U1575 on the Main Board. Reinstall the sampler shield.

9. Turn on the 1502. Set mρ/DIV control to 200 *(500 metric)*, FEET/DIV control to 1 *(2.5 metric)* and turn DISTANCE dial to 000.

F. **X.1 Positioning**

1. Attach a 50 Ω coaxial cable to CABLE connector. Set Multiplier to X1.

2. Adjust ZERO REF (SET) control to position leading edge of test pulse on vertical reference line. Set Multiplier to X.1.

3. Leading edge of test pulse should be within one division of vertical reference line. If not within spec, adjust R1132 (X.1 POS CAL) on Main Board so that leading edge of test pulse is within one division of vertical reference line.

NOTE: This adjustment drifts with temperature. Make sure the instrument is fully warmed up before setting R1132.

10. Vertical Calibration

NOTE: Most of the following steps interact. For example:

- *The snapoff/avalanche affects the noise and falltime*
- *TD bias affects falltime and aberrations*
- *The number of aberrations affect the falltime (more aberrations produce faster falltime.*
- *Loop gain affects noise*

A. TD Bias

NOTE

In order to adjust TD Bias for full instrument efficiency, you must use either a 2000 foot, 50 Ω coaxial cable or a 75 Ω simulator attached to the CABLE connector. A simulator can be built as per Figure 4-15.

Parts List and Schematic

10	46μH Coils	108-0360-00
10	.0047μF 500 WVDC Caps	283-0083-00
10	.0033μF 100 WVDC Caps	283-0051-00
1	75 Ω coax, 42" long	012-0074-00
2	Female BNC's	131-0955-00
1	Suitable mounting box	

BNC on output is for holding the coil/cap assembly in place.

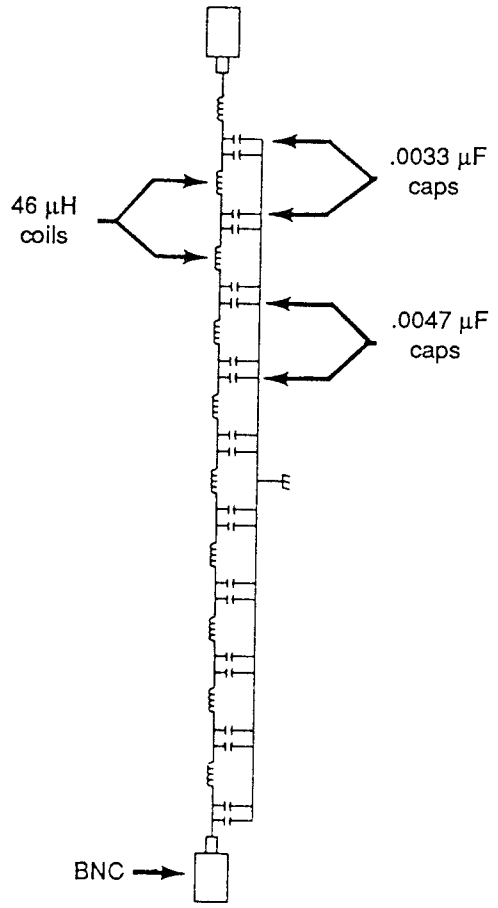


Fig. 4-15. 75 Ω Simulator

A. TD Bias (con't)

1. Attach the 75Ω simulator, if used, to the front panel CABLE connector and set-up as follows. If the 2000 foot cable method is used, attach the cable to the front panel CABLE connector and skip to step 3.

2. Set front panel controls as follows for 75Ω simulator:

mρ/DIV	200
FEET/DIV	1
(METRES/DIV)	*(0.25)*
Multiplier	X.1
ZERO REF (SET)	Pulse on screen

Go to step 4.

3. Set front panel controls as follows for 2000 foot cable:

mρ/DIV	500
FEET/DIV	200
(METRES/DIV)	*(50)*
Multiplier	X1
ZERO REF (SET)	Pulse on screen

4. If the test pulse does not appear, or the leading edge of the pulse is noisy, proceed as follows. Otherwise, skip to section G.

5. Turn R1692 (TD BIAS) on the Main Board fully counterclockwise.

6. Slowly adjust R1692 clockwise until the test pulse appears on the CRT.

CAUTION

Adjusting the TD Bias may affect the loop gain overshoot, the shape of the aberrations, the falltime and possibly the noise! If TD Bias is adjusted, you should go back to section A (Loop Gain) and recheck sections A through F to make sure one of the previous tests has not gone out of spec.

B. Loop Gain

1. Set front panel controls as follows:

mρ/DIV	200
FEET/DIV	20
(METRES/DIV)	*(5)*
Multiplier	X1
DISTANCE Dial	000
DIELECTRIC	Switches out
VAR	Full cw
CABLE	50Ω term

2. Adjust ZERO REF (SET) and POSITION controls to position the pulse as in Figure 4-16.

3. Adjust the gain pot on the front panel for exactly a 5 division high pulse.

4. Check that the over-shoot on the upper front corner of the pulse is no higher than 1 minor division and no less than a square corner.

   Adjust R1643 (LOOP GAIN on the Main board) if necessary (typically set the over-shoot for .5 minor division).

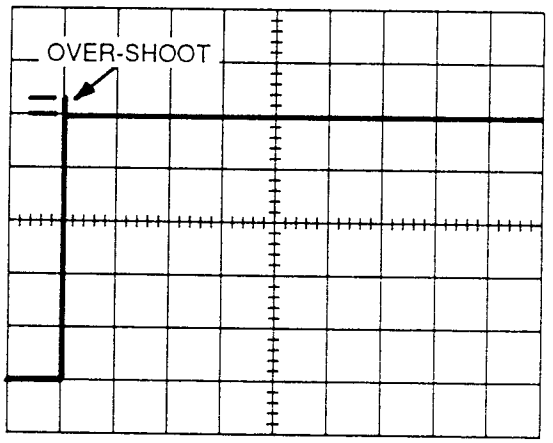


Fig. 4-16. Loop Gain

C. Double Strobing - Snapoff and Avalanche

Double Strobing

NOTE: If no double strobing is present, the following adjustments are not necessary. Go to step D. Aberrations.

A. Set front panel controls as follows:

mρ/DIV	500
FEET/DIV	1
(METRES/DIV)	*(0.25)*
Multiplier	X.1

B. Remove the 50 Ω terminator from the CABLE connector and attach the BNC probe adapter. Center the pulse with the POSITION and ZERO REF (SET) controls (see Fig. 4-3a).

C. Verify that the leading edge of the pulse DOES NOT have double strobing (see Figs. 4-3a and 4-3b).

Snapoff and Avalanche

A. Set front panel controls as follows:

mρ/DIV	500
FEET/DIV	1
(METRES/DIV	*(0.25)*
Multiplier	X.1
Cable	Probe Adaptor

B. Center the pulse on the screen (see Fig. 4-17).

C. Adjust R1525 (Avalanche) and R1538 (Snapoff) fully counterclockwise.

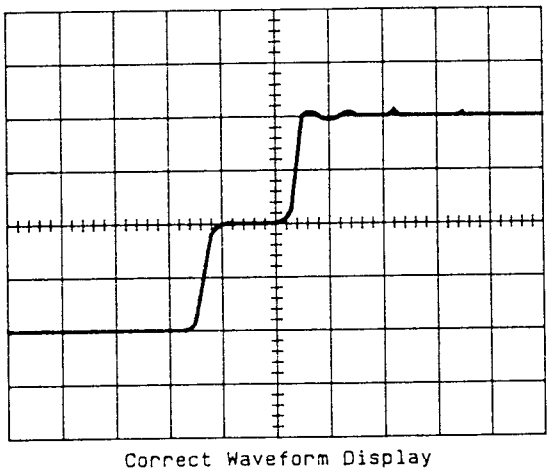
1. Turn the Avalanche pot until double strobing occurs, then adjust it back slightly.
2. Adjust the Snapoff pot the same as the Avalanche pot.
3. Check the pulse for no double strobing (see Fig. 4-17).

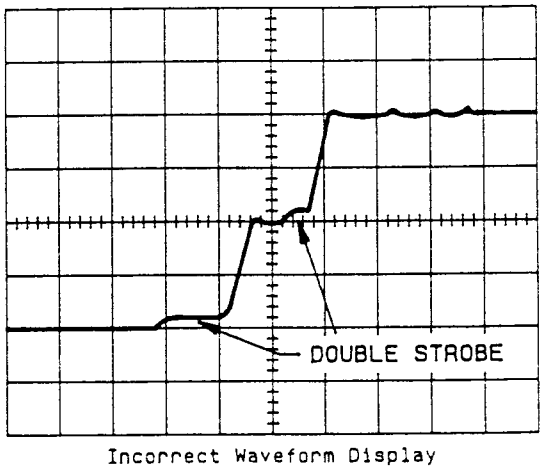
D. Turn the position pot fully counterclockwise. The high point of the pulse should go at least 1 minor division below the center graticule line.

E. Turn the position pot fully clockwise. The lowest point on the pulse should go at least 0.5 DIV above the center graticule line.

F. Change the mρ/DIV to 5 and turn the ZERO REF fully counterclockwise.

1. Center the trace on screen.
2. Turn the Snapoff counterclockwise until the minimum amount of noise is present. The LF comp (R1657) may need to be adjusted to reduce fuzziness on the noise.


Correct Waveform Display



Incorrect Waveform Display

Fig. 4-17. Snapoff and Avalanche.

3. Repeat step 2 for the Avalanche.
4. Check that the noise is less than ± 1.5 DIV peak in height.
5. Recheck for double strobing.

D. Aberrations

NOTE: If the 1502 has the Option 02 (static suppression diodes), skip to section F.

1. Set front panel controls as follows:

mρ/DIV	50
FEET/DIV	1
(METRES/DIV)	*(.25)*
Multiplier	X.1
ZERO REF (SET)	Full ccw

2. With the POSITION control, set the trace on the center graticule line.
3. Slowly turn the ZERO REF (SET) control clockwise until the front corner of the pulse appears at center screen (see Fig. 4-18).
4. Check that the aberrations stay within ±1 major division vertically from the center graticule line.
5. If the aberrations do not meet the spec in step 4, see the Aberrations section in the Stripline Troubleshooting Guide at the rear of the Calibration Section.

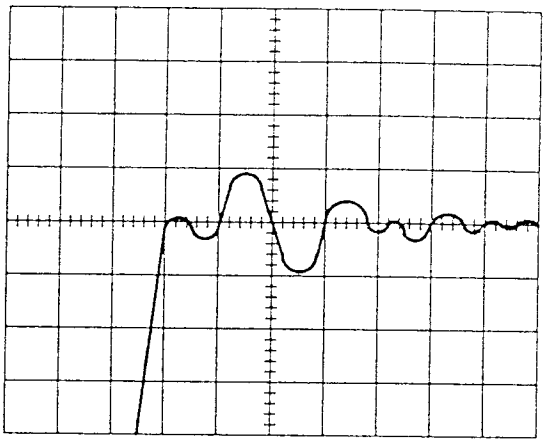


Fig. 4-18. Aberrations

E. Noise

1. Set front panel controls as follows:

mρ/DIV	5
ZERO REF (SET)	Full ccw
POSITION	Trace on Center Graticule

2. Check that the noise is less than or equal to ±1.0 major divisions (2 Divs peak-to-peak, ignore any random spikes). Adjust R1657 (LOW FREQ COMP on the Main board) for the lowest peak-to-peak noise level and best display resolution.

   NOTE: Battery charging pulses may be present within the noise if AC is plugged into the instrument. However, they may not exceed the noise spec. The ground strap from the power supply board to the chassis may be removed to help reduce the charging pulses.

3. Push in the NOISE FILTER button. Reposition the trace on the center graticule line. Check for less than or equal to ±0.4 major divisions (0.8 Divs peak-to-peak) of noise.

4. Release the NOISE FILTER button. Tap on the front panel near the CRT with your index finger. Check for microphonics (extra noise spikes or the whole noise band jumping around) caused by the tapping. The noise must stay within the spec in step 2 while tapping on the front panel. If the noise does go out of spec as a result of the tapping, see the Microphonics section in the Stripline Troubleshooting Guide at the rear of the Calibration Section.

**** Option 02 ONLY skip to section F. ****

F. Falltime

1. Set front panel controls as follows:

mρ/DIV	200
FEET/DIV	1
(METRES/DIV)	*(0.25)*
Multiplier	X.1
DIELECTIC	Switches out
CABLE	Precision (GR) Short
ZERO REF (SET)	Full ccw

2. With the POSITION control, set the trace exactly 1½ divisions up from the bottom graticule line.

3. Slowly turn the ZERO REF (SET) control clockwise until the pulse is on screen (see Fig. 4-19).

4. Set the pulse with the ZERO REF (SET) control (do not move the POSITION control) so that the bottom right corner of the pulse is touching any vertical graticle line and the second horizontal graticule line up from the bottom (see Fig. 4-19).

5. From the point at which the pulse intersects the second horizontal graticule line up from the bottom (10%), to the point where it intersects the second horizontal graticule line down from the top (90%) can be no more than 0.7 (metric 0.8) major divisions (see Fig. 4-19).

6. Go to section H (Option 02 ONLY tests follow).

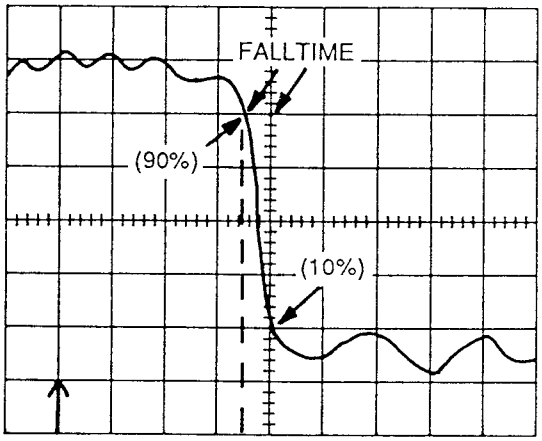


Fig. 4-19. Standard falltime

G. Option 02 Falltime and Aberration

1. Set front panel controls as follows:

mρ/DIV	200
FEET/DIV	1
(METRES/DIV)	*(0.25)*
Multiplier	X.1
DIELECTRIC	Switches out
CABLE	Precision (GR) Short
ZERO REF (SET)	Full ccw

Measure Falltime

2. With the POSITION control, set the trace exactly 1½ divisions up from the bottom graticule line.

3. Slowly turn the ZERO REF (SET) control clockwise until the pulse is on screen (see Fig. 4-20).

4. Set the pulse with the ZERO REF (SET) control (do not move the POSITION control) so that the bottom right corner of the pulse is touching any vertical graticule line and the second horizontal graticule line up from the bottom (see Fig. 4-20).

5. From the point at which the pulse intersects the second horizontal graticule line up from the bottom (10%), to the point where it intersects the second horizontal graticule line down from the top (90%) can be no more than 1.6 (metric 1.93) major divisions (see Fig. 4-20).

Measure Aberration

6. Measure the Option 02 aberration: verify that from the front corner of the pulse down to the bottom of the large notch in the middle of the pulse is less than or equal to 1.8 vertical divisions (see Fig. 4-20).

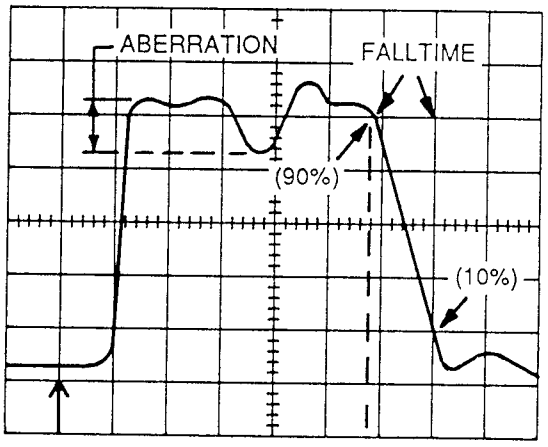


Fig. 4-20. Opt 02 Falltime/Aberration

H. DC Balance

1. Set front panel controls as follows:

mp/DIV	100
FEET/DIV	1
(METRES/DIV)	*(0.25)*
Multiplier	X.1
ZERO REF (SET)	Full cw
CABLE	50Ω term

2. Adjust the POSITION control to place the trace on the center graticule line.

3. Remove the 50Ω terminator and adjust R1659 (DC BAL) on the Main board to place the trace on the center graticule line. The spec is less than or equal to ± 0.5 major divisions of vertical change with the 50Ω terminator on and off.

I. Vertical Attenuation

1. Set front panel controls as follows:

mp/DIV	500
ZERO REF (SET)	Full cw

2. Set the multimeter to 2 DC VOLTS.

3. Connect the lead from the multimeter's LO terminal to C2137 on the Vertical-Amp/Slow-Ramp Board (the side towards the edge of the board, see Fig. 4-21).

4. Connect the lead from the multimeter's VOLTS/Ω terminal to the left end of R2229.

5. Adjust the ZERO REF (SET) and POSITION/FINE controls so that the multimeter reads 1.000 V ±0.008 V.

6. Move the VOLTS/Ω lead to R2326. The multimeter should read 0.400 V ±0.008 V.

7. Move the VOLTS/Ω lead to R2325. The multimeter should read 0.199 V ±0.004 V.

8. Move the VOLTS/Ω lead to R2323. The multimeter should read 0.0991 V ±0.002 V.

9. Move the VOLTS/Ω lead to R2322. The multimeter should read 0.0405 V ±0.0008 V.
10. Move the VOLTS/Ω lead to R2321. The multimeter should read 0.0200 V ±0.0004 V.
11. Move the VOLTS/Ω lead to R2228. The multimeter should read 0.0100 V ±0.0002 V.
12. Remove the test leads from the 1502 and turn the ZERO REF (SET) control fully counterclockwise.

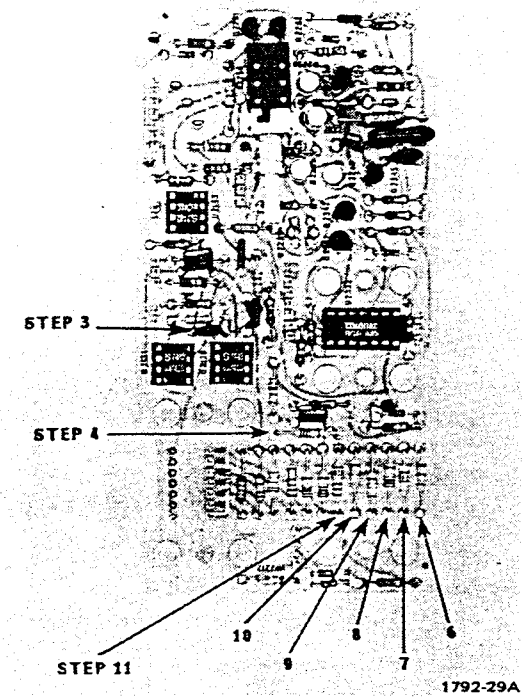


Fig. 4-21. Vertical Amp/Slow Ramp Board

11. Output Module Calibration

A. Pen Lift Signal

1. Set the multimeter to 20 VDC.
2. Connect the jumper on the Output Module Board to the negative slope pins. (see Fig. 4-22).
3. Connect the VOLTS/Ω terminal on the multimeter to the red PEN LIFT terminal on the Output Module. Connect the LOW terminal on the multimeter to the black PEN LIFT terminal on the Output Module.
4. Check that the multimeter reads approximately 5 V.
5. Press and release the RECORD switch. The voltage readout on the multimeter should drop to 0.5 V or less and return to approximately 5 V at the end of the record sweep.
6. Reconnect the jumper on the Output Module Board to the positive slope pins.
7. Check that the multimeter reads approximately 0.5 V.
8. Press and release the RECORD switch. The Voltage displayed on the multimeter should read 4 V or greater and return to approximately 0.5 V at the end of the record sweep.

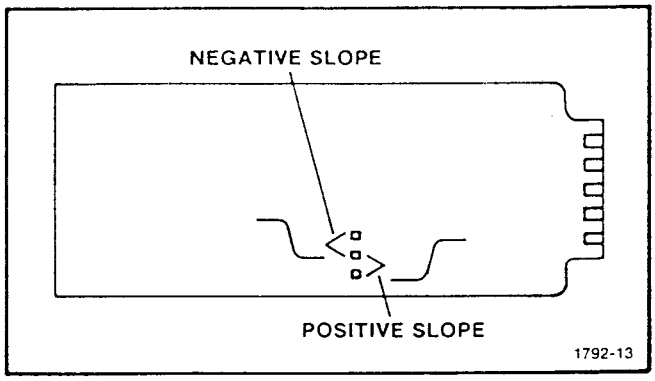


Fig. 4-22. X-Y Output Module Board

B. Y Output

1. Move the multimeter test leads from the PEN LIFT terminals and connect them to the corresponding positive and negative Y terminals.

2. Set the front panel controls as follows:

mρ/DIV	500
FEET/DIV	100
(METRES/DIV)	*(25)*
Multiplier	X1
CABLE	50Ω term

3. Set the multimeter to 2 VDC. Adjust the GAIN pot on the front panel for a 4 division high pulse.

4. Press and hold the RECORD switch, and adjust the POSITION control until the multimeter reads 0 V.

5. Adjust the ZERO REF (SET) control fully counterclockwise and adjust R7225 on the Output Module Board until the multimeter peaks at 0.4 V while the RECORD switch is being held.

6. Release the RECORD switch. The sweep will disappear, and the multimeter should read 0 VDC when the trace reappears.

C. X Output

1. Move the multimeter test leads from the Y terminals to the corresponding positive and negative X terminals.

2. Center the trace with the POSITION control. Press and release the RECORD switch. Monitor the multimeter and check that the voltage steadily climbs until it reaches 1 V (±0.15 V), then returns to zero at the end of the record sweep.

3. Turn the 1502 POWER switch off.

NOTE

If the instrument meets calibration standards, go on to section 12, "Case Reinstallation". If the instrument does not meet the standards affected by the stripline, refer to the "Stripline Troubleshooting Guide" following "Case Reinstallation".

12. Case Reinstallation

A. Remove all attachments to the CABLE connector.

B. Remove the battery pack and the AC power cord from the instrument.

C. Replace the EMI shields.

D. Set the instrument face down on a flat surface and lightly lubricate the seal on the back of the subpanel with a waterproof lubricant such as General Electric No. G-661 Silicone Grease (Tek Part No. 006-2207-00).

E. Slide the case over the chassis until it contacts the seal.

F. Tighten the four screws on the back of the case until the case seats lightly against the seal. Then, using a torque screwdriver, tighten the four screws to 8 inch-pounds.

CAUTION

It is very important to properly torque down the back case screws. If the screws are overtightened, the case may break; if the screws are undertightened, the case may leak.

G. Install the battery pack in the instrument and tighten the two battery pack screws to a torque of 4 inch-pounds.

H. Place the AC power cord and the other accessories in the front cover storage area and latch the cover to the front of the instrument.

Stripline Troubleshooting Guide

Introduction

The Stripline Troubleshooting Guide explains the most common fixes that affect pulse aberrations and microphonics. The stripline must be calibrated if pulse aberrations cannot be corrected through normal calibration methods.

Building an "Aberration Suppressor"

The aberration suppressor is sometimes used as a last resort to calibrate the stripline. The suppressor lowers the peak of the second aberration and raises the valley that follows the second aberration. It should be used only after all other stripline calibration alternatives have been tried.

To build an aberration suppressor, see Figure 4-23. Parts affected include C1643, R1643, R1641 on Main Board plus a gold ground-strap (Tek Part No. 346-0160-00).

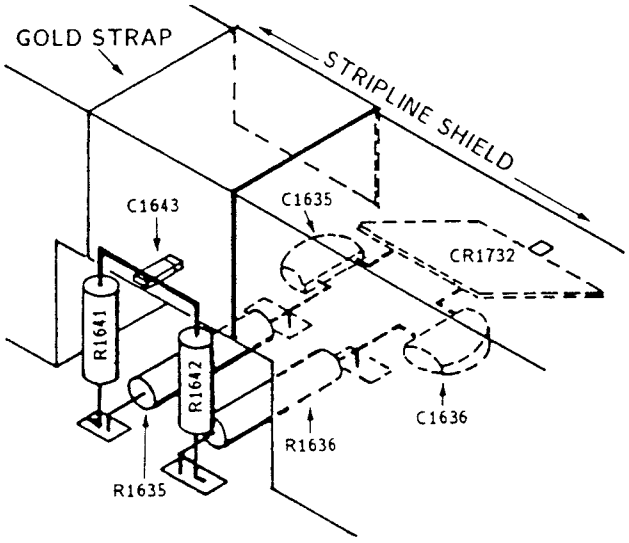


Fig. 4-23. Aberration Suppressor Build Procedure

CAUTION

Whenever the top or bottom stripline shields are removed the ground connection to the BNC is broken. This ground connection must be restored with Eccobond #59C (Tek 006-2513-00), or equivalent liquid conductor material. Apply a small amount of Eccobond on the BNC tab where it joins the stripline shield.

Dressing the Stripline

1. Remove stripline shield, and dress C1639/R1639 and C1630/R1630 as per Figure 4-24. Check that components do not short to anything. C1635 and C1636 should lie flat and have no more than 1/16-inch between the board and component insulation.

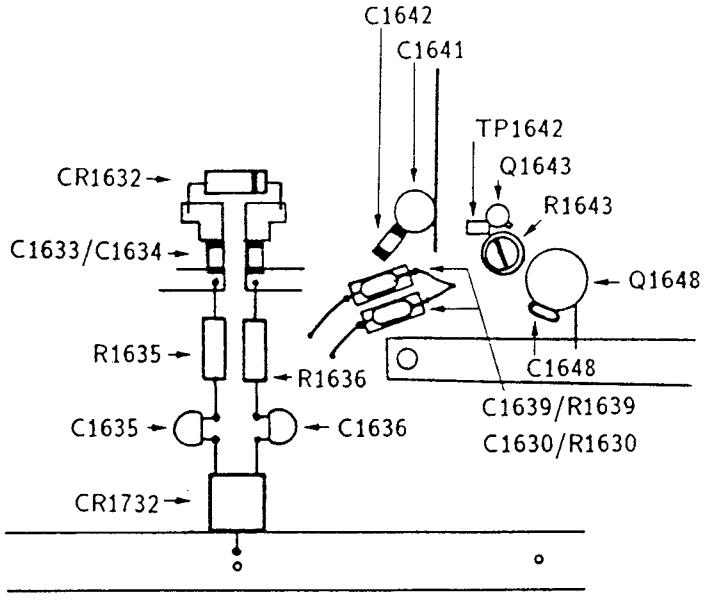


Fig. 4-24. Dressing Front of Stripline

2. Position sampling diode CR1732 so that side nearest stripline touches board and side opposite stripline is raised off board (see Fig. 4-25). Do not allow solder to enter hole in stripline next to diode.

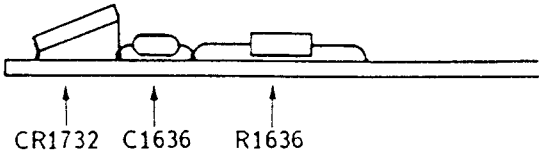


Fig. 4-25. CR1732 Dressing

3. Dress rear of stripline per Figure 4-26. R1609 lead that is soldered to C1609 should be as short as possible.

4. Reinstall stripline shield and use two screws to anchor it temporarily. One screw should be near CR1703 and one near CR1732.

5. Bend the extra lead on Q1648 up so that it hangs over top edge of stripline shield.

6. Reinstall shield that covers sampling circuitry and temporarily anchor it with three screws - one near lead of Q1648 on stripline shield and the other two positioned to anchor shield securely.

7. Perform Vertical Calibration procedure, Step 10, parts A through I. Check aberrations and falltime as per Figures 4-18 and 4-19 (Option 02 Figure 4-20).

   If aberrations and falltime are within spec, finish installing stripline shield and shield that covers sampling circuitry. Apply Eccobond #59C to BNC connector where it joins the shield. (See *CAUTION* notice, page 4-21.)

   If aberrations or falltime are out of spec, refer to the following examples for corrective action.

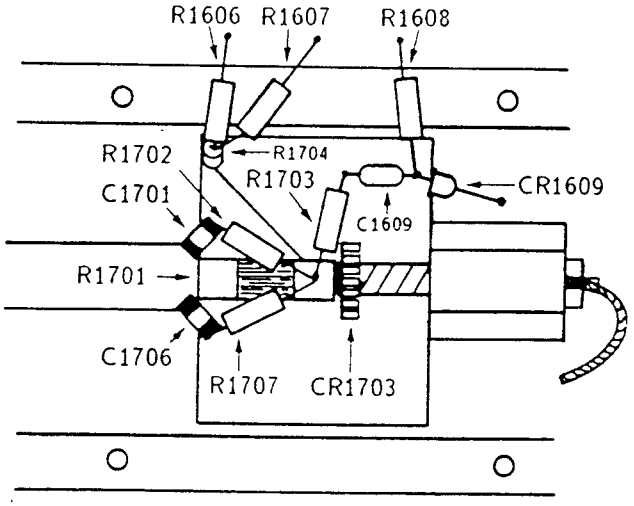


Fig. 4-26. Dressing Rear of Stripline

Backside Combo

1. The "backside" RC combo is located on the back of the board under the stripline shield (see Fig. 4-27). Access is gained by removing the CRT and the shields on the back of the main board. (See *Maintenance* section for CRT removal.)

2. Note that the resistors of the backside combo can be checked from the top side of the main board. If replacing these components, make sure they are dressed (see Fig. 4-27) and securely fastened to the main board with Humiseal (Tek Part No. 006-1744-00) to prevent microphonics.

   Allow Humiseal to dry at least two hours before resuming calibration. (Wet Humiseal causes a "fuzzy" CRT trace.)

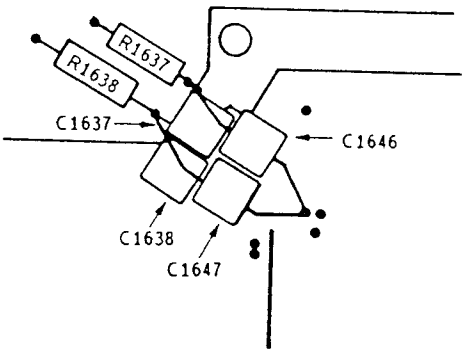


Fig. 4-27. Backside RC Combo

Aberrations

The following examples illustrate typical aberrations. Under each example is a list of corrective measures for solving the problem listed. The corrective measures are ranked in order of most likely to least likely (i.e., number 1 is the most common cause of the problem; number 6 is the least common cause of the problem). After any particular corrective measure has been taken, repeat Steps 4, 5, 6 and 7 of Dressing the Stripline to find out if the measure worked. If it didn't work, go on to the next corrective measure in the sequence. Refer to page 4-15 in the Calibration Procedure for the Aberrations set-up and test. Refer to Figure 4-28 for typical aberrations "in spec".

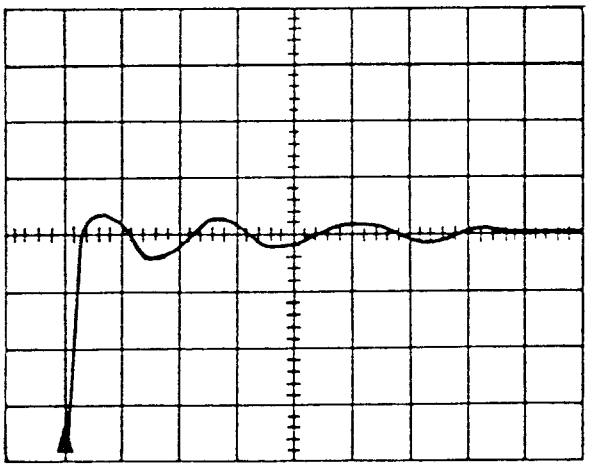


Fig. 4-28. Correct Aberration

Low Front Corner

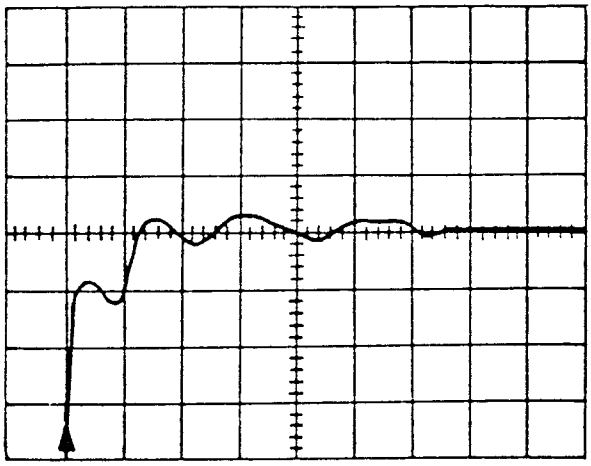


Fig. 4-29. Low Front Corner.

1. Make sure that back of R1701 is soldered to stripline.
2. Raise front of C1635 off board.
3. Replace C1701.
4. The normal value of R1702 is 220 Ω, but may be varied from 75 Ω to 510 Ω. 75 Ω raises the front corner; 510 Ω lowers the front corner. When the front corner is low, replace R1702 with a 100 Ω resistor. Maximum- and minimum-value resistors should be used only as a last resort.
5. Replace 20 mA TD (CR1703).

High Second Aberration

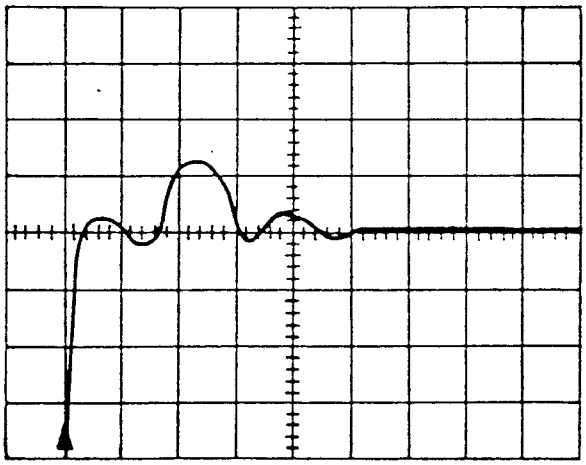


Fig. 4-30. High Second Aberration

1. Remove excess solder from stripline.
2. Replace 10 mA TD (CR1609).
3. Replace C1636 with the smallest bodied capacitor available. Keep leads as short as possible.
4. Replace snap-off diode (CR1632).
5. Replace sampling diode (CR1732).
6. Install aberration suppressor (see installation procedure at beginning of this guide).

Slow Falltime (not enough ringing)

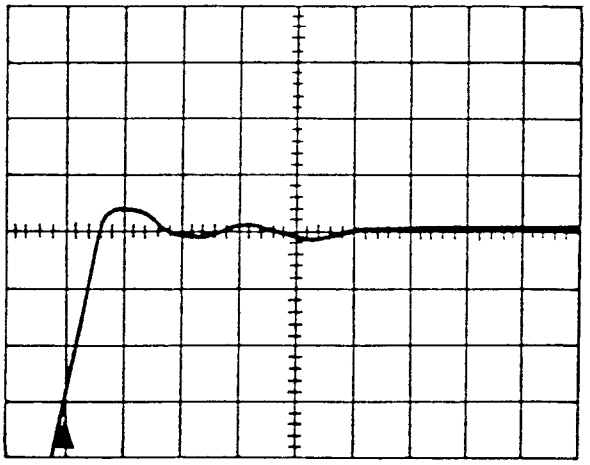


Fig. 4-31. Slow Falltime

1. Replace snap-off diode (CR1632).
2. Replace 20 mA TD (CR1703).
3. Replace sampling diode (CR1732).
4. Replace 10 mA TD (CR1609).
5. Replace CR1635 and CR1636.
6. Remove excess solder from both ends of stripline.
7. Raise bodies of C1635 and C1636 above board.
8. Move R1703 back toward CR1703.

High Front Corner

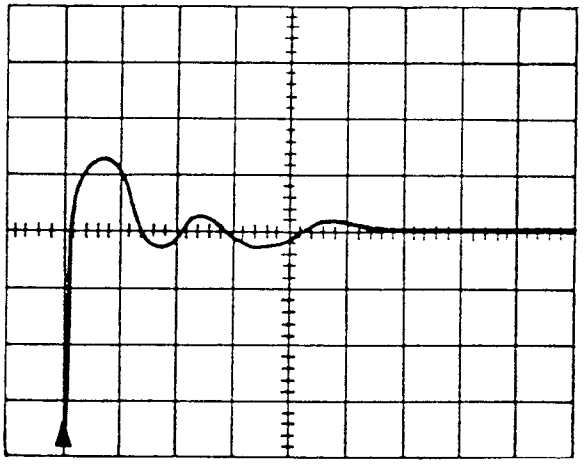


Fig. 4-32. High Front Corner

1. Remove excess solder from both ends of stripline.
2. Replace C1701.
3. Verify that R1701 has a value of 48 Ω.
4. Shorten leads on C1635.
5. Replace 10 mA TD (CR1609).
6. The normal value of R1702 is 220 Ω, but may be varied from 75 Ω to 510 Ω. Change R1702 to a higher value to lower the front corner.

Offset Baseline

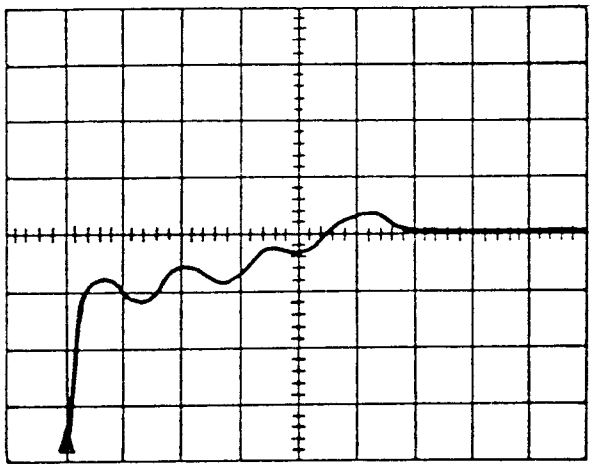


Fig. 4-33. Offset Baseline

1. Replace C1706.
2. Verify that R1701 has a value of 48 Ω.
3. Replace 20 mA TD (CR1703).
4. Replace 10 mA TD (CR1609).
5. The normal value of R1707 is 750 Ω, but may be varied from 470 Ω to 1500 Ω. Change R1707 to 1500 Ω.

Low First Valley

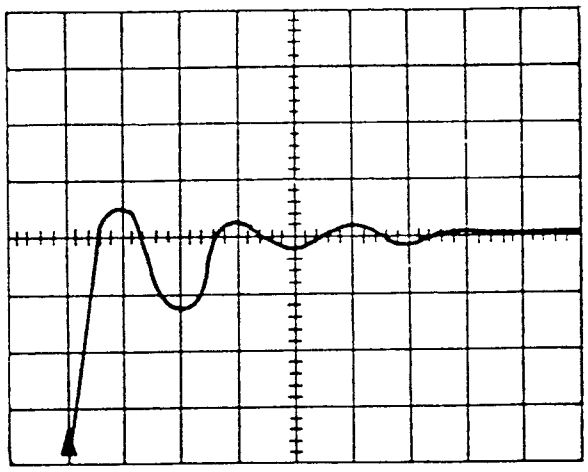


Fig. 4-34. Low First Valley

1. Shorten the anode lead on 10 mA TD (CR1609).
2. Replace 10 mA TD (CR1609).
3. Replace C1635 and C1636.
4. Replace 20 mA TD (CR1703).
5. Install an aberration suppressor (see installation procedure at beginning of this guide).

Low Second Valley

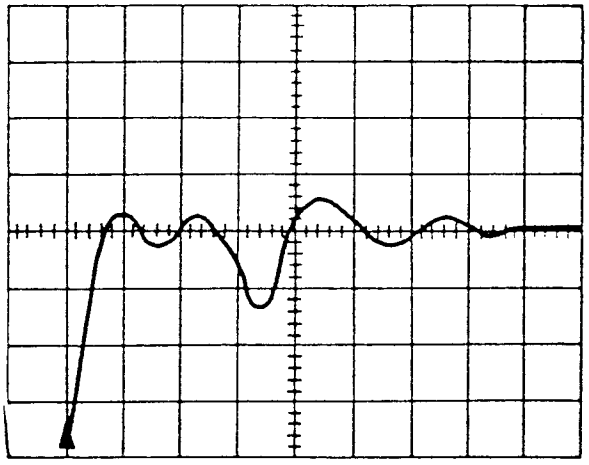


Fig. 4-35. Low Second Valley

1. Redress the leads on the back end of stripline, shortening the leads on the 1.5 pF capacitor (C1609), the 10 mA TD (CR1609), and the 39 Ω resistor (R1704).
2. Change the front 10 pF capacitors (C1635, C1636). Make sure the leads are no shorter than 1/16th-inch.
3. Move the top RC combination (C1630/R1630 - C1639/R1639) closer to the stripline.
4. Check the values of the 39 Ω resistor (R1704) and the 390 Ω resistor (R1608) for tolerances. Also check each combination for a 10:1 ratio between individual component values.
5. Change the 20 mA TD (CR1703).
6. Change the 10 mA TD (CR 1609).

Microphonics

1. The test for microphonics consists of tapping on the instrument's front panel near the CRT. Microphonics are characterized by noise on the CRT display when the front panel is subjected to vibration. The noise may range from spikes to massive clutter. Although the cause may be electrical, most microphonics are caused by loose mechanical parts.
2. Check all stripline and cavity shield screws for tightness.
3. Check all main board internal shields. These are the six metal strips located on the top and back side of the main board. They should be checked for cracked or loose solder joints. Resolder if necessary.
4. Make sure C1630/R1630, C1639/R1639, C1641, and C1648 in the sampling circuit on the top of the main board are Humisealed (Tek Part No. 006-1744-00) to the board.
5. Make sure the "backside" RC combination on the back of the main board is dressed properly and Humisealed (see Figure 4-27).

Component Affects on Stripline

Rear of Stripline

CR1703 (20 mA tunnel diode): Causes slow falltime and abnormal aberrations.

CR1609 (10 mA tunnel diode): Causes slow falltime and abnormal aberrations. Shortening the anode lead decreases the second aberration and reduces ringing.

C1602 (1.5 pF capacitor): Raises or lowers the second aberration; affects falltime. Shortening the leads lowers the second aberration; lengthening the leads raises the second aberration, and may have an effect on all aberrations.

R1609 (39 Ω resistor): By lengthening lead that is soldered to C1602, aberrations will get larger. By shortening lead, aberrations will get smaller.

R1704 (2.7 Ω resistor): By moving resistor toward CR1703, aberrations will get larger. By moving resistor away from CR1703, aberrations will get smaller.

R1702 (220 Ω resistor): Affects the first aberration. Values can vary from 75 Ω to 510 Ω. 75 Ω raises the first aberration; 510 Ω lowers the first aberration.

R1707 (750 Ω resistor): Affects third aberration and beyond. Values can vary from 470 Ω to 1500 Ω. 470 Ω raises the aberrations; 1500 Ω lowers the aberrations.

R1701 (48 Ω pellet resistor): Removing or adding small amounts of solder to connection between R1701 and end of stripline changes the aberrations radically. Removing solder from the bottom of R1701 lowers the front corner. Removing solder from the top of R1701 raises the front corner.

Front of Stripline

CR1732 (sampling diode): Position of diode with respect to stripline affects aberrations and falltime. Raising diode off board raises aberrations and speeds falltime. By moving CR1732 toward or away from stripline affects the shape of the aberrations.

C1635 and **C1636** (10 pF capacitors): Changing the lead length or raising these capacitors off the board changes the first and second aberrations. Raising or lengthening the leads of C1635 raises the first aberration. Raising or lengthening the leads of C1636 raises the second aberration. Raising C1636 also moves the second aberration away from the first aberration. Raising both capacitors forces the aberrations to ring bigger.

R1635 and **R1636** (150 Ω resistor): If vertical positioning spec cannot be met when snapoff current is adjusted, trace can be adjusted downward on CRT by moving the leads of R1635 and R1636 that are soldered to the leadless capacitors toward the front of the instrument.

MAINTENANCE

This section contains information on preventive and corrective maintenance, troubleshooting, panel control assembly procedures and shipping instructions. Please refer to schematics for physical location of circuits and components. *NOTE: we recommend that service be performed at an authorized Tektronix Service Center, or by a technician skilled in sampling and pulse techniques.*

PREVENTIVE MAINTENANCE

Preventive maintenance includes cleaning, visual inspection and lubrication. A convenient time to perform preventive maintenance is during the periodic performance check/calibration procedure. If the instrument has been subjected to extreme environments or harsh handling, more frequent preventive maintenance may be necessary.

Cleaning

CAUTION

Do not use chemical cleaning agents that contain benzene, toluene, xylene, acetone, etc., because of possible damage to plastics in the instrument.

The exterior case and front panel should be washed gently with mild soap and water. The CRT faceplate should be cleaned gently with Kendall Webril nonwoven wipes (Tek Part No. 006-0164-00), or equivalent, moistened with isopropyl alcohol. Do not use abrasive cleaners.

The interior of the 1502 is protected from dirt and dust as long as the plug-in compartment and case are intact. However, if interior cleaning is necessary, blow off accumulated dust with low-pressure air, and remove remaining dirt with a soft brush, cotton swab or pipe cleaner moistened with isopropyl alcohol. *NOTE: to remove and replace instrument case, follow directions in the* Calibration Procedure *section of this manual.*

Lubrication

Reliability of potentiometers, switches and other moving parts can be maintained by proper lubrication. A lubrication kit (Tek Part No. 003-0342-02) containing necessary lubricants and instructions is available from Tektronix.

Visual Inspection

Obvious defects such as broken connections, damaged boards, frayed cables, improperly seated components and heat-damaged components should be corrected first before attempting further troubleshooting. Heat damage usually indicates a deeper problem somewhere in the circuitry, and should be traced and corrected immediately.

We do not recommend electrical checks of individual components because defective components will become evident during instrument operation.

Recalibration

After maintenance has been performed, the instrument should be recalibrated per procedures explained in the *Calibration Procedure* section of this manual.

PART REMOVAL/REPLACEMENT

Removing the Case

1. Remove battery pack from back of instrument. Remove instrument's front cover.
2. Loosen the four screws on back of case and set instrument face up on flat surface. Swing handle out of way of front panel. Break chassis seal by pushing downward on handle pivots on each side of case with both hands.
3. Grasp case with one hand, and lift chassis out with other hand. Lift by grasping outside perimeter of front panel. Do not lift on front-panel controls.
4. Remove EMI shields from top and bottom of chassis.

Fuses

AC line fuses are located on front panel. DC protection fuses and spares are located on Power Supply Board inside instrument (see Figure 5-1 and Power Supply Board schematic). For line fuse replacement, use 0.5 A for 115 VAC (Tek Part No. 159-0032-00) or 0.3 A for 230 VAC (Tek Part No. 159-0029-00).

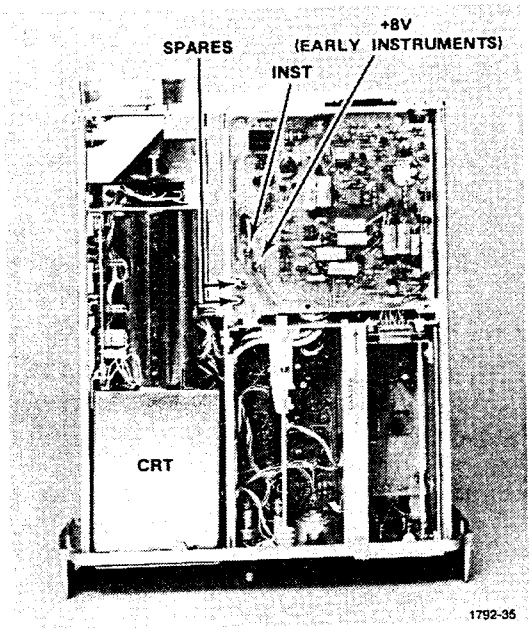


Fig. 5-1. DC Fuse Location

Air Dryer

Check silica gel cartridge mounted on rear of instrument. If the crystals of silica seen through the window are blue, dehydrating agent is dry and no further maintenance is needed.

If the silica has turned pink, the cartridge must be rejuvenated per the following procedure:

1. Loosen the cartridge hold-down bracket located on the rear of the instrument, and remove the cartridge.
2. Heat in an oven at approximately 350° F. until blue color is restored. Place cartridge in an air tight, moisture proof container until cool.
3. When cool, place cartridge on back of instrument and tighten retaining bracket.

Board/Transformer Removal

Most board-mounted components can be replaced without removing the boards from the instrument. An exception is the High Voltage Board located under the Power Supply Board.

If a board is damaged beyond repair, the entire assembly including all soldered components should be replaced (refer to Replaceable Electrical Parts list for part numbers on fully assembled boards). Before removing a board, note locations of all connectors to make reinstallation easy.

Use the following procedure to remove boards and transformer from instrument. Reverse the procedure to reinstall boards and transformer.

Power Supply Board

CAUTION

170 V may be present on Power Supply Board due to charged capacitors. Discharge the capacitors by shorting R6517 to ground. (see Figure 5-2).

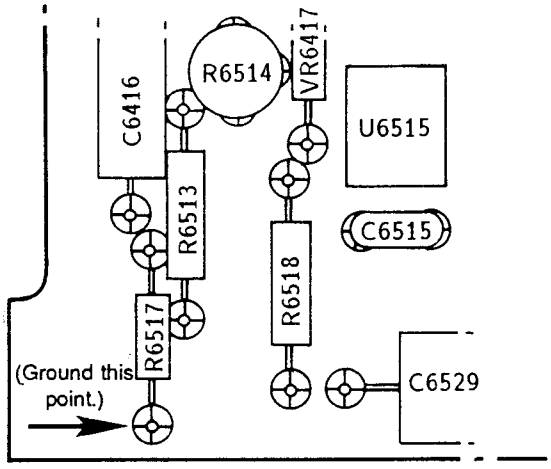


Fig. 5-2. R6517 on Power Supply Board

1. Remove four screws that hold board in place.
2. Desolder the ground wire that runs from the ground lug on the board. *NOTE: Ground lug may be missing on some instruments.*
3. Disconnect pin connectors near rear edge of board.
4. Carefully lift back of board and disconnect bottom pin connectors. Remove board from chassis.

High Voltage Board

1. Power Supply Board must be removed first.

CAUTION

Two kV may be present on High Voltage Board due to charged capacitors. Discharge the capacitors by shorting them from point A to ground (see Figure 5-3). Point A is accessible by removing battery pack and turning instrument upside down.

2. Disconnect pin connectors.
3. Remove four screws that hold board in place and remove board from chassis.

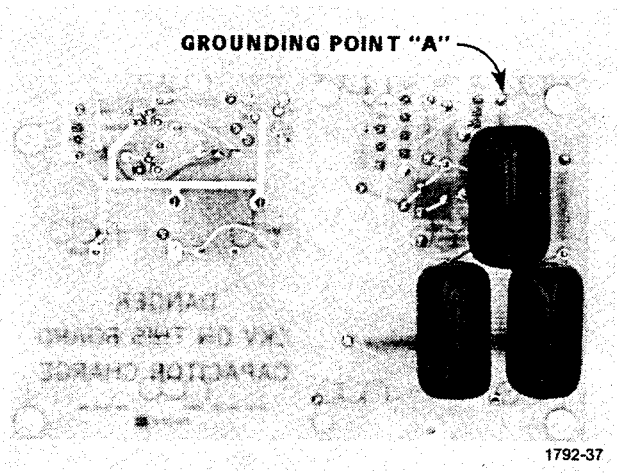


Fig. 5-3. Point A on High Voltage Board.

Power Transformer

1. Power Supply and High Voltage boards must be removed first.
2. Desolder the two leads on bottom of Transformer (T0389)(see Figure 5-4).
3. Remove four bolts that hold transformer in place (ground wire and lug on bottom of transformer will come off when bolt is removed).
4. Remove Transformer from chassis.

CAUTION

Note longer screw attaching ground lug. This screw must be installed in the same mounting hole to prevent damage to logic board, and to facilitate attaching the ground lug.

Output Amps Board

1. Remove four screws that hold board in place.
2. Slide board through opening in side of chassis.
3. Disconnect pin connectors.

Logic Board

1. Disconnect pin connectors.
2. Remove four screws that hold board in place.
3. Carefully pull board to disconnect chassis pins, and remove board (use care when reinstalling board to prevent bending the pins).

Main Board and Vertical-Amp/Slow-Ramp Board

Removing the Main Board and Vertical-Amp/Slow-Ramp Board requires removal of certain front-panel controls. This destroys the weathertight integrity of the front panel. For this reason, these boards should be removed only at an authorized Tektronix Service Center.

Power Cord Conductor Color Code

Conductor	Color	Alternate Color
Ungrounded (line)	Brown	Black
Grounded (neutral)	Blue	White
Grounded (earth)	Green/yellow	Green/yellow

CRT Removal

CAUTION

Handle CRT carefully to prevent accidental implosion. Wear protective clothing and safety glasses. Do not strike CRT against a hard surface. Store it in a protective carton or in a protected location, face down on a smooth surface with faceplate resting on a soft mat to protect it from scratches.

1. Remove battery pack from instrument.

CAUTION

Dangerous voltages may exist due to capacitor charge. Discharge both the Power Supply Board and the High Voltage Board (see Figures 5-2 and 5-3).

2. Remove Power Supply Board (refer to Power Supply Board procedure).
3. Remove Output Amps Board (refer to Output Amps Board procedure).
4. Remove four screws that hold CRT bracket to chassis.
5. Remove large screw that braces CRT socket.
6. Slide the entire CRT assembly (CRT, socket, bracket, shield) about one-quarter inch to rear. Lift straight up on assembly, clearing the tabs on the front-panel casting.
7. Set assembly, with socket wiring still attached, on top of instrument. Remove rubber gasket from around CRT faceplate.
8. Unplug socket from CRT.
9. Carefully remove CRT from its shield. Guide the two-wire pin connector through hole in shield during removal.
10. Remove trace rotation yoke (L0234) from CRT. *NOTE: before removing yoke, note its position on CRT because it must be reinstalled in the same position.*
11. When reinstalling CRT, reverse the removal process. Make sure that the CRT and implosion shield are clean. Take care that the trace rotation yoke is reinstalled in its original position, and is fastened tightly against neck of CRT with tape. Be careful when tightening the screw that braces the CRT socket. The socket holddown pad should be snug, but rotate with the fingers.

230 Volt Operation

Unless the instrument is ordered with an "A" Option, the power Transformer (T0389) is factory wired for 115 V operation. If 230 V operation is desired, proceed as follows (see Figure 5-4):

1. Remove the RTV covered the transformer lugs.
2. Cut the wires between lugs 1 and 2, and lugs 3 and 4.
3. Solder a strap from lug 2 to lug 3.
4. Cover lugs with 3145 RTV to prevent electrical hazard.

CAUTION

When rewiring the instrument for 230 V operation, be sure to change the frontpanel line fuses to 0.3 A (Tek Part No. 159-0029-00).

PANEL CONTROL INSTALLATION

Watertight Seals

To prevent moisture and dirt from getting into the 1502, special seals are used around the CRT faceplate, plug-in module, battery pack, front panel and front-panel controls. Removing a front-panel control will require special resealing procedures to retain the instrument's weathertightness.

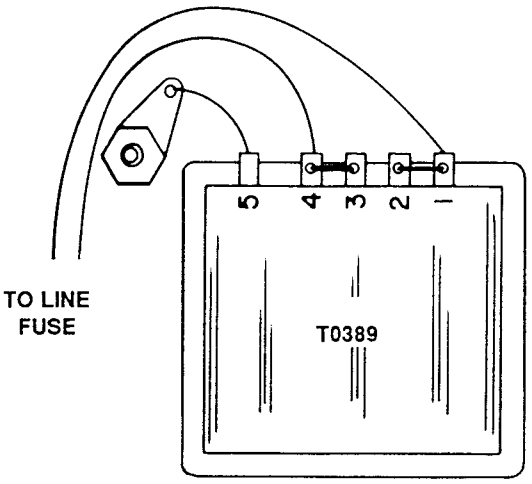
We recommend that resealing be done by an authorized Tektronix Service Center. However, if this is inconvenient, resealing instructions are included as part of the panel control installation procedure.

The front-panel/cover seal should be inspected regularly and replaced every six to eight months depending on operating environment and use.

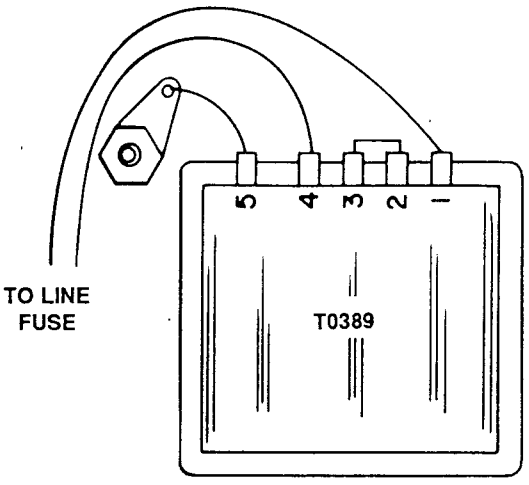
All other seals should be inspected during normal adjustment/calibration periods, paying special attention to the battery pack seals, subpanel/case seal and plug-in module seal.

CAUTION

If the case, battery pack, plug-in module or a front-panel control is removed, the weathertight integrity of the instrument will be jeopardized.



120 VAC Transformer Wiring



230 VAC Transformer Wiring

Fig. 5-4. Power Transformer Wiring

SEALING MATERIALS

Tek Part No.	Sealant	Comments
006-2302-00	Dow Corning 3145 Adhesive Sealant	Use to form watertight gaskets (24-hour cure)
252-0199-00	Dow Corning 3140 Coating	Use where application requires a more fluid sealant than 3145 (24-hour cure).
006-0315-00	Dow Corning 4 Silicon Dielectric Compound	Use to seal battery pack.
006-2207-00	GE G-661 Silicone Grease	Waterproof lubricant.
006-0500-00	Acetone	Cleaning agent.
006-0034-00	Isopropyl alcohol	Cleaning agent.

Panel Control Installation Procedure

In the following steps, the part being referred to is identified by its Figure Number and Part Index Number that are found in the Replaceable Mechanical Parts (MPL) list section of this manual. Example: MPL 3-26 refers to part 26 on exploded drawing number 3.

Referenced illustrations are found at the back of this section of the manual.

1. **Prepare subpanel for assembly.**
   Subpanel, Front, MPL 3-26. *See Figure 5-5.*
   a. Clean entire front and back of subpanel with isopropyl alcohol.

2. **Install holder for battery meter.**
   Holder, MPL 2-54. *See Figure 5-6.*
   a. Apply No. 3145 sealant to mating surface of holder (holder protrudes on back on subpanel).
   b. Insert holder in subpanel.

3. **Install seal for POWER switch.**
   Seal, Switch, MPL 2-52. *See Figure 5-6.*
   a. Clean mating surface of seal with acetone (seal protrudes on back of subpanel).
   b. Apply No. 3145 sealant to mating surface of seal and install in subpanel.

4. **Install washers for fuseholders.**
   Washer, Flat (2 ea), MPL 2-49. *See Figure 5-6.*
   a. Clean washers with acetone.
   b. Apply No. 3145 sealant to one side of washers and install washers on subpanel.

5. **Install all pushbutton seals.**
   Seal, Pushbutton, MPL 2-50, 2-51. *See Figure 5-6.*
   a. Clean mating surfaces of seals with acetone (seals protrude on back of subpanel).
   b. Apply No. 3145 sealant to mating surfaces of seals and install in subpanel.

6. **Install front-panel/cover seal and subpanel/case seal.**
   Seal, Rubber (2 ea), MPL 2-55. *See Figures 5-6, 5-7.*
   a. Clean rubber seals with acetone.

b. Apply thin film of No. 3140 sealant to bottom surface of front and back grooves that surround perimeter of subpanel (do not apply sealant to side surfaces of grooves).

c. Place seals in grooves and trim each seal so that its ends butt together. Apply small drop of No. 3140 to butt joint.

d. Lubricate exposed surfaces of both seals with G-661 lubricant.

7. **Install implosion shield and retainer.**
Shield, Implosion, MPL 2-94; Retainer, MPL 2-93. *See Figures 5-7, 5-8.*

a. Use acetone to clean area on subpanel that mates with retainer and implosion shield.

b. Remove protective paper from implosion shield.

c. On the back of the casting, run a continuous spaghetti-size bead of No. 3145 sealant around the implosion shield mount. Place the implosion shield into the mounting hole and press down firmly around the edge of the shield.

d. Run a larger bead of No. 3145 sealant around the seam of the implosion shield and casting.

e. Position retainer over bead of sealant and press retainer and shield against subpanel. *NOTE: pressing on retainer should cause sealant to extrude around perimeter of retainer. Failure of sealant to appear at any point around perimeter of retainer indicates inadequate sealing, and entire mounting procedure will have to be repeated.*

f. Allow sealant to cure approximately four hours. Then use a small wooden dowel such as a Q-Tip® handle to gently remove excess sealant that is visible between shield and retainer.

8. **Bond plug-in compartment seal to front panel.**
Front Panel, MPL 2-47. *See Figure 5-4*
Seal, Plug-In, MPL 2-48. *See Figure 5-9*

a. Clean surface of seal with acetone.

b. Apply No. 3145 sealant to surface of seal that mates with subpanel.

c. Apply seal to back side of front panel. Allow two hours curing time, then inspect seal bond and remove any excess sealant.

9. **Install washer on BNC connector.**
Connector, Receptacle, MPL 2-125; Washer, Flat Sponge, MPL 2-111. *See Figure 5-10.*

a. Clean mating surfaces of washer and BNC connector with acetone.

b. Apply No. 3145 sealant to mating surface of BNC connector.

c. Install washer on BNC connector and let sealant cure for 24 hours.

10. **Install pushbuttons and their shaft assemblies.**
Pushbuttons, MPL 2-8, 2-9, 2-10, 2-11; Extension Shaft, MPL 2-114 (4 ea). *See Figure 5-11.*

a. Clean contact surface of each shaft where it enters seal with isopropyl alcohol.

b. Insert shafts into seals.

c. Apply No. 3145 sealant to exterior surface of each shaft/seal interface.

d. Install pushbuttons on their respective shafts.

11. **Attach subpanel to frame sections.**
Frame Sections: Left, MPL 3-116; Center, MPL 3-117; Right, MPL 3-118; Screws, MPL 3-27 (1 ea) and MPL 3-28 (5 ea). *See Figure 5-12.*

a. Fill countersunk screw holes on subpanel with No. 3145 sealant.

b. Attach frame sections to subpanel; install and tighten screws (exposed nickel-plated screw goes in upper left corner of subpanel). Remove excess sealant from around screw holes.

12. **Install front panel on subpanel**

a. Apply thin layer of G-661 lubricant to back surface of plug-in compartment seal and exposed surface of both fuse-holder washers.

b. Set front panel on subpanel.

13. **Install battery meter.**
Meter, MPL 2-53. *See Figure 5-15*

a. Apply No. 3145 sealant to meter where it contacts meter holder.

b. Install meter in subpanel aligned as shown in Figure 5-16.

14. **Install fuseholders.**
Fuseholders, MPL 2-24. *See Figure 5-13.*

a. Assemble and install fuseholder assembly in subpanel.

b. Tighten retaining nut on fuseholder until front panel is pulled flush with subpanel (do not overtighten nut).

15. **Install washers in fuseholder caps.**
Washers, MPL 2-25. *See Figure 5-14.*

a. Clean washers and caps with isopropyl alcohol.

b. Apply No. 3145 sealant to mating surfaces of washers and caps, and install washers in caps.

c. Put caps on fuseholders and press on caps to fully seat washers.

d. Remove caps from fuseholders and wipe away excess sealant. Apply a thin coat of G-661 lubricant to exposed surfaces of washers.

e. Insert proper fuse in cap (refer to Replaceable Electrical Parts list) and install caps on fuseholders (caps must be twisted to lock them in position).

16. **Install FOCUS and INTENSITY controls.**
Resistor, Variable (2 ea), MPL 2-38 and 2-41. *See Figure 5-17.*

a. Apply No. 3145 sealant around fillet side of bushing.

b. Install assembly on subpanel using washers and nuts supplied.

17. **Install POSITION FINE control.**
Resistor, Variable, MPL 2-30. *See Figures 5-18, 5-19.*

a. Apply No. 3145 sealant around bushing threads of assembly.

b. Install nut on bushing as shown in Figure 5-19.

c. Apply No. 3145 sealant at interface of nut and bushing.

d. Install assembly on subpanel using washers and nuts supplied.

18. **Install DISTANCE dial.**
Resistor, Variable, MPL 2-44. *See Figure 5-20.*

a. Insert assembly in subpanel.

b. Apply No. 3145 sealant at interface of assembly and subpanel (sealant should cover threads and anti-rotation lug).

c. Use flat washer, lock washer and nut to secure assembly to subpanel.

NOTE: If lens must be attached to the DISTANCE dial, apply a small bead of No. 3145 sealant to mating surface of Distance dial and install the lens.

19. **Install ZERO REF control.**
Resistor, Variable, MPL 2-27. *See Figures 5-21, 5-22.*

a. Apply No. 3145 sealant around threads of bushing.

b. Install assembly on subpanel using washers and nuts supplied.

20. **Install RECORD switch.**
Switch, Toggle, MPL 2-20; Cap, Toggle Switch, Seal, MPL 2-21. *See Figures 5-23, 5-24, 5-25.*

a. Apply No. 3145 sealant around bushing/housing interface.

b. Install nut on bushing.

c. Apply No. 3145 sealant around nut/bushing interface.

d. Install assembly on front panel using the rubber covered nut supplied.

21. **Install VAR and GAIN controls.**
Resistor, Variable, MPL 2-16 and MPL 2-33. *See Figures 5-26, 5-27.*

a. Partially unscrew hex spacer nut and apply a bead of No. 3145 sealant around bushing threads. Retighten spacer nut.

b. Pack the shaft/threaded bushing interface with G-661 lubricant.

c. Apply No. 3145 sealant on end of spacer nut.

d. Install assembly in subpanel using washers and nuts supplied.

22. **Partially install Main Board in chassis.**
(not an MPL item)

a. Apply thin film of G-661 lubricant to washer on BNC connector.

b. Insert Main Board in chassis and connect pushbutton shafts to their respective switches. Be careful not to damage the pushbutton seals. Do not install Main Board screws at this point.

23. **Install cam switch inserts for FEET/DIV and mρ/DIV controls.**
Insert, Shaft Seal (2 ea), MPL 2-155; O-ring (2 ea), MPL 2-116. *See Figure 5-28.*

a. Apply G-661 lubricant to O-ring and install per Figure 5-28.

b. Apply No. 3145 sealant around fillet area of insert.

c. Install inserts in subpanel. Tighten until snug, then back off 2 to 3 degrees and remove excess sealant.

24. **Finish installing Main Board.**

a. Install Main Board anchor screws.

b. Install washer and nut on BNC connector. Tighten nut to a torque of 20 ± 3 inch-pounds.

25. **Install POWER switch shaft.**
Extension Shaft, MPL 2-14; Bushing, MPL 2-15. *See Figure 5-29.*

a. Insert bushing in POWER switch seal previously installed.

b. Apply G-661 lubricant to detent area on switch shaft.

c. Install switch per Figure 5-29.

26. **Install POSITION and FINE controls.**
Knob, POSITION, MPL 2-4; Knob, FINE, MPL 2-2. *See Figures 5-30, 5-31.*

a. Apply G-661 lubricant to POSITION knob per Figure 5-30.

b. Install POSITION and FINE knobs per Figure 5-31.

27. **Install ZERO REF SET and CHECK controls.**
Knob, ZERO REF, MPL 2-4; Pushbutton, MPL 2-3. *See Figures 5-32, 5-33.*

a. Apply G-661 lubricant to ZERO REF SET knob per Figure 5-32.

b. Install ZERO REF SET knob and CHECK pushbutton per Figure 5-33.

c. Actuate CHECK pushbutton several times and remove excess lubricant.

28. **Install FOCUS and INTENSITY controls.**
Knob (2 ea), MPL 2-1. *See Figure 5-34.*

a. Apply G-661 lubricant to knobs per Figure 5-34.

b. Install knobs on FOCUS and INTENSITY control shafts.

29. **Seal Battery Pack.**
Battery Pack, (See MPL Fig. 4.); Panel, MPL 4-9; Heat Sinks, MPL 4-3; Gasket, MPL 4-6. *See Figures 5-35, 5-36.*

a. Clean panel with isopropyl alcohol.

b. Apply No. 3145 sealant to each of six screw holes in panel.

c. Apply Dow Corning No. 4 Silicon Dielectric Compound to mating surfaces of heat sinks and panel, and join per Figure 5-36.

d. Clean gasket with acetone.

e. Apply No. 3145 sealant to gasket, and attach gasket to panel per Figure 5-36.

30. **Seal jacks on X-Y Output Module.**
Panel, MPL 3-13; Subpanel, MPL 3-14; Jack Tip, Black (3 ea), MPL 3-5; Jack Tip, Red (3 ea), MPL 3-6. *See Figure 5-37.*

a. Clean mating surface of subpanel with isopropyl alcohol.

b. Align panel with subpanel and insert the jack in its respective position.

c. Apply No. 3145 sealant to jack/subpanel interface per Figure 5-37.

d. Secure jack with washer and nut supplied.

e. Repeat Steps b, c and d for the remaining jacks.

31. **Seal thumbscrews on X-Y Output Module.**
O-ring (2 ea), MPL 3-11; Pin (shaft) (2 ea), MPL 3-8; Knob (2 ea), MPL 3-7. *See Figure 5-38.*

a. Insert one shaft through Output Module panel and subpanel.

b. Apply G-661 lubricant to O-ring.

c. Position O-ring on shaft.

d. Install knob on shaft and tighten setscrew.

e. Repeat Steps a through d for second thumbscrew.

32. **Install latch assemblies on front cover.** Cover, Front, MPL 1-29; Latch Assembly, MPL 1-0. *See Figure 5-39.*

a. Apply No. 3145 sealant to both screw holes in each latch assembly.

b. Install EMI shields.

c. Install latch assemblies on front cover.

33. **Install instrument in case.**

a. Lubricate both rubber seals on the front and back of subpanel with G-661 lubricant before installing instrument in case or attaching front cover.

b. Set instrument face down on a flat surface.

c. Slide case over chassis until it contacts seal on back of subpanel.

d. Tighten the four screws on back of case until case seats lightly against seal. Then, using a torque screwdriver, continue tightening the four screws to 8 inch-pounds.

CAUTION

If screws are overtightened, case may break; if screws are undertightened, case may leak.

PANEL INSTALLATION ILLUSTRATIONS

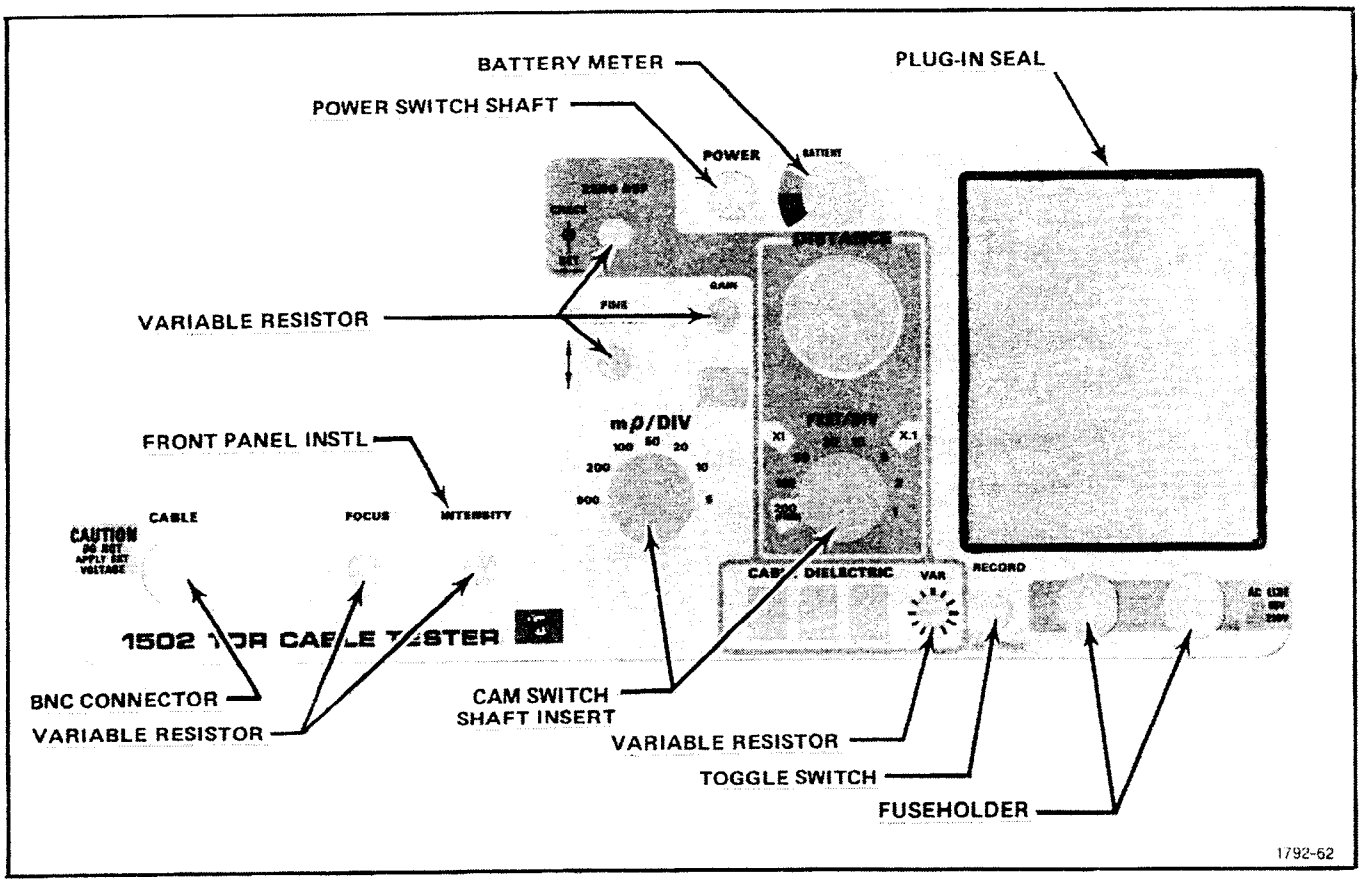


Fig. 5-5. Front Panel Identification

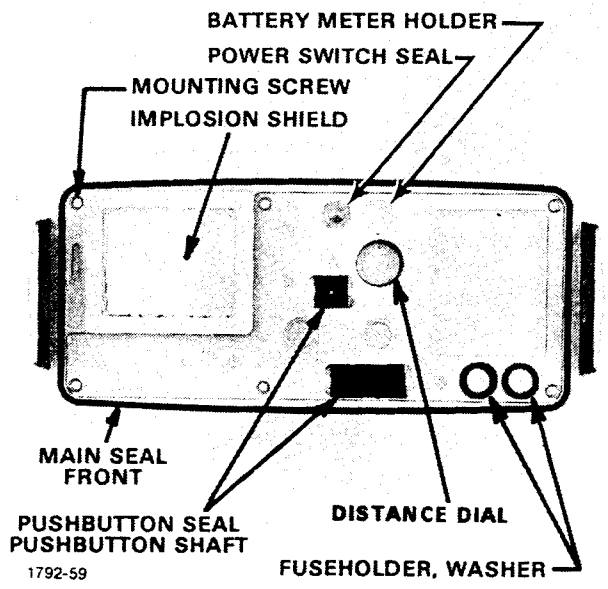


Fig. 5-6. Front Subpanel.

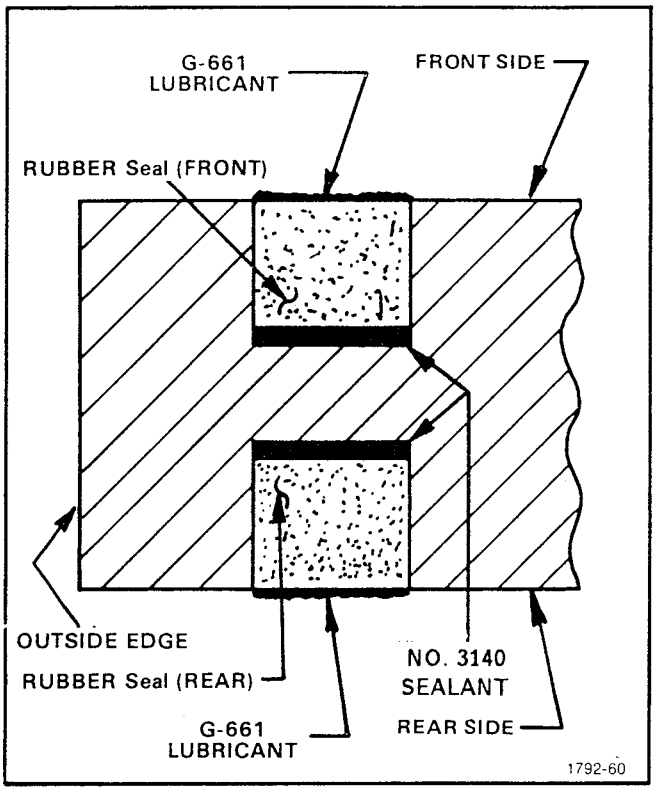


Fig. 5-7. Rubber Seals, Subpanel

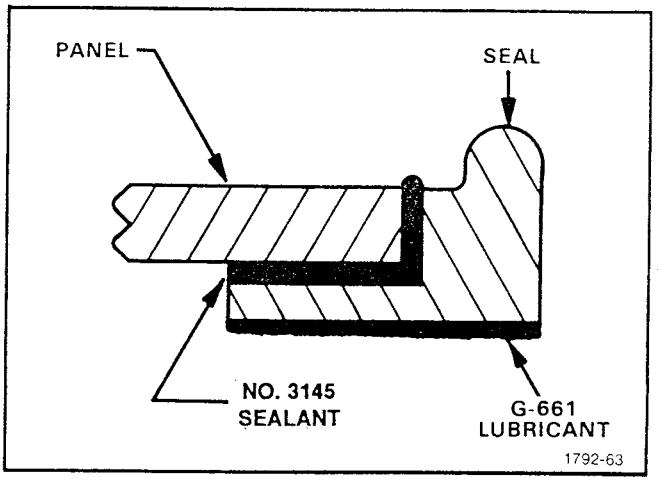


Fig. 5-9. Plug-in Compartment Seal

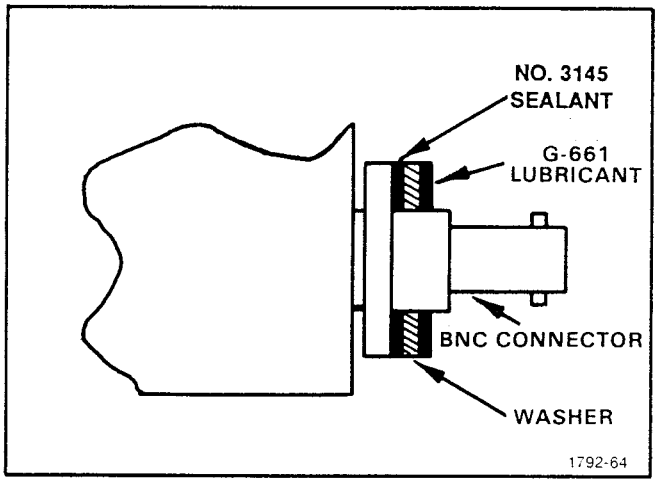


Fig. 5-10. BNC Connector and Washer

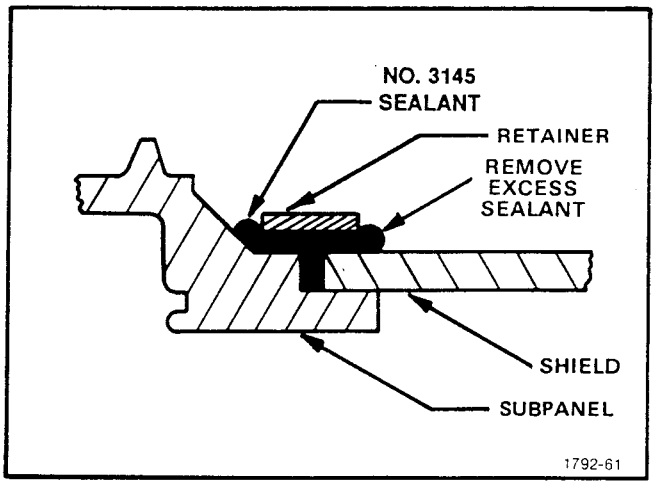


Fig. 5-8. Detail of Implosion Shield

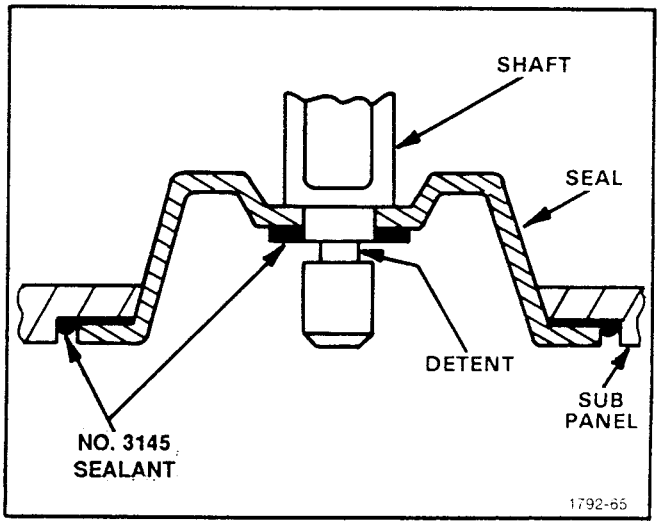


Fig. 5-11. Pushbutton and Shafts

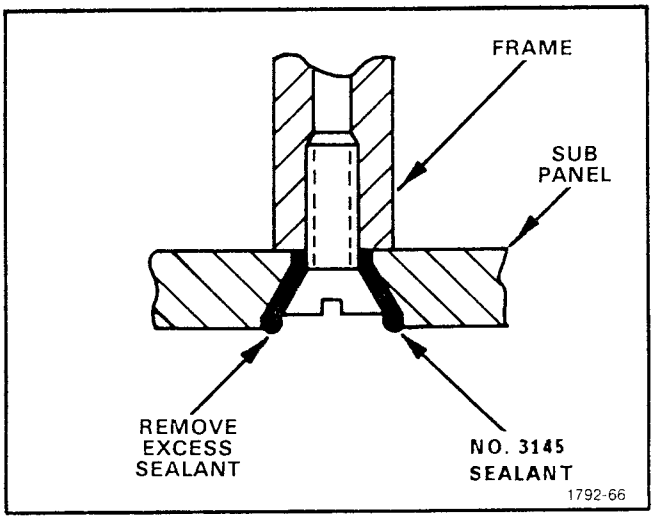


Fig. 5-12. Subpanel Screwhole

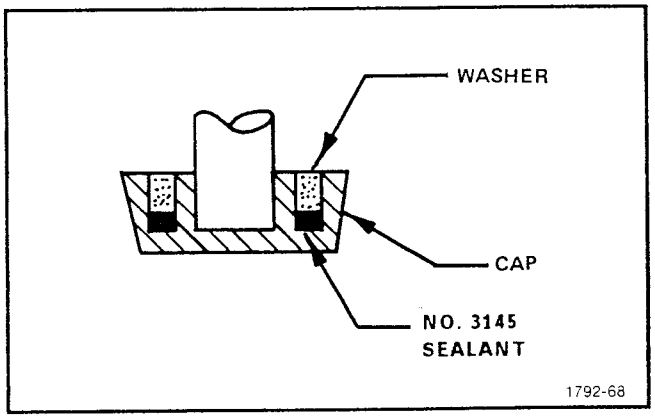


Fig. 5-14. Fuseholder Caps

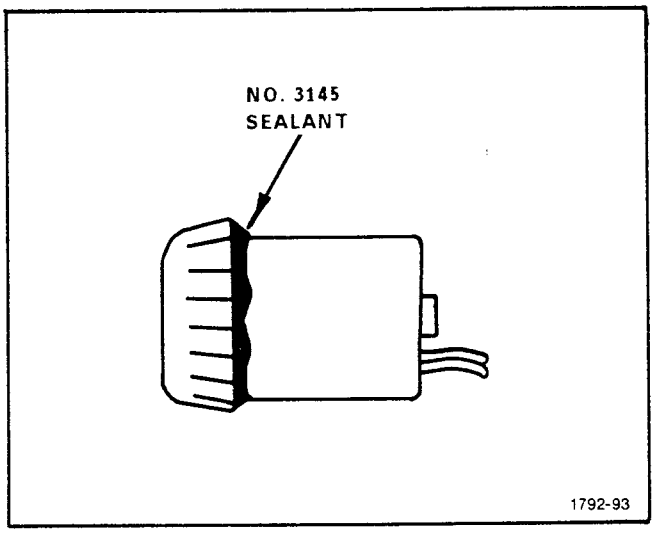


Fig. 5-15. Battery Meter Sealing

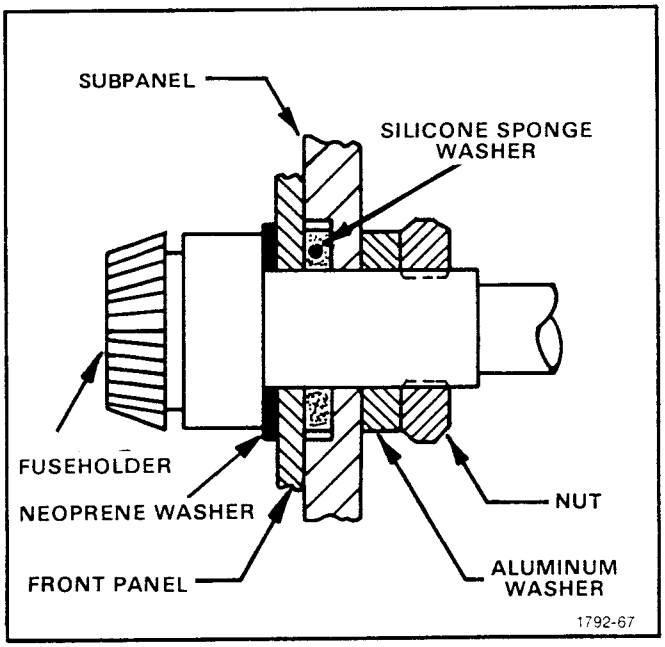


Fig. 5-13. Fuseholder Detail

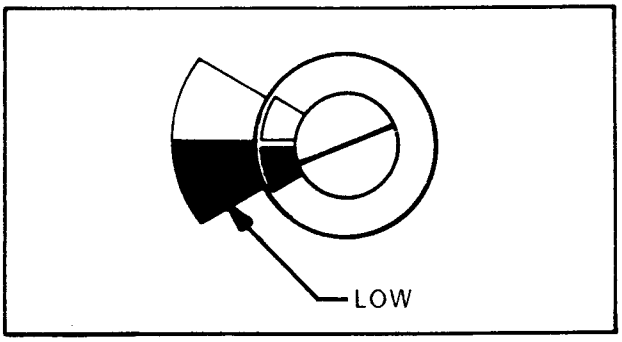


Fig. 5-16. Battery Meter Alignment

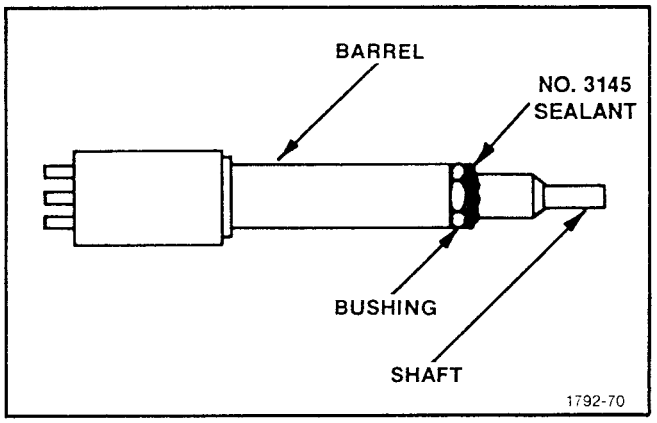


Fig. 5-17. FOCUS and INTENSITY Controls

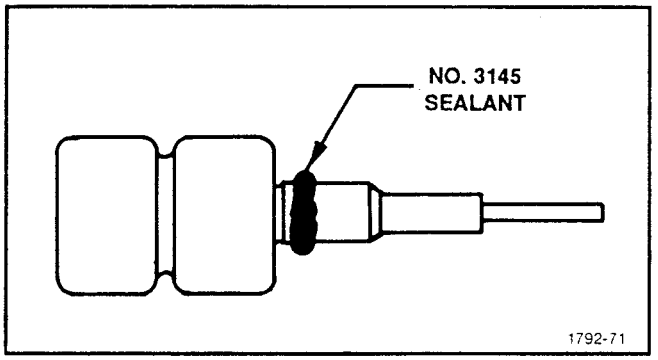


Fig. 5-18. FINE Control Bushing

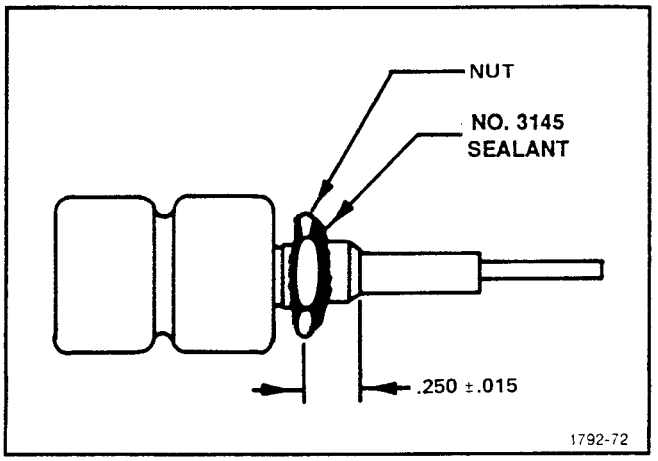


Fig. 5-19. FINE Control Nut

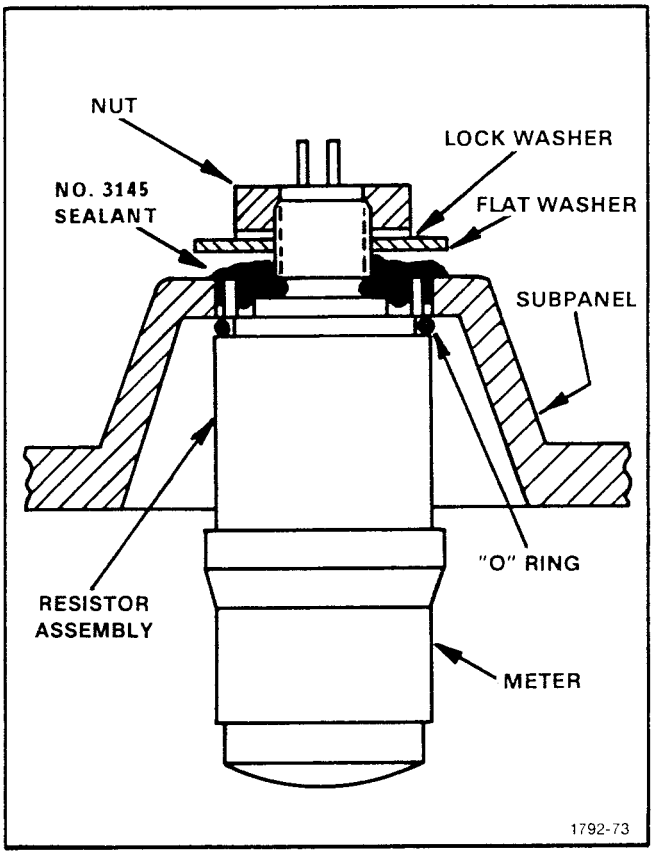


Fig. 5-20. Installation of DISTANCE Dial

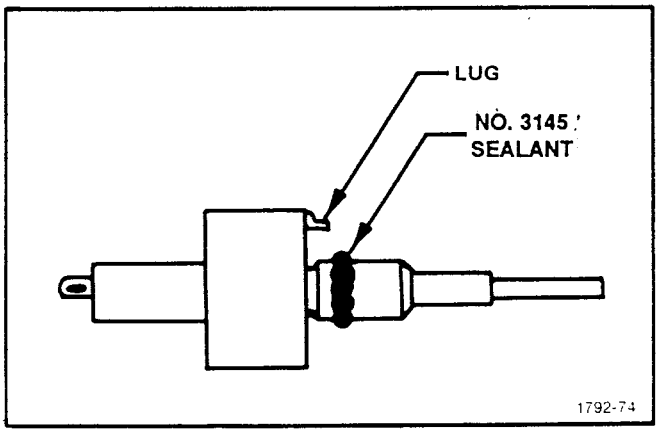


Fig. 5-21. ZERO REFERENCE Bushing

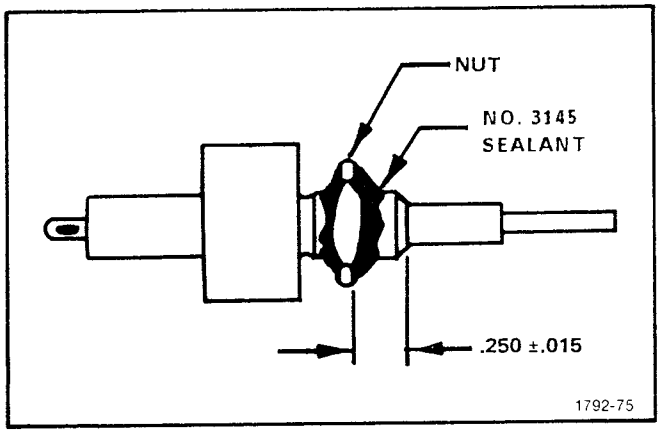


Fig. 5-22. ZERO REFERENCE Nut

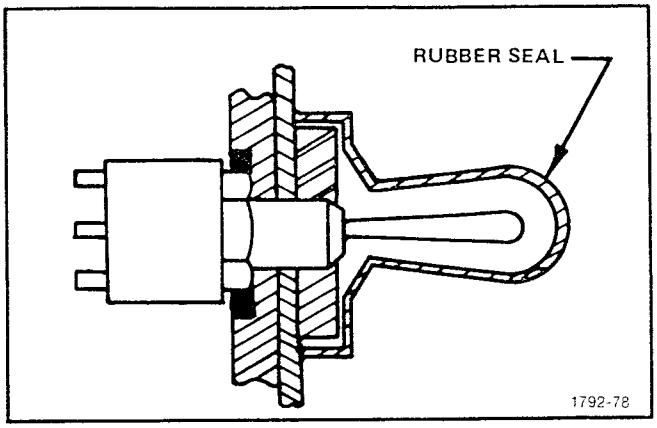


Fig. 5-25. RECORD Switch Cap-Seal

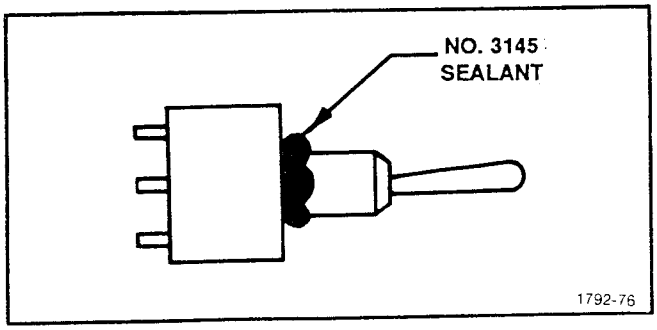


Fig. 5-23. RECORD Switch Bushing

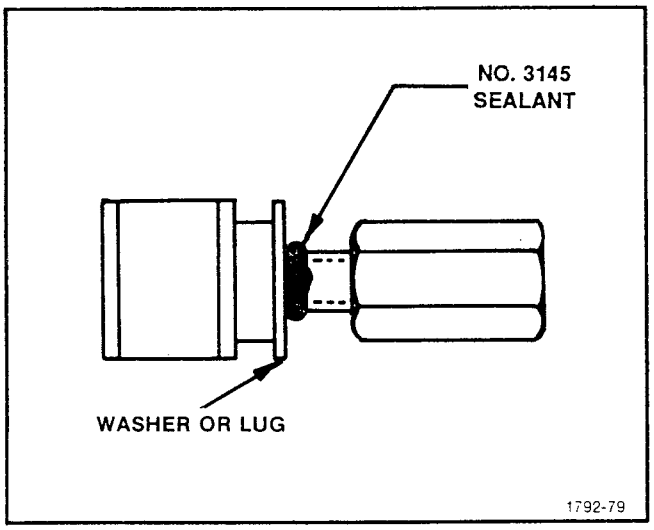


Fig. 5-26. GAIN Control

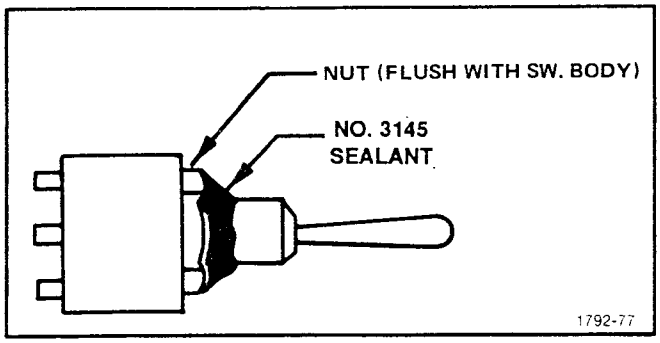


Fig. 5-24. RECORD Switch Nut

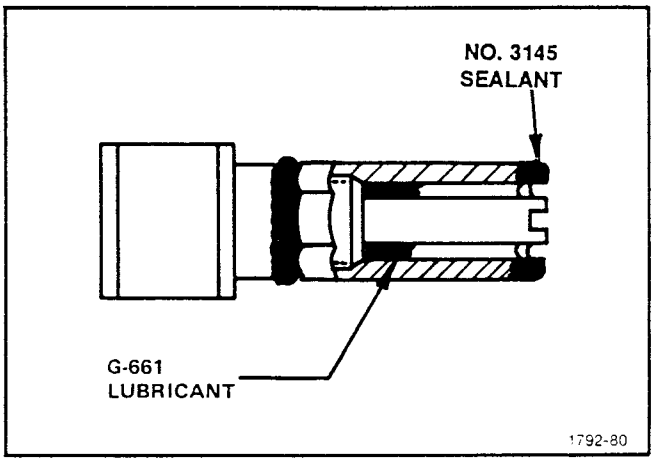


Fig. 5-27. VAR Control

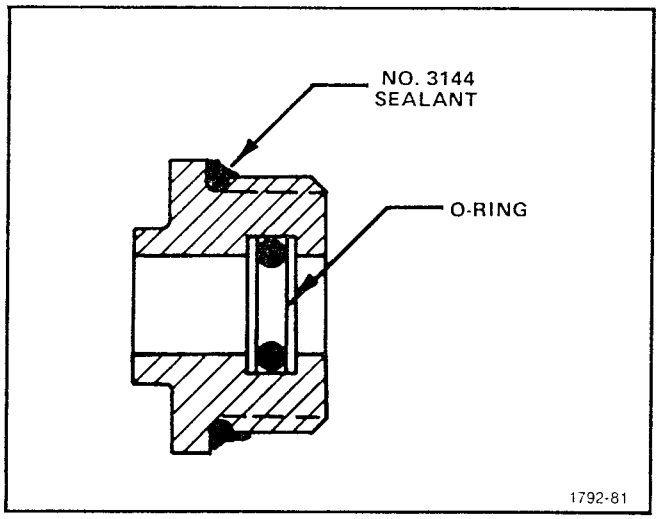


Fig. 5-28. Cam-switch O-Rings

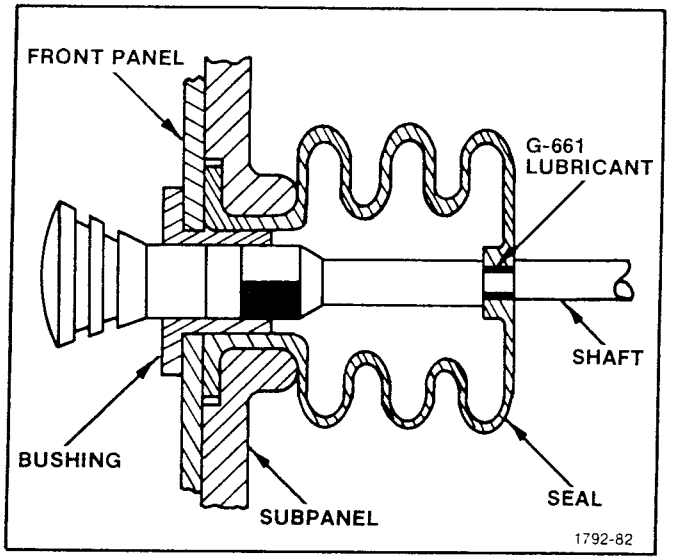


Fig. 5-29. POWER Switch

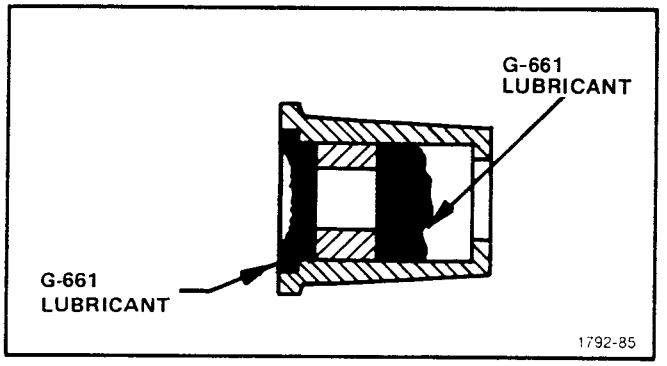


Fig. 5-30. POSITION Control Knob

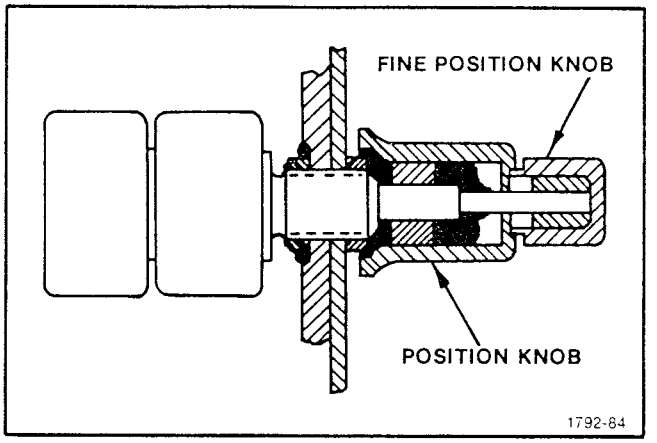


Fig. 5-31. POSITION Control Knob Installation

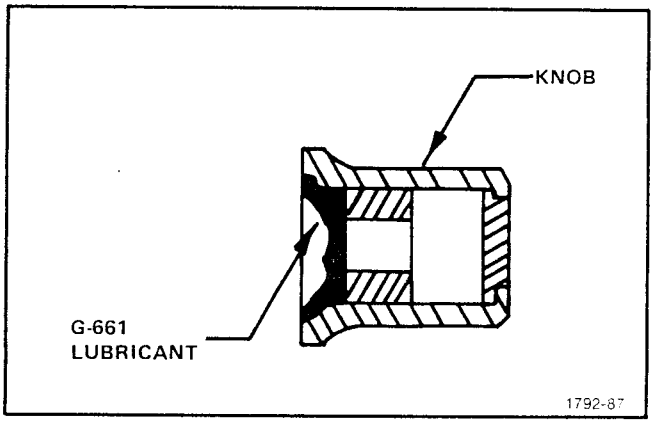


Fig. 5-32. ZERO REFERENCE Knob

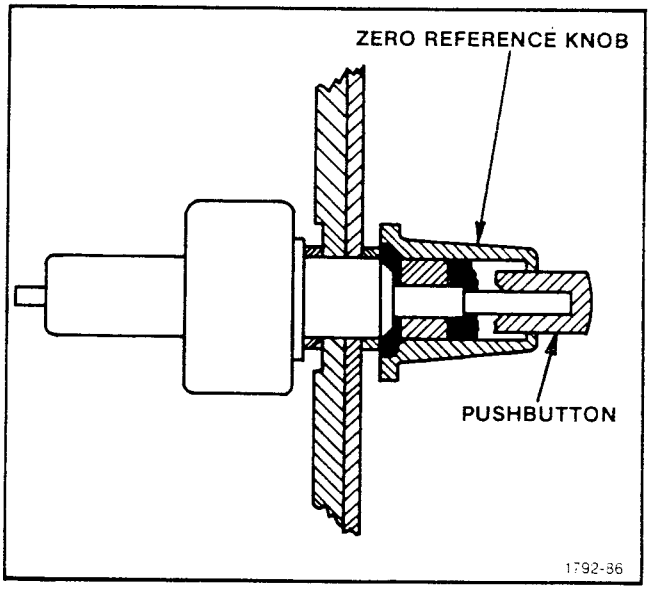


Fig. 5-33. ZERO REFERENCE Knob Installation

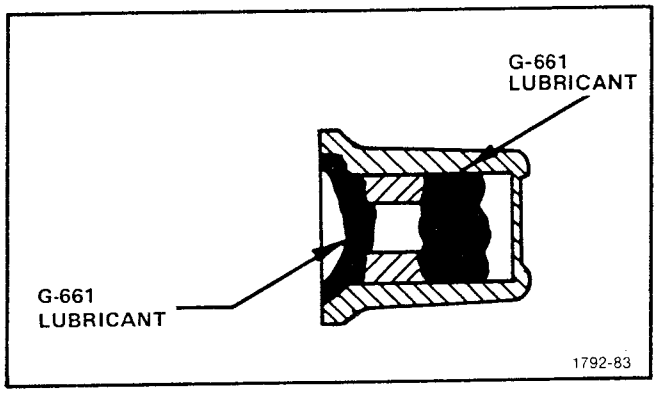


Fig. 5-34. FOCUS and INTENSITY Knobs

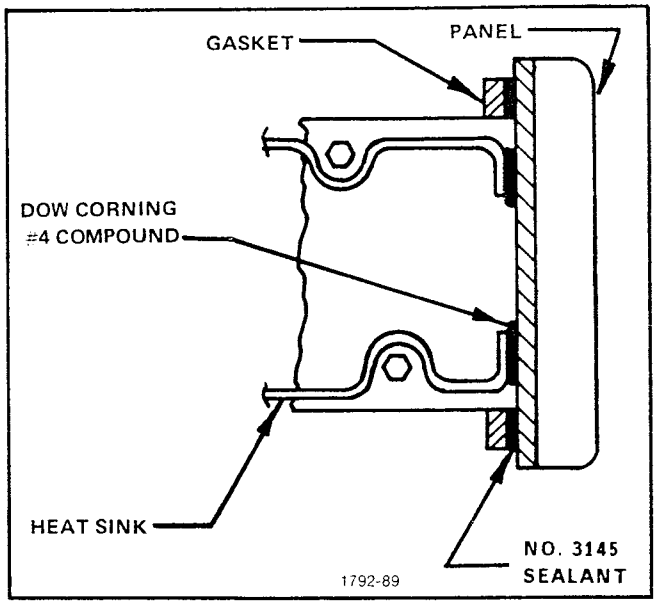


Fig. 5-36. Battery Pack Dielectric Application

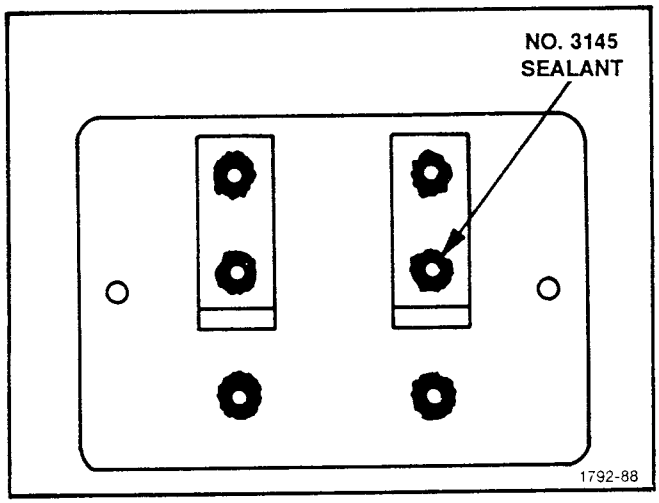


Fig. 5-35. Battery Seal Screwholes

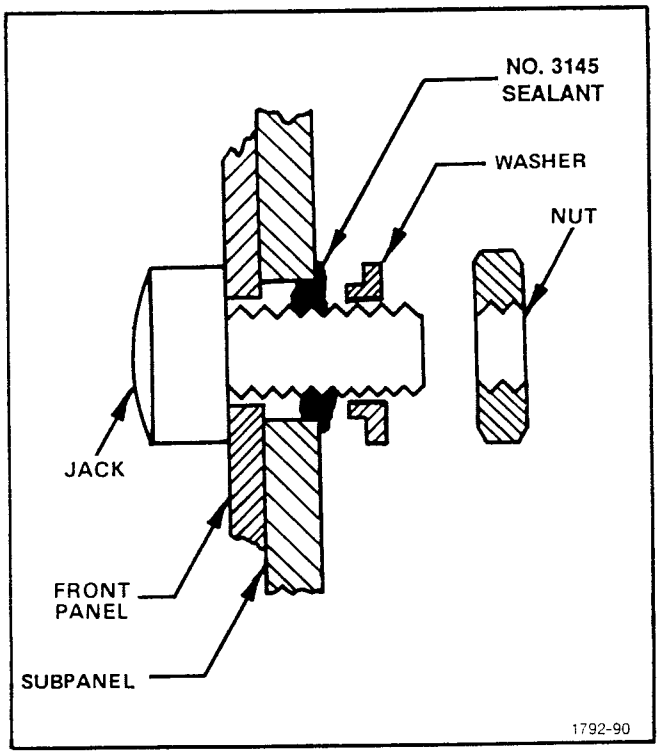


Fig. 5-37. X-Y Module Front Panel Jacks

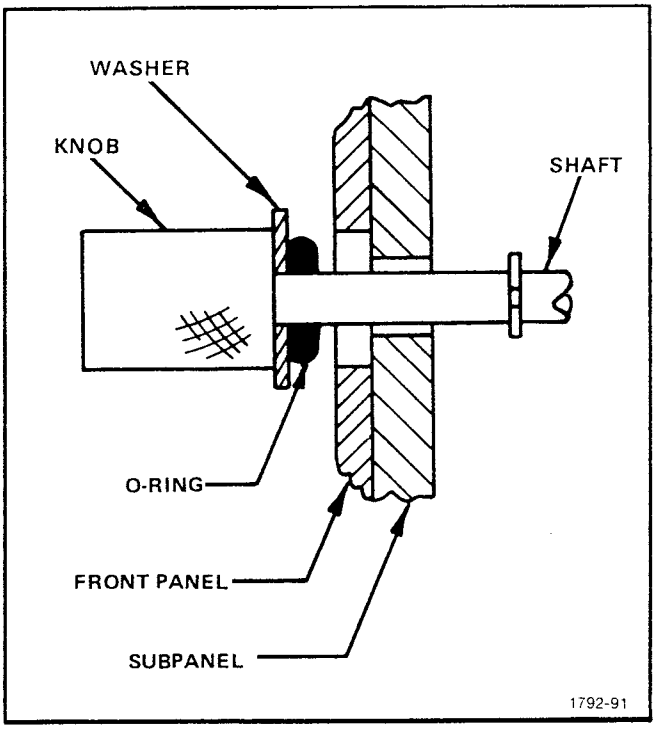


Fig. 5-38. X-Y Module Thumbscrews

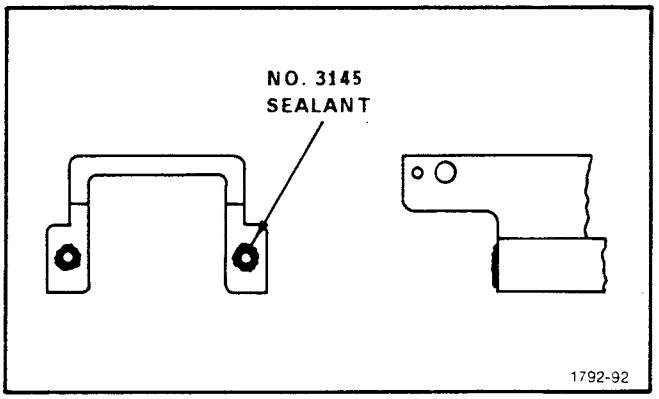


Fig. 5-39. Latch Assembly Screwholes

SHIPPING INSTRUCTIONS

Use the following procedure to pack an instrument for shipment to an authorized Tektronix Service Center.

1. If possible, reuse the original packaging materials. If this is not possible, use a carton with inside dimensions of no less than six inches for cushioning materials. Refer to the following table for test strength requirements.

SHIPPING CARTON TEST STRENGTH	
Gross Weight (lb)	Carton Test Strength (lb)
0-10	200
10-30	275
30-120	375
120-140-	500
140-160	600

2. Surround the instrument with polyethylene sheeting to protect the finish of the instrument.

3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between carton and instrument, allowing three inches on all sides.

4. Seal carton with shipping tape or industrial stapler.

OPTIONS

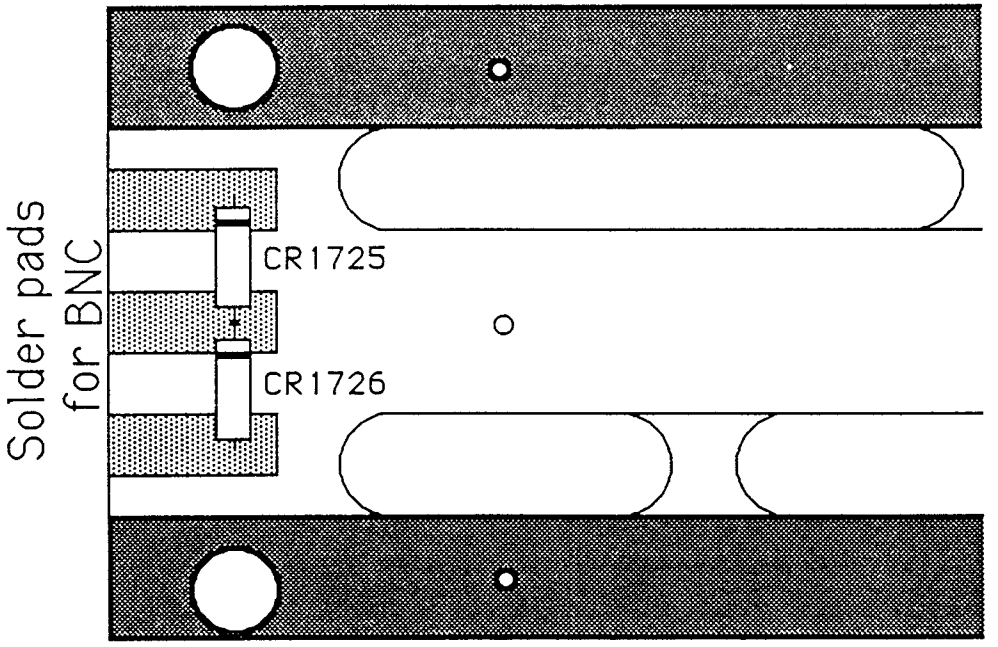
The following options are available for the 1502 TDR:

OPTION 02 **Static Suppression**: This option adds static suppression to the 1502 TDR to protect internal components from external voltage transients. It is capable of suppressing induced charges up to 7.5 μC (500 pF charged to 15 kV; the equivalent of 16 feet of 50 Ω cable charged to that voltage). It is not effective against sustained overloads (e.g. exceeding 15kV for one nanosecond, such as might be encountered in switching an external cable to an underground outdoor antenna).

The *CAUTION* notice on page 2-5 of this manual remains applicable. Option 02 increases reflected risetime from ≤ 0.07 foot (2.1 cm) to 0.16 foot (4.9 cm), or from 140 ps to 320 ps. There is no observable effect on the incident risetime.

Option 02 introduces a capacitive aberration (notch) of approximately 300 mρ amplitude, located approximately 0.25 foot (7.6) cm) from the leading edge of the pulse, with a displayed width approximately equal to the system risetime. In addition, reflections from an open are clipped by approximately 50 mρ.

Option 02 circuitry is shown on the Pulsar/Sampler schematic.



Option 02 Parts Locations

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from your Tektronix Field Office or representative. When ordering parts, include the part number plus instrument type, serial number and modification number (if applicable).

If a part has been replaced with a new or improved part, your Tektronix representative will contact you regarding any change in part number.

LIST OF ASSEMBLIES

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

MFR. CODE NUMBER-TO-MANUFACTURER CROSS INDEX

The Mfr. Code Number-to-Manufacturer cross index provides codes, names and addresses of manufacturers of components listed in the Replaceable Electrical Parts List.

ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (Column 1 of Electrical Parts List)

A numbering method is used to identify assemblies, subassemblies and parts. An example of this numbering method and typical expansions is as follows:

A23A2R1234 = A23 (Assembly number) A2 (Subassembly number) R1234 (Circuit number)

Read: resistor 1234 of subassembly 2 of assy 23

Only circuit numbers appear on the schematics and circuit board illustrations, and Each schematic and illustration is marked with its assembly number. Assembly numbers are also marked on the mechanical exploded view located in the Replaceable Mechanical Parts list. A component number is obtained by adding the assembly number prefix to the circuit number.

This parts list is arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts precedes A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are listed at the end of the Replaceable Electrical Parts list.

TEKTRONIX PART NO. (Column 2)

This column lists the part number used when ordering a replacement part from Tektronix.

SERIAL/MODEL NO. (Columns 3 and 4)

Column 3 lists the serial number of the first instrument in which the part was used. Column 4 lists the serial number of the last instrument in which the part was used. No entry indicates that the part is used in all instruments.

NAME AND DESCRIPTION (Column 5)

In this parts list, the item name is separated from its description by a colon (:). Because of space limitations, the item name may appear to be incomplete. For further item name identification, refer to the U.S. Federal Cataloging Handbook, H6-1.

MFR. CODE (Column 6)

This column lists the code number of the manufacturer of the part.

MFR. PART NUMBER (Column 7)

This column lists the manufacturer's part number.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00213	NYTRONICS COMPONENTS GROUP,INC SUBSIDIARY OF NYTRONICS INC	14TH AND ARNOLD STREETS	CHICAGO HEIGHTS, IL 60411
00853	SANGAMO WESTON INC	SANGAMO RD,P.O.BOX128	PICKENS, SC 29671-9716
01002	GENERAL ELECTRIC CO CAPACITOR PRODUCTS DIVISION	JOHN STREET	HUDSON FALLS, NY 12839
01121	ALLEN-BRADLEY COMPANY	1201 SECOND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPRESSWAY P.O BOX 225012	DALLAS, TX 72565
02735	RCA CORP/SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NJ 08876
03508	GENERAL ELECTRIC CO SEMICONDUCTOR PRODUCTS DEPT	W GENESEE STREET	AUBURN, NY 13201
03888	KDI PYROFILM CORP	60 S JEFFERSON ROAD	WHIPPANY, NJ 07981
04222	AVX CERAMICS	19TH AVE SOUTH,P.O BOX 867	MYRTLE BEACH, SC 29577
04713	MOTOROLA INC SEMICONDUCTOR GROUP	5005 E McDOWELL ROAD	PHOENIX, AZ 85008
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIVISION	11901 MADISON AVE	CLEVELAND, OH 44101
07716	TRW INC/ELECTRONIC COMPONENTS TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT.PLEASANT AVE	BURLINGTON, IA 52601
09023	CORNELL-DUBILIER ELECTRONICS DIVISION OF PACIFIC ELECTRIC CO.	2652 DALRYMPLE STREET	SANFORD, NC 27330
09353	C AND K COMPONENTS INC	15 RIVERDALE AVE	NEWTON, MA 02158
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON STREET	DOVER, NH 03820
12969	UNITRODE CORP	5 FORBES ROAD	LEXINTON, MA 02713-7305
14099	SEMTECH CORP	652 MITCHELL ROAD	NEWBURY PARK, CA 91320
14552	MICRO/SEMICONDUCTOR CORP	2830 S FAIRVIEW STREET	SANTA ANA, CA 92704
14752	ELECTRO CUBE INC	1710 S DEL MAR AVE	SAN GABRIEL, CA 91776
14936	GENERAL INSTRUMENT CORP DISCRETE SEMICONDUCTOR DIVISION	600 W JOHN STREET	HICKSVILLE, NY 11802
19396	ILLINOIS TOOL WORKS INC PAKTRON DIVISION	900 FOLLIN LANE SE	VIENNA, VA 22180
19701	MEPCO ELECTRA INC A NORTH AMERICAN PHILIPS CO	P.O BOX 760	MINERAL WELLS, TX 76067
21847	AERTECH INDUSTRIES	825 STEWART DRIVE	SUNNYVALE, CA 94086
22229	SOLITRON DEVICES INC SEMICONDUCTOR GROUP	8808 BALBOA AVE	SAN DIEGO, CA 92123
24138	INTERNATIONAL ELECTRONIC CORP HUNTINGTON STATION	316 SERVICE ROAD	MELVILLE,L.I.,NY 11746
24931	SPECIALTY CONNECTOR CO INC	2620 ENDRESS PLACE P.O BOX "D"	GREENWOOD, IN 46142
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA, CA 95051-0606
31433	UNION CARBIDE CORP ELECTRONICS DIV	HWY 276 SE P.O. BOX 5928	GREENVILLE, SC 29606
32997	BOURNS INC/TRIMPOT DIVISION	1200 COLUMBIA AVE	RIVERSIDE, CA 92507
51406	MURATA CORP OF AMERICA	1148 FRANKLIN ROAD SE	MARIETTA, GA 92627
55112	WESTLAKE CAPACITORS INC	5334 STERLING CENTER DR	WESTLAKE VILLAGE, CA 91361
56289	SPRAGUE ELECTRIC CO	87 MARSHALL STREET	NORTH ADAMS, MA 01247
59660	TUSONIX INC	2155 N FORBES BLVD	TUCSON, AZ 85705

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
59821	CENTRALAB INC SUB OF NORTH AMERICAN PHILIPS CORP	7158 MERCHANT AVE	EL PASO, TX 79915
61935	SCHURTER INC	1016 CLEGG COURT	PETALUMA, CA 94952-1152
71400	McGRAW-EDISON CO BUSSMANN MFG DIVISION	502 EARTH CITY PLAZA P.O BOX 14460	ST.LOUIS, MO 63178
72982	ERIE TECHNOLOGICAL PRODUCTS INC	645 W 11TH ST	ERIE, PA 16512
73890	ROHM CORPORATION	P.O. BOX 19515	IRVINE, CA 92713
75915	LITTLEFUSE INC	800 E NORTHWEST HWY	DES PLAINES, IL 60016
80009	TEKTRONIX INC	P.O BOX 500	BEAVERTON, OR 97077
80031	MEPCO/ELECTRA INC PRESTOLE EVERLOCK DIVISION	1345 MIAMI STREET P.O BOX 278	TOLEDO, OH 43605
90291	AEROVEX MALLORY	101 MALLORY DRIVE	GLASCOW, KY 42141
91637	DALE ELECTRONICS INC	P.O BOX 609	COLUMBUS, NE 68601

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
	672-1220-00			CKT BD ASSY:MAIN OPT 05 METRIC W/21mA TD	80009	672-1220-00
A1CR1703	152-0489-00			SEMICOND DVC,DI:TNL,GE,21mA,1.5pF W/GND	53399	SMTD0892 W/CLAMP
A1	670-4338-00	B010100	B102647	CKT BOARD ASSY:MAIN OPTION 5 METRIC	80009	670-4338-00
	670-4338-01	B102648	R115469	CKT BOARD ASSY:MAIN OPTION 5 METRIC	80009	670-4338-01
	670-4338-03	R115470	R115491	CKT BOARD ASSY:MAIN OPTION 5 METRIC	80009	670-4338-03
	670-4338-04	R115492		CKT BOARD ASSY:MAIN OPTION 05 METRIC	80009	670-4338-04
	672-1221-00			CKT BD ASSY:MAIN STANDARD W/21mA TD	80009	672-1221-00
A1CR1703	152-0489-00			SEMICOND DVC,DI:TNL,GE,21mA,1.5pF W/GND	53399	SMTD0892 W/CLAMP
A1	670-3008-00	B010100	B020394	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-00
	670-3008-01	B020395	B029999	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-01
	670-3008-02	B030000	B069999	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-02
	670-3008-03	B070000	B081980	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-03
	670-3008-04	B081981	B102647	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-04
	670-3008-05	B102648	B114129	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-05
	670-3008-06	B114130	R115469	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-06
	670-3008-08	R115470	R115491	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-08
	670-3008-09	R115492		CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-09
A2	670-3009-00	B010100	B049999	CKT BOARD ASSY:VERT AMPL/SLOW RAMP	80009	670-3009-00
	670-3009-01	B050000	B102647	CKT BOARD ASSY:VERT AMPL/SLOW RAMP	80009	670-3009-01
	670-3009-02	B102648	B114112	CKT BOARD ASSY:VERT AMPL/SLOW RAMP	80009	670-3009-02
	670-3009-03	B114113	R115491	CKT BOARD ASSY:VERT AMPL/SLOW RAMP	80009	670-3009-03
	670-3009-04	R115492		CKT BOARD ASSY:VERT AMPL/SLOW RAMP	80009	670-3009-04
A3	670-3130-00	B010100	B099999	CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-00
	670-3130-02	B100000	B102647	CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-02
	670-3130-03	B102648	B113809	CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-03
	670-3130-04	B113810		CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-04
A4	670-3010-00	B010100	B099999	CKT BOARD ASSY:HIGH VOLTAGE POWER	80009	670-3010-00
	670-3010-01	B100000	B102647	CKT BOARD ASSY:HIGH VOLTAGE POWER	80009	670-3010-01
	670-3010-02	B102648		CKT BOARD ASSY:HIGH VOLTAGE POWER	80009	670-3010-02
A5	670-3513-00	B010100	B029999	CKT BOARD ASSY:CHART RECORDER LOGIC	80009	670-3513-00
	670-3513-01	B030000	B102647	CKT BOARD ASSY:CHART RECORDER LOGIC	80009	670-3513-01
	670-3513-02	B102648		CKT BOARD ASSY:CHART RECORDER LOGIC	80009	670-3513-02
A6	670-3520-00	B010100	B020394	CKT BOARD ASSY:POWER SUPPLY	80009	670-3520-00
	670-3520-01	B020395	B102647	CKT BOARD ASSY:POWER SUPPLY	80009	670-3520-01
	670-3520-02	B102648	B118458	CKT BOARD ASSY:POWER SUPPLY	80009	670-3520-02
	670-3520-03	B118459		CKT BD ASSY:POWER SUPPLY	80009	670-3520-03
A7	670-3865-00	B010100	B102647	CKT BOARD ASSY:X-Y PLUG-IN	80009	670-3865-00
	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 (THIS ASSEMBLY HAS NO ELECTRICAL PARTS)	80009	670-0364-00

A1-MAIN OPTION 5 METRIC

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
	672-1220-00			CKT BD ASSY:MAIN OPT 5 METRIC W/21mA TD	80009	672-1220-00
A1CR1703	152-0489-00			SEMICOND DVC,DI:TNL,GE,21mA,1.5pF, W/GND	53399	SMTD0892 W/CLAMP
A1	670-4338-00	B010100	B102647	CKT BOARD ASSY:MAIN OPTION 5 METRIC	80009	670-4338-00
	670-4338-01	B102648	R115469	CKT BOARD ASSY:MAIN OPTION 5 METRIC	80009	670-4338-01
	670-4338-03	R115470	R115491	CKT BOARD ASSY:MAIN OPTION 5 METRIC	80009	670-4338-03
	670-4338-04	R115492		CKT BOARD ASSY:MAIN OPTION 5 METRIC	80009	670-4338-04
A1R1218	321-0309-00			RES.,FXD FILM:16.2K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1227	321-0405-00			RES.,FXD FILM:162K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1312	321-0213-00			RES.,FXD,FILM:1.62K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1432	321-0196-00			RES.,FXD,FILM:1.07K OHM,1%,0.125W	07716	CEAD100700F

A1-MAIN STANDARD 1502

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
	672-1221-00			CKT BD ASSY:MAIN STANDARD W/21mA TD	80009	672-1221-00
A1CR1703	152-0489-00			SEMICOND DVC,DI:TNL,GE,21mA,1.5pF W/GND	53399	SMTD0892 W/CLAMP
A1	670-3008-00	B010100	B020394	CKT BOARD ASSY:MAIN STANDARD 1502)	80009	670-3008-00
	670-3008-01	B020395	B029999	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-01
	670-3008-02	B030000	B069999	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-02
	670-3008-03	B070000	B081980	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-03
	670-3008-04	B081981	B102647	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-04
	670-3008-05	B102648	B114129	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-05
	670-3008-06	B114130	R115491	CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-06
	670-3008-09	R112492		CKT BOARD ASSY:MAIN STANDARD 1502	80009	670-3008-09
A1C1155	290-0534-00			CAP.,FXD,ELCTLT:1µ F,20%,35V	TK0875	DTS3501-105M
A1C1161	290-0534-00			CAP.,FXD,ELCTLT:1µ F,20%,35V	TK0875	DTS3501-105M
A1C1237	283-0622-00			CAP.,FXD,MICA:450pf,1%,300V	TKO891	RDM15FD451F03
A1C1313	283-0204-00			CAP.,FXD,CER DI:0.01µ F,20%,50V	04222	SR155E104MAA
A1C1325	285-1062-00			CAP., FXD,PLSTC:0.005µ F,0.1%,200V	19396	502F02PP460
A1C1332	281-0205-00			CAP.,VAR,PLSTC:5.5-65pf,100V	80031	2810C5R565QJ02F0
A1C1341	283-0111-00			CAP.,FXD,CER DI:0.1µ F,20%,50V	04222	SR215E104MAA
A1C1345	283-0177-00			CAP.,FXD,CER DI:1µ F,+80-20%,25V	TK1156	CZ30C105Z
A1C1435	283-0003-00			CAP.,FXD,CER DI:0.01µ F,+80-20%,150V	TK1134	855-558Z5U-103Z
A1C1464	283-0154-00			CAP.,FXD,CER DI:22pf,5%,50V	04222	3418050A220J
A1C1504	283-0119-00	B030000		CAP.,FXD,CER DI:2200pf,5%,200V	59821	2DDH66K222J
A1C1506	290-0530-00	B020395		CAP.,FXD,ELCTLT:68µ F,20%,6V	05397	T368B686M00
A1C1507	283-0176-00			CAP.,FXD,CER DI:0.0022µ F,20%,50V	04222	SR205C222MAA
A1C1508	283-0111-00			CAP.,FXD,CER DI:0.1µ F,20%,50V	04222	SR215E104MAA
A1C1531	285-0598-00			CAP.,FXD,PLSTC:0.01µF,5%,100V	19396	DU490B103J
A1C1534	283-0201-00			CAP.,FXD,CER DI:27pf,10%,200V	51406	RPE110COG270K
A1C1542	283-0201-00			CAP.,FXD,CER DI:27pf,10%,200V	51406	RPE110COG270K
A1C1543	283-0196-00			CAP.,FXD,CER DI:270pf,10%,50V	20932	5018M50RD271K
A1C1546	283-0204-00			CAP.,FXD,CER DI:0.01µ F,20%,50V	04222	SR155E103MAA
A1C1551	283-0060-00			CAP.,FXD,CER DI:100pf,5%,200V	59660	855-535UJ101J
A1C1555	283-0111-00	B010100	B020394	CAP.,FXD,CER DI:0.1µ F,20%,50V	04222	SR215E104MAA
A1C1556	283-0067-00			CAP.,FXD,CER DI:0.001µ F,10%,200V	51406	DD09B10Y5F102K
A1C1566	290-0723-00			CAP.,FXD,ELCTLT:150µ F,20%,6V	TK0961	NDK1576C
A1C1567	283-0067-00			CAP.,FXD,CER DI:0.001µ F,10%,200V	51406	DD09B10Y5F102K
A1C1572	283-0032-00			CAP.,FXD,CER DI:470pf,5%,500V	56289	562CBB501AE471J
A1C1581	281-0523-00			CAP.,FXD,CER DI:100pf,20%,500V	59660	301-000U2M0101M
A1C1592	281-0523-00			CAP.,FXD,CER DI:100pf,20%,500V	59660	301-000U2M0101M
A1C1596	281-0546-00	B010100	B029999	CAP.,FXD,CER DI:330pf,10%,500V	04222	7001-1380
A1C1596	281-0580-00	B030000	B114129	CAP.,FXD,CER DI:470pf,10%,500V	04222	7001-1374
A1C1596	283-0597-00	B114130		CAP.,FXD,MICA D:470pf,10%,300V	TK0891	RDM15FD471K03
A1C1605	290-0723-00			CAP.,FXD,ELCTLT:150µ F,20%,6V	TK0961	NDK1576C
A1C1609	283-0160-00			CAP.,FXD,CER DI:1.5pf,±0.1pf,50V	51642	100050NP0159B
A1C1625	283-0003-00			CAP.,FXD,CER DI:0.01µ F,+80-20%,150V	TK1134	855-558Z5U-103Z
A1C1630	283-0195-00			CAP.,FXD,CER DI:680pf,5%,50V	04222	SR205A681J
A1C1631	283-0139-00			CAP.,FXD,CER DI:150pf,20%,50V	05397	C312C151M5G5CA
A1C1632	283-0139-00			CAP.,FXD,CER DI:150pf,20%,50V	05397	C312C151M5G5CA
A1C1633	283-0318-00			CAP.,FXD,CER DI:10pf,±1pf,100V	04222	ULA151A100K2
A1C1634	283-0318-00			CAP.,FXD,CER DI:10pf,±1pf,100V	04222	ULA151A100K2
A1C1635	283-0175-00			CAP.,FXD,CER DI:10pf,5%,200V	51406	RPE110NP0100D
A1C1636	283-0175-00			CAP.,FXD,CER DI:10pf,5%,200V	51406	RPE110NP0100D
A1C1637	283-0260-00			CAP.,FXD,CER DI:5.6pf,±0.25pf,200V	51406	RPE110COG5R6C
A1C1638	283-0260-00			CAP.,FXD,CER DI:5.6pf,±0.25pf,200V	51406	RPE110COG5R6C

A1-MAIN STANDARD 1502(cont)

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
A1C1639	283-0195-00			CAP.,FXD,CER DI:680pf,5%,50V	04222	SR205A681J
A1C1641	290-0534-00			CAP.,FXD,ELCTLT:1µ F,20%,35V	TK0875	DTS3501105M
A1C1642	283-0252-00			CAP.,FXD,CER DI:.001µ F,10%,50V	04222	ULA105C102K2T60
A1C1643	283-0320-00			CAP.,FXD,CER DI:1pf,0.25%,50V,LEADLESS	51642	UCO805-050NPO
A1C1645	283-0191-00			CAP.,FXD,CER DI:0.022µ F,20%,50V	04222	SR205E224MAA
A1C1646	283-0070-00			CAP.,FXD,CER DI:30pf,10%,50V	72982	8121-060C0G0300K
A1C1647	283-0070-00			CAP.,FXD,CER DI:30pf,10%,50V	72982	8121-060C0G0300K
A1C1648	283-0157-00			CAP.,FXD,CER DI:7pf,5%,500V	51406	RPE110COG070D
A1C1652	283-0067-00			CAP.,FXD,CER DI:0.001µ F,10%,200V	51406	DD09B10Y5F102K
A1C1655	283-0003-00			CAP.,FXD,CER DI:0.01µ F,+80-20%,150V	TK1134	855-558Z5U103Z
A1C1661	290-0723-00			CAP.,FXD,ELCTLT:150µ F,20%,6V	TK0961	NDK157M6C
A1C1662	283-0067-00	B010100	B029999	CAP.,FXD,CER DI:0.001µ F,10%,200V	51406	DD09B10Y5F102K
A1C1675	281-0523-00			CAP.,FXD,CER DI:100pf,20%,350V	59660	301-000U2M0101M
A1C1701	283-0320-00			CAP.,FXD,CER DI:1pf,0.25%,50V,LEADLESS	51642	UCO805-050-NPO
A1C1706	283-0354-00			CAP.,FXD,CER DI:4.7pf,±0.5pf,100V,LEADLESS	04222	ULA151A4R7D2
A1CR1359	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A1CR1609	152-0140-01			SEMICOND DVC:TUNNEL,8pf,10mA	03508	SMTD995
A1CR1632	152-0335-01			SEMICOND DVC:SILICON,SNAP-OFF,40V	21847	A4X583
A1CR1691	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A1CR1732	152-0631-00			SEMICOND DVC,DI:GATE,CER PKG	80009	152-0631-00
A1CR1725	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200mA (OPTION 02 ONLY)	07263	FDH-6012
A1CR1726	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200mA (OPTION 02 ONLY)	07263	FDH-6012
A1Q1317	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A1Q1325	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1328	151-0325-00			XSTR:SILICON,PNP,SEL	80009	151-0325-00
A1Q1329	151-0325-00			XSTR:SILICON,PNP,SEL	80009	151-0325-00
A1Q1336	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1337	151-0441-00			XSTR:SILICON,NPN	04713	SRF501
A1Q1338	151-0325-00			XSTR:SILICON,PNP,SEL	80009	151-0325-00
A1Q1339	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1347	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1348	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1355	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1357	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1358	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1413	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1425	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1431	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1443	151-0325-00			XSTR:SILICON,PNP,SEL	80009	151-0325-00
A1Q1444	151-0325-00			XSTR:SILICON,PNP,SEL	80009	151-0325-00
A1Q1447	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1448	151-0192-00			XSTR:SILICON,NPN,SEL	04713	SPS8801
A1Q1502	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1504	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1529	151-0347-00			XSTR:SILICON,NPN	TK1016	2N5551
A1Q1535	151-0271-00			XSTR:SILICON PNP	04713	SPS8236
A1Q1537	153-0556-00	B010100	B081649	XSTR:SILICON,5V,SEL	80009	153-0556-00
A1Q1537	151-0108-01	B081650		XSTR:SELECTED	80009	151-0108-01
A1Q1539	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1544	151-0441-00			XSTR:SILICON,NPN	04713	SRF501
A1Q1553	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A1Q1556	151-0302-00			XSTR:SILICON NPN	04713	ST899

A1-MAIN STANDARD 1502(cont)

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
A1Q1583	151-0302-00			XSTR:SILICON NPN	04713	ST899
A1Q1589	151-0302-00	B010100	B029999	XSTR:SILICON NPN	04713	ST899
A1Q1595	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1597	151-0302-00	B010100	B029999	XSTR:SILICON NPN	04713	ST899
A1Q1602	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A1Q1603	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A1Q1608	151-0325-00			XSTR:SILICON,PNP,SEL	80009	151-0325-00
A1Q1643	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1648	151-1054-01			XSTR:SILICON,JFET,N-CHANNEL,DUAL	22229	FD1764
A1Q1656	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1675	151-0302-00			XSTR:SILICON NPN	04713	ST899
A1Q1683	151-0302-00			XSTR:SILICON NPN	04713	ST899
A1Q1688	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1Q1693	151-1022-00			XSTR:FET,N-CHANNEL,SI,TO-18	80009	151-1022-00
A1Q1695	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A1R1129	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A1R1132	311-1559-00	B010100	R115469	RES,VAR,NONWW:10K OHM,20%,0.50W	32997	3352T-1-103
A1R1132	311-1943-00	R115470		RES.,VAR,NONWW:10K OHM,10%,0.5W	02111	64W103T611
A1R1135	315-0223-00	B010100	B069999	RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A1R1135	315-0682-00	B070000		RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A1R1138	321-0135-00	B010100	B069999	RES.,FXD,FILM:249 OHM,1%,0.125W	01121	ORD BY DESCR
A1R1138	315-0121-00	B070000	B081980	RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
A1R1138	321-0172-00	B081981		RES.,FXD,FILM:604 OHM,1%,0.125W	07716	CEAD604R0F
A1R1144	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1146	321-0208-00			RES.,FXD,FILM:1.43K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1148	321-1210-01			RES.,FXD,FILM:1.52K OHM,0.5%,0.125W	91637	MFF1816G15200D
A1R1152	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A1R1216	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1217	321-0271-00			RES.,FXD,FILM:6.49K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1218	321-0300-00			RES.,FXD,FILM:13K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1219	321-0338-00			RES.,FXD,FILM:32.4K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1226	321-0367-00			RES.,FXD,FILM:64.9K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1227	321--396-00			RES.,FXD,FILM:130K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1235	321-0286-00	B010100	B069999	RES.,FXD,FILM:9.31K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1235	315-0472-00	B070000	B081980	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R1235	321-0255-00	B081981		RES.,FXD,FILM:4.42K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1239	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1312	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1315	311-1560-00			RES.,VAR,NONWW:5K OHM,20%,0.50W	32997	3352T-1-502
A1R1318	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A1R1319	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
A1R1323	321-0434-00			RES.,FXD,FILM:324K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1324	321-0463-00			RES.,FXD,FILM:649K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1326	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
A1R1333	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A1R1335	315-0180-00			RES.,FXD,CMPSN:18 OHM,5%,0.25W	01121	CB1805
A1R1338	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
A1R1341	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A1R1342	321-0164-00	B010100	B081980	RES.,FXD,FILM:499 OHM,1%,0.125W	01121	ORD BY DESCR
A1R1342	321-0210-00	B081981		RES.,FXD,FILM:1.5K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1352	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A1R1353	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A1R1354	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A1R1355	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1358	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225

A1-MAIN STANDARD 1502(cont)

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
A1R1422	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A1R1431	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
A1R1432	321-0204-00			RES.,FXD,FILM:1.3K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1434	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1435	311-1562-00			RES,VAR,NONWW:2K OHM,20%,0.50W	32997	3352T-1-202
A1R1437	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A1R1441	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	32997	ORD BY DESCR
A1R1442	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A1R1443	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A1R1445	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A1R1462	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A1R1463	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A1R1502	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
A1R1507	321-0253-00			RES.,FXD,FILM:4.22K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1508	321-0209-00			RES.,FXD,FILM:1.47K OHM,1%,0.125W	07716	CEAD14700F
A1R1509	315-0510-00			RES.,FXD CMPSN:51 OHM,5%,0.25W	01121	CB5105
A1R1525	311-0698-00			RES.,VAR,NONWW:1M OHM,10%,0.50W	32997	3329H-L58-105
A1R1528	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A1R1533	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1536	317-0332-00	B010100	R116351	RES.,FXD,CMPSN:3.3K OHM,5%,0.125W	01121	BB3325
	322-3243-00	R116352		RES.,FXD,FILM:3.32K OHM,1%,0.2W	73890	RB20FX-3K32
A1R1537	317-0332-00	B010100	R115351	RES.,FXD,CMPSN:3.3K OHM,5%,0.125W	01121	BB3325
	322-3243-00	R116352		RES.,FXD,FILM:3.32K OHM,1%,0.2W	73890	RB20FX-3K32
A1R1538	311-1267-00			RES.,VAR,NONWW:5K OHM,10%,0.50W	32997	3329P-L58-502
A1R1539	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R1540	315-0563-00	B010100	R117428	RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
	321-0361-00	R117428		RES.,FXD,FILM:56.2K OHM,1%,0.125W	07716	CEAD5620F
A1R1541	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A1R1542	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	91121	CB1835
A1R1544	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1545	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R1546	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1547	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R1548	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A1R1549	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R1553	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
A1R1556	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A1R1558	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1559	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1574	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1577	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A1R1582	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1584	315-0472-00	B010100	B029999	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R1587	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R1588	321-0263-00			RES.,FXD,FILM:5.36K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1593	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1594	315-0102-00	B010100	B029999	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A1R1594	315-0681-00	B030000		RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
A1R1597	321-0258-00			RES.,FXD,FILM:4.75K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1598	321-0250-00	B010100	B029999	RES.,FXD,FILM:3.92K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1598	315-0100-00	B030000		RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A1R1599	321-0248-00			RES.,FXD,FILM:3.74K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1601	315-0151-00			RES.,FXD CMPSN:150 OHM,5%,0.25W	01121	CB1515
A1R1602	315-0332-00			RES.,FXD CMPSN:3.3K OHM,5%,0.25W	01121	CB3325

A1-MAIN STANDARD 1502(cont)

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
A1R1604	315-0361-00			RES.,FXD CMPSN:360 OHM,5%,0.25W	01121	CB3615
A1R1606	317-0103-00	B010100	R116351	RES.,FXD,CMPSN:10K OHM,5%,0.125W	01121	BB1035
	322-3289-00	R116352		RES.,FXD,FILM:10K OHM,1%,0.2W	73890	RB20FX-10K
A1R1607	317-0470-00	B010100	R116351	RES.,FXD,CMPSN:47 OHM,5%,0.125W	01121	BB4705
	322-3066-00	R116352		RES.,FXD,FILM:47.5 OHM,1%,0.2W	73890	RB20FX-47E5
A1R1608	317-0391-00	B010100	R116351	RES.,FXD,CMPSN:390 OHM,5%,0.125W	01121	BB3915
	322-3154-00	R115352		RES.,FXD,FILM:392 OHM,1%,0.2W	73890	RB20FX-392E
A1R1625	317-0430-00	B010100	R116351	RES.,FXD,CMPSN:43 OHM,5%,0.125W	01121	BB4305
	322-3062-00	R115352		RES.,FXD,FILM:43.2 OHM,1%,0.2W	73890	RB20FX-43E2
A1R1630	317-0107-00			RES.,FXD,CMPSN:100M OHM,5%,0.125W	01121	BB1075
A1R1631	317-0120-00	B010100	R116351	RES.,FXD,CMPSN:12 OHM,5%,0.125W	01121	BB1205
	322-3009-00	R116352		RES.,FXD,FILM:12.1 OHM,1%,0.2W	73890	RB20FX-12E1
A1R1632	317-0120-00	B010100	R116351	RES.,FXD,CMPSN:12 OHM,5%,0.125W	01121	BB1205
	322-3009-00	R116352		RES.,FXD,FILM:12.1 OHM,1%,0.2W	73890	RB20FX-12E1
A1R1633	317-0430-00	B010100	R116351	RES.,FXD,CMPSN:43 OHM,5%,0.125W	01121	BB4305
	322-3062-00	R115352		RES.,FXD,FILM:43.2 OHM,1%,0.2W	73890	RB20FX-43E2
A1R1635	317-0151-00	B010100	R116351	RES.,FXD,CMPSN:150 OHM,5%,0.125W	01121	BB1515
	322-3114-00	R116352		RES.,FXD,FILM:150 OHM,1%,0.2W	73890	RB20FX-150E
A1R1636	317-0151-00	B010100	R116351	RES.,FXD,CMPSN:150 OHM,5%,0.125W	01121	BB1515
	322-3114-00	R116352		RES.,FXD,FILM:150 OHM,1%,0.2W	73890	RB20FX-150E
A1R1637	317-0151-00	B010100	R116351	RES.,FXD,CMPSN:150 OHM,5%,0.125W	01121	BB1515
	322-3114-00	R116352		RES.,FXD,FILM:150 OHM,1%,0.2W	73890	RB20FX-150E
A1R1638	317-0151-00	B010100	R116351	RES.,FXD,CMPSN:150 OHM,5%,0.125W	01121	BB1515
	322-3114-00	R116352		RES.,FXD,FILM:150 OHM,1%,0.2W	73890	RB20FX-150E
A1R1639	317-0107-00			RES.,FXD,CMPSN:100M OHM,5%,0.125W	01121	BB1075
A1R1641	317-0201-00	B060986	R116351	RES.,FXD CMPSN:200 OHM,5%,0.125W	01121	BB2015
	322-3126-00	R116352		RES.,FXD,FILM:200 OHM,1%,0.2W	73890	RB20FX-200E
A1R1642	317-0201-00	B060986	R116351	RES.,FXD CMPSN:200 OHM,5%,0.125W	01121	BB2015
	322-3126-00	R116352	R118275	RES.,FXD,FILM:200 OHM,1%,0.2W	73890	RB20FX-200E
A1R1643	311-1266-00			RES.,VAR,NONWW:2.5K OHM,10%,0.50W	32997	3329P-L58-252
A1R1645	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A1R1651	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R1654	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1656	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1657	311-1266-00			RES.,VAR,NONWW:2.5K OHM,10%,0.50W	32997	3329P-L58-252
A1R1659	311-1562-00			RES.,VAR,NONWW:2K OHM,20%,0.50W	32997	3352T-1-202
A1R1674	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1681	321-0221-00			RES.,FXD,FILM:1.96K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1682	321-0148-00			RES.,FXD,FILM:340 OHM,1%,0.125W	01121	ORD BY DESCR
A1R1683	321-0234-00			RES.,FXD,FILM:2.67K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1684	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	01121	ORD BY DESCR
A1R1685	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A1R1691	315-0433-00	B010100	B029999	RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
A1R1691	315-0133-00	B030000		RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
A1R1692	311-1560-00			RES.,VAR,NONWW:5K OHM,20%,0.50W	32997	3352T-1-502
A1R1693	315-0620-00	B010100	B029999	RES.,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A1R1693	315-0101-00	B030000		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A1R1701	307-0099-00			RES.,FXD,FILM:48 OHM,5%,0.25W	03888	125R250T48R00F
A1R1702	317-0221-00	B010100	R116351	RES.,FXD,CMPSN:220 OHM,5%,0.125W	01121	BB2215
	322-3130-00	R116352		RES.,FXD,FILM:221 OHM,1%,0.2W	73890	RB20FX-221E
A1R1703	317-0027-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.125W	01121	BB2R705
A1R1704	317-0390-00	B010100	R116351	RES.,FXD,CMPSN:39 OHM,5%,0.125W	01121	BB3905
	322-3058-00	R116352		RES.,FXD,FILM:39.2 OHM,1%,0.2W	73890	RB20FX-39E2
A1R1707	317-0751-00	B010100	R116351	RES.,FXD,CMPSN:750 OHM,5%,0.125W	01121	BB7515
	322-3181-00	R116352		RES.,FXD,FILM:750 OHM,1%,0.2W	73890	RB20FX-750E

A1-MAIN STANDARD 1502(cont)

Ckt.No	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr.Part Code	Number
A1R1752	317-0103-00	B010100	R116351	RES.,FXD,CMPSN:10K OHM,5%,0.125W	01121	BB1035
	322-3289-00	R115352		RES.,FXD,FILM:10K OHM,1%,0.2W	73890	RB20FX-10K
A1R1753	317-0202-00	B010100	B029999	RES.,FXD,CMPSN:2K OHM,5%,0.125W	01121	BB2025
	317-0152-00	B030000	R116351	RES.,FXD,CMPSN:1.5K OHM,5%,0.125W	01121	BB1525
	322-3210-00	R115352		RES.,FXD,FILM:1.5K OHM,1%,0.2W	73890	RB20FX-1.5K
A1S1222	263-1109-00			SWITCH CAM ACTUATOR ASSY:FEED/DIV (REPLACEABLE AS A UNIT ONLY)	80009	263-1109-00
A1S1251	263-0013-05			ACTUATOR ASSY,PUSH:3 LATCH,10MM,6 CONTACT	80009	263-0013-05
A1T1538	120-0544-00			XFMR,TOROID:2 WINDINGS,S1/S2	80009	120-0544-00
A1U1344	156-0067-00	B010100	B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROP7401C
	156-0067-12	B082050	R117277	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
	156-0067-01	R117278		MICROCKT,LI:OPNL AMPL,CHECKED	04713	MC1741CP1DS
A1U1569	156-0519-00	B010100	B102647	MICROCKT,DI:PRESET DIVIDE-BY-N-CNTR	80009	156-0519-00
A1U1569	156-0519-01	B102648		MICROCKT,DI:PRESET DIVIDE-BY-N-CNTR	80009	156-0519-01
A1U1575	156-0349-00			MICROCKT,DI:QUAD 2-INP NOR GATE	04713	MC14001UBCL
A1U1671	156-0350-00	B010100	B102647	MICROCKT,DI:QUAD 2-INP NAND GATE	80009	156-0350-00
A1U1671	156-0350-02	B102648		MICROCKT,DI:QUAD 2-INP NAND GATE,SEL	80009	156-0350-02
A1VR1531	152-0513-00			SEMICOND DVC:ZENER,1W,91V,5%	80009	152-0513-00

A2-VERTICAL AMPL/SLOW RAMP

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A2	670-3009-00	B010100	B049999	CKT BOARD ASSY:VERTICAL AMP/SLOW RAMP	80009	670-3009-00
	670-3009-01	B050000	B102647	CKT BOARD ASSY:VERTICAL AMPL/SLOW RAMP	80009	670-3009-01
	670-3009-02	B102648	B114112	CKT BOARD ASSY:VERTICAL AMPL/SLOW RAMP	80009	670-3009-02
	670-3009-03	B114113	R115491	CKT BOARD ASSY:VERTICAL AMPL/SLOW RAMP	80009	670-3009-02
	670-3009-04	R115492		CKT BOARD ASSY:VERTICAL AMPL/SLOW RAMP	80009	670-3009-02
A2C2137	283-0000-00			CAP.,FXD,CER DI:0.001µ F,+100-0%,500V	51406	DD07512YP102P
A2C2138	290-0530-00			CAP.,FXD,ELCTLT:68µ F,20%,6V	05397	T368B686M006ASC
A2C2146	283-0111-00			CAP.,FXD,CER DI:0.1µ F,20%,50V	04222	5R215E104MAA
A2C2147	290-0530-00			CAP.,FXD,ELCTLT:68µ F,20%,6V	05397	T368B686M006ASC
A2C2158	283-0340-00	B010201		CAP.,FXD,CER DI:45pf,5%,100V	59660	0808505C0G0450J
A2C2229	290-0530-00			CAP.,FXD,ELCTLT:68µ F,20%,6V	05397	T368B686M006ASC
A2C2232	290-0530-00			CAP.,FXD,ELCTLT:68µ F,20%,6V	05397	T368B686M006ASC
A2C2241	283-0111-00			CAP.,FXD,CER DI:0.1µ F,20%,50V	04222	5R215E104MAA
A2C2252	285-1056-00			CAP.,FXD,PLSTC:1µ F,2%,50V	14752	650B1A105G
A2C2325	290-0534-00			CAP.,FXD,ELCTLT:1µ F,20%,35V	TK0875	DTS3501-105M
A2C2345	290-0512-00	B050000		CAP.,FXD,ELCTLT:22µ F,20%,15V	05397	368B226M015AZ
A2C2349	283-0115-00			CAP.,FXD,CER DI:47µ F,5%,200V	59821	2DDT60K470J
A2C2351	283-0204-00	B010100	B114112	CAP.,FXD,CER DI:0.01µ F,20%,50V	04222	SR155E103MAA
A2C2351	285-1256-00	B114113		CAP.,FXD,MTLZD:0.01µ F,10%,100V	55112	168/.01K63B
A2C2356	283-0624-00			CAP.,FXD,MICA:1300pf,2%,500V	TK0891	RDM19FD132G03
A2CR2161	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2CR2216	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2CR2217	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2CR2262	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2CR2324	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2CR2341	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2CR2344	152-0141-02	B050000		SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2CR2353	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A2Q2246	151-1054-00			XSTR:SILICON,JFE,N-CHANNEL,DUAL	80009	151-1054-00
A2Q2248	151-1022-00			XSTR:FET,N-CHAN,SI,TO-18	80009	151-1022-00
A2Q2249	151-1022-00			XSTR:FET,N-CHAN,SI,TO-18	80009	151-1022-00
A2Q2257	151-1022-00			XSTR:FET,N-CHAN,SI,TO-18	80009	151-1022-00
A2Q2258	151-1022-00			XSTR:FET,N-CHAN,SI,TO-18	80009	151-1022-00
A2Q2259	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A2Q2261	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A2Q2262	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A2Q2341	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A2Q2342	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A2Q2345	151-0410-00			XSTR:SILICON,PNP	80009	151-0410-00
A2R2137	315-0623-00			RES.,FXD,CMPSN:62K OHM,5%,0.25W	01121	CB6235
A2R2138	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A2R2139	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A2R2142	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
A2R2144	315-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
A2R2146	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A2R2149	316-0186-00	B010100	R116660	RES.,FXD,CMPSN:18M OHM,10%,0.25W	01121	CB1861
	131-0566-00	R116661		BUS,COND:DUMMY RESISTOR	24546	OMA 07
A2R2157	315-0473-00	B010100	B020384	RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A2R2157	315-0333-00	B020385		RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A2R2158	321-0422-00			RES.,FXD,FILM:243K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2166	315-0185-00			RES.,FXD,CMPSN:1.8M OHM,5%,0.25W	01121	CB1855
A2R2220	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055

A2-VERTICAL AMPL/SLOW RAMP(cont)

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.\Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A2R2221	321-0310-00		RES.,FXD,FILM:16.5K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2222	321-0298-00		RES.,FXD,FILM:12.4K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2223	321-0293-00		RES.,FXD,FILM:11K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2224	321-0291-00		RES.,FXD,FILM:10.5K OHM,1%,0.125W	19701	5033ED10K50F
A2R2225	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A2R2226	321-0290-00		RES.,FXD,FILM:10.2K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2227	321-0614-00		RES.,FXD,FILM:10.1K OHM,1%,0.125W	91637	MFF1816G1010F
A2R2228	321-0481-00		RES.,FXD,FILM:1M OHM,1%,0.125W	01121	ORD BY DESCR
A2R2229	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2233	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A2R2235	315-0330-00		RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
A2R2236	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A2R2237	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A2R2242	315-0333-00		RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A2R2247	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB3335
A2R2251	315-0155-00		RES.,FXD,CMPSN:1.5M OHM,5%,0.25W	01121	CB1555
A2R2258	315-0223-00		RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A2R2266	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB3335
A2R2267	321-0318-00		RES.,FXD,FILM:20K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2311	315-0682-00	B010100 B049999	RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A2R2311	----- -----	B050000	SELECTED		
A2R2321	321-0452-00		RES.,FXD,FILM:499K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2322	321-0423-00	B010100 B050000	RES.,FXD,FILM:249K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2322	321-0618-04	B050000	RES.,FXD,FILM:250K OHM,0.1%,0.125W	07716	ORD BY DESCR
A2R2323	321-0385-00		RES.,FXD,FILM:100K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2324	315-0224-00		RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
A2R2325	321-0356-00		RES.,FXD,FILM:49.9K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2326	321-0327-00		RES.,FXD,FILM:24.9K OHM,1%,0.125W	01121	ORD BY DESCR
A2R2337	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A2R2345	315-0103-00	B050000	RES.,FXD,CMPSN;10K OHM,5%,0.25W	01121	CB1035
A2R2346	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A2R2347	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A2R2348	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A2R2353	325-0199-00		RES.,FXD,FILM:24M OHM,2%,0.25W	03888	PVC60-G24004G
A2R2354	315-0272-00		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
A2R2355	315-0223-00		RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A2R2361	321-0321-00		RES.,FXD,FILM:21.5K OHM,1%,0.125W	01121	ORD BY DESCR
A2S2126	263-1108-00		SWITCH,CAM ACTUATOR:REFLECTION/DIVISION (REPLACEABLE AS A UNIT ONLY)	80009	263-1108-00
A2S2254	260-1445-02		SWITCH,PUSH:DPDT,W/8 POLE SPRING	80009	260-1445-02
A2U2131	156-0067-00	B010100 B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
A2U2131	156-0067-12	B082050	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
A2U2136	156-0067-00	B010100 B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
A2U2136	156-0067-12	B082050	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
A2U2143	156-0067-00	B010100 B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
A2U2143	156-0067-12	B082050	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
A2U2332	156-0350-00	B010100 B102647	MICROCKTDI:QUAD 2-INPUT NAND GATE	80009	156-0350-00
A2U2332	156-0350-02	B102648	MICROCKT,DI:QUAD 2-INPUT NAND GATE,SEL	80009	156-0350-02
A2VR2122	152-0149-00	B010100 B0499999	SEMICOND DVC:ZENER,0.4W,10V,5%	04713	SZG35009K3
A2VR2122	152-0149-00	B050000	SEMICOND DVC:ZENER,0.4W,10V,5%	04713	SZG35009K3

A3-OUTPUT AMPLIFIER

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A3	670-3130-00	B010100	B099999	CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-00
	670-3130-02	B100000	B102647	CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-02
	670-3130-03	B102648	B113809	CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-03
	670-3130-04	B0113810		CKT BOARD ASSY:OUTPUT AMPLIFIER	80009	670-3130-04
A3C3132	283-0067-00	B010100	R116254	CAP.,FXD,CER DI:0.001µ F,10%,200V	51406	DD09810Y5F102K
A3C3219	283-0116-00			CAP.,FXD,CER DI:820pf,5%,500V	59660	0801547Y5D0821J
A3C3226	283-0116-00			CAP.,FXD,CER DI:820pf,5%,500V	59660	0801547Y5D0821J
A3C3233	283-0114-00			CAP.,FXD,CER DI:0.0015µ F,5%,200V	59660	815534Y5DO152J
A3C3241	290-0534-00			CAP.,FXD,ELCTLT:1µ F,20%,35V	56289	DTS3501105M
A3C3246	290-0534-00			CAP.,FXD,ELCTLT:1µ F,20%,35V	56289	DTS3501105M
A3Q3113	151-0341-00			XSTR:SILICON,NPN	04713	SPS6919
A3Q3114	151-0341-00			XSTR:SILICON,NPN	04713	SPS6919
A3Q3118	151-0279-00			XSTR:SILICON,NPN	01295	SCG2622
A3Q3137	151-0341-00	BO10100	R1166254	XSTR:SILCON NPN	04713	SPS6919
A3Q3139	151-0341-00			XSTR:SILICON,NPN	04713	SPS6919
A3Q3221	151-0279-00			XSTR:SILICON,NPN	01295	SCG2622
A3Q3232	151-0279-00			XSTR:SILICON,NPN	01295	SCG2622
A3Q3235	151-0341-00			XSTR:SILICON,NPN	04713	SPS6919
A3Q3236	151-0279-00			XSTR:SILICON,NPN	01295	SCG2622
A3R3112	321-0280-00	B010100	B099999	RES.,FXD,FILM:8.06K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3112	321-0251-00	B100000	B113809	RES.,FXD,FILM:4.02K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3112	321-0263-00	B113810		RES.,FXD,FILM:5.36K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3114	321-0251-00	B010100	B099999	RES.,FXD,FILM:4.02K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3114	321-0222-00	B100000	B113809	RES.,FXD,FILM:2K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3114	321-0178-00	B113810		RES.,FXD,FILM:698 OHM,1%,0.125W	01121	ORD BY DESCR
A3R3115	321-0251-00	B010100	B099999	RES.,FXD,FILM:4.02K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3115	321-0222-00	B100000	B113809	RES.,FXD,FILM:2K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3115	321-0178-00	B113810		RES.,FXD,FILM:698 OHM,1%,0.125W	01121	ORD BY DESCR
A3R3116	321-0306-00	B010100	B099999	RES.,FXD,FILM:15K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3116	321-0277-00	B100000		RES.,FXD,FILM:7.5K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3121	315-0474-00	B010100	B099999	RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
A3R3121	321-0420-00	B100000		RES.,FXD,FILM:232K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3122	315-0474-00	B010100	B099999	RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
A3R3122	321-0420-00	B100000		RES.,FXD,FILM:232K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3124	315-0203-00	BO10100	R116254	RES.,FXD CMPSN:20K OHM,5%,0.25W	01121	CB2035
A3R3126	315-0123-00	B010100	B099999	RES.,FXD,CMPSN:12K OHM,5%,0.25W	01121	CB1235
A3R3126	321-0267-00	B100000		RES.,FXD,FILM:5.9K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3127	315-0103-00	B010100	R116307	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
	315-0104-00	R116308		RES.,FXD,CMPSN:100K OHM,55,0.25W	01121	CB1045
A3R3131	315-0103-00	B010100	R116254	RES.,FXD CMPSN:10K OHM,5%,0.25W	01121	CB1035
A3R3133	315-0754-00	B010100	B099999	RES.,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
A3R3133	321-0440-00	B100000		RES.,FXD,FILM:374K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3134	321-0440-00	B100000		RES.,FXD,FILM:374K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3135	321-0308-00	B010100	B099999	RES.,FXD,FILM:15.8K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3135	321-0279-00	B100000		RES.,FXD,FILM:7.87K PHM,1%,0.125W	01121	ORD BY DESCR
A3R3136	315-0104-00	B010100	R116254	RES.,FXD CMPSN:100K OHM,5%,0.25W	01121	CB1045
A3R3138	315-0104-00	B010100	R116254	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A3R3139	321-0251-00	B010100	B099999	RES.,FXD,FILM:4.02K OHM,1%,0.125W	01121	
A3R3139	321-0222-00	B100000		RES.,FXD,FILM:2K OHM,1%,0.125W	01121	ORD BY DESCR

A3-OUTPUT AMPLIFIER(cont)

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A3R3142	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A3R3143	311-1556-00			RES.,VAR,NONWW:50K OHM,20%,0.50W	32997	3352T-1-503
A3R3146	321-0251-00	B010100	B099999	RES.,FXD,FILM:4.02K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3146	321-0222-00	B100000		RES.,FXD,FILM:2K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3148	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
A3R3149	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
A3R3212	321-0325-00	B010100	B099999	RES.,FXD,FILM:23.7K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3212	321-0297-00	B100000		RES.,FXD,FILM:12.1K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3213	311-1556-00	B010100	B099999	RES.,VAR,NONWW:50K OHM,20%,0.50W	32997	3352T-1-503
A3R3213	311-1557-00	B100000		RES.,VAR,NONWW:25K OHM,20%,0.50W	32997	3352T-1-253
A3R3216	321-0325-00	B010100	B099999	RES.,FXD,FILM:23.7K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3216	321-0297-00	B100000		RES.,FXD,FILM:12.1K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3217	311-1557-00	B100000	B099999	RES.,VAR,NONWW:25K OHM,20%,0.50W	32997	3352T-1-253
A3R3217	311-1559-00	B100000		RES.,VAR,NONWW:10K OHM,20%,0.50W	32997	3352T-1-103
A3R3219	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A3R3225	315-0104-00	B010100	R116254	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A3R3226	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A3R3229	315-0105-00	B010100	R116254	RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
	315-0105-00	R116308		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A3R3233	315-0363-00	B010100	B099999	RES.,FXD,CMPSN:36K OHM,5%,0.25W	01121	CB3635
A3R3233	321-0313-00	B100000		RES.,FXD,FILM:17.8K OHM,1%,0.125W	01121	ORD BY DESCR
A3R3234	315-0183-00	B010100	B099999	RES.,FXD,CMPSN;18K OHM,5%,0.25W	01121	CB1835
A3R3234	321-0284-00	B100000		RES.,FXD,FILM:8.87K OHM,1%,0.125W	91637	MFF1816G88700F
A3R3237	311-1554-00	B010100	R116254	RES.,VAR,NONWW:200K OHM,20%,0.50W	32997	3352T-1-204
A3R3238	315-0183-00	B010100	B099999	RES.,FXD,CMPSN;18K OHM,5%,0.25W	01121	CB1835
A3R3238	321-0284-00	B100000		RES.,FXD,FILM:8.87K OHM,1%,0.125W	91637	MFF1816G88700F
A3R3242	311-1554-00			RES.,VAR,NONWW:200K OHM,20%,0.50W	32997	3352T-1-204
A3R3248	311-1554-00			RES.,VAR,NONWW:200K OHM,20%,0.50W	32997	3352T-1-204
A3R3249	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
A3U3123	156-0350-00	B010100	B102647	MICROCKT,DI:QUAD 2-INPUT NAND GATE	80009	156-0350-00
A3U3123	156-0350-02	B102648		MICROCKT,DI:QUAD 2-INPUT NAND GATE,SEL	80009	156-0350-02
A3U3223	156-0289-00			MICROCKT,DI:QUAD BILATERAL SWITCH	02735	CD401GAF

A4-HIGH VOLTAGE POWER

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A4	670-3010-00	B010100	B099999	CKT BOARD ASSY:HIGH VOLTAGE POWER	80009	670-3010-00
	670-3010-01	B100000	B102647	CKT BOARD ASSY:HIGH VOLTAGE POWER	80009	670-3010-01
	670-3010-02	B102648		CKT BOARD ASSY:HIGH VOLTAGE POWER	80009	670-3010-02
A4C4118	283-0068-00			CAP.,FXD,CER DI:0.01µ F,+100-0%,500V	59660	871-533E103P
A4C4119	285-1093-00			CAP.,FXD,PLSTC:0.027µ F,20%,1200V	19396	273-M-12PA1350
A4C4128	283-0068-00			CAP.,FXD,CER DI:0.01µ F,+100-0%,500V	59660	871-533E103P
A4C4134	283-0000-00			CAP.,FXD,CER DI:0.001µ F,-0+100%,500V	59660	831610Y5U0102P
A4C4135	283-0000-00			CAP.,FXD,CER DI:0.001µ F,-0+100%,500V	59660	831610Y5U0102P
A4C4312	285-1093-00			CAP.,FXD,PLSTC:0.027µ F,20%,1200V	19396	273-M-12PA1350
A4C4321	285-1093-00			CAP.,FXD,PLSTC:0.027µ F,20%,1200V	19396	273-M-12PA1350
A4C4328	285-0644-00			CAP.,FXD,PLSTC:0.033µ F,20%,600V	56289	430P333X06
A4CR4151	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A4CR4156	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A4CR4211	152-0429-00			SEMICOND DVC:SILICON,5000V,10mA	14099	SA3282
A4CR4311	152-0429-00			SEMICOND DVC:SILICON,5000V,10mA	14099	SA3282
A4CR4313	152-0429-00			SEMICOND DVC:SILICON,5000V,10mA	14099	SA3282
A4CR4323	152-0429-00			SEMICOND DVC:SILICON,5000V,10mA	14099	SA3282
A4Q4145	151-0273-00	B010100	B020245	XSTR:SILICON,NPN	80009	151-0273-00
A4Q4145	151-0347-00	B020246	B069999	XSTR:SILICON,NPN	56289	2N5551
A4Q4145	151-0136-03	B070000		XSTR:SILICON,NPN,SEL	80009	151-0136-03
A4Q4149	151-0273-00	B010100	B020245	XSTR:SILICON,NPN	80009	151-0273-00
A4Q4149	151-0347-00	B020246	B069999	XSTR:SILICON,NPN	56289	2N5551
A4Q4149	151-0136-03	B070000		XSTR:SILICON,NPN,SEL	80009	151-0136-03
A4R4114	315-0106-00	B010100	B020231	RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
A4R4114	315-0125-00	B020232	B069999	RES.,FXD,CMPSN:1.2M OHM,5%,0.25W	01121	CB1255
A4R4114	315-0625-00	B070000		RES.,FXD,CMPSN:6.2M OHM,5%,0.25W	01121	CB6255
A4R4122	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
A4R4123	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
A4R4126	315-0225-00	B010100	B020231	RES.,FXD,CMPSN:2.2M OHM,5%,0.25W	01121	CB2255
A4R4126	315-0155-00	B020232	B069999	RES.,FXD,CMPSN:1.5M OHM,5%,0.25W	01121	CB1555
A4R4126	315-0474-00	B070000		RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
A4R4126	----- -----			(NOMINAL VALUE,SELECTED)		
A4R4129	315-0475-00			RES.,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
A4R4146	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A4R4148	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A4R4121	315-0475-00			RES.,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
A4R4222	311-1257-00			RES.,VAR,NONWW:5M OHM,20%,0.50W	01121	E2B505
A4R4245	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A4T4241	120-975-01	B010100	B069999	XFMR,PWR,SDN/SU:HIGH VOLTAGE POT CORE	80009	120-0975-00
A4T4241	120-0975-01	B070000		XFMR,RF:HIGH VOLTAGE POT CORE	80009	120-0975-01
A4VR4117	152-0147-00			SEMICOND DVC:ZENER,0.4W,150V,5%	04713	SZG275K1RL

A5-CHART RECORDER LOGIC

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A5	670-3513-00	B010100	B029999	CKT BOARD ASSY:CHART RECORDER LOGIC	80009	670-3513-00
	670-3513-01	B030000	B102647	CKT BOARD ASSY:CHART RECORDER LOGIC	80009	670-3513-01
	670-3513-02	B102648		CKT BOARD ASSY:CHART RECORDER LOGIC	80009	670-3513-02
A5C5116	283-0198-00			CAP.,FXD,CER DI:0.22µ F,	04222	3439-050E-224M
A5C5117	283-0054-00			CAP.,FXD,CER DI:150pf,5%,200V	59660	855-535U2J0 151J
A5C5131	290-0524-00	B010100	B029999	CAP.,FXD,ELCTLT:4.7µ F,20%,10V	TK0875	DTS1002-475M
A5C5159	283-0203-00			CAP.,FXD,CER DI:0.47µ F,20%,50V	04222	5R305SE474MAA
A5C5167	283-0004-00			CAP.,FXD,CER DI:0.02µ F,+80-20%,150V	TK1134	855-558Z5V203Z
A5C5219	283-0111-00			CAP .,FXD,CER DI:0.1µ F,20%,50V	04222	SR215E104MAA
A5C5249	283-0111-00			CAP .,FXD,CER DI:0.1µ F,20%,50V	04222	SR215E104MAA
A5C5253	283-0154-00			CAP.,FXD,CER DI:22pf,5%,50V	04222	3418050A220J
A5C5263	283-0110-00			CAP.,FXD,CER DI:0.005µ F,+80-20%,150V	56289	19C242B
A5C5266	283-0010-00			CAP.,FXD,CER DI:0.05µ F,+100-20%,50V	04222	SR305E503ZAA
A5C5276	283-0346-00			CAP.,FXD,CER DI:0.47µ F,+80-20%,100V	TK1356	RPE113Z5U474Z
A5CR5162	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A5CR5243	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A5CR5244	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A5CR5245	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A5CR5254	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A5Q5112	151-1078-00	B010100	B029999	XSTR:SILICON,JFE,N-CHANNEL	04713	SPF3040
A5Q5112	151-1022-00	B030000		XSTR:FET,N-CHAN,SI,F1782,10-18	80009	151-1022-00
A5Q5114	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A5Q5144	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A5Q5173	151-0126-00			XSTR:SILICON,NPN	04713	ST1046
A5Q5179	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A5Q5226	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A5Q5229	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A5Q5237	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A5Q5239	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A5Q5266	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A5Q5273	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A5Q5277	151-0260-00			XSTR:SILICON,NPN	80009	151-0260-00
A5Q5279	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A5R5112	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5116	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5118	315-0186-00			RES.,FXD,CMPSN:1.8M OHM,10%,0.25W	01121	CB1865
A5R5119	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5121	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5122	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5126	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5128	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5130	321-0644-00			RES.,FXD,FILM:100K OHM,1%,0.125W	07716	CEAE10002C
A5R5131	315-0335-00			RES.,FXD,CMPSN:3.3M OHM,5%,0.25W	01121	CB3355
A5R5132	321-0756-03			RES.,FXD,FILM:50K OHM,0.25%,0.125W	01121	ORD BY DESCR
A5R5134	321-0644-00			RES.,FXD,FILM:100K OHM,1%,0.125W	07716	CEAE10002C
A5R5135	321-0756-03			RES.,FXD,FILM:50K OHM,0.25%,0.125W	01121	ORD BY DESCR
A5R5136	321-0756-03			RES.,FXD,FILM:50K OHM,0.25%,0.125W	01121	ORD BY DESCR
A5R5137	321-0756-03			RES.,FXD,FILM:50K OHM,0.25%,0.125W	01121	ORD BY DESCR

A5-CHART RECORDER LOGIC(cont)

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A5R5138	321-0644-00			RES.,FXD,FILM:100K OHM,1%,0.125W	07716	CEAE10002C
A5R5139	321-0644-00			RES.,FXD,FILM:100K OHM,1%,0.125W	07716	CEAE10002C
A5R5141	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5148	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5155	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5158	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5161	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5163	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5166	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5167	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5168	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5171	315-0333-00			RES.,FXD,CMPSN:33K OHM,%%,0.25W	01121	CB3335
A5R5177	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A5R5178	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A5R5211	321-0318-02			RES.,FXD,FILM:20K OHM,0.5%,0.125W	07716	CEA20KOHM
A5R5216	321-0306-01			RES.,FXD,FILM:15K OHM,0.5%,0.125W	07716	CEAD15001D
A5R5221	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5222	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5223	321-0345-00			RES.,FXD,FILM:38.3K OHM,1%,0.125W	01121	ORD BY DESCR
A5R5225	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5229	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5231	321-0756-03			RES.,FXD,FILM:50K OHM,0.25%,0.125W	01121	ORD BY DESCR
A5R5232	321-0644-00			RES.,FXD,FILM:100K OHM,0.25%,0.125W	07716	CEAE10002C
A5R5233	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A5R5234	321-0644-00			RES.,FXD,FILM:100K OHM,0.25%,0.125W	07716	CEAE10002C
A5R5235	321-0644-00			RES.,FXD,FILM:100K OHM,0.25%,0.125W	07716	CEAE10002C
A5R5236	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5237	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5246	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5247	315-0566-00			RES.,FXD,CMPSN:56M OHM,5%,0.25W	01121	CB5665
A5R5248	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5255	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5259	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5263	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A5R5266	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A5R5267	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5268	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A5R5269	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A5R5275	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A5U5117	156-0686-00			MICROCKT,LI:OPNL AMPL,HIGH IMPEDANCE	02735	CA3130S
A5U5127	156-0525-03	B010100	B102647	MICROCKT,DI:DUAL J-K MASTER SLAVE FF-SE	80009	156-0525-03
A5U5127	156-0525-03	B102648		MICROCKT,DI:DUAL J-K MASTER SLAVE FF-FF	80009	156-0525-03
A5U5147	156-0523-01			MICROCKT,DI:7 STAGE BINARY COUNTER,SCRN	02735	CD4024BFX
A5U5156	156-0350-00	B010100	B102647	MICROCKT,DI:QUAD 2-INPUT NAND GATE	80009	156-0350-00
A5U5156	156-0350-02	B102648		MICROCKT,DI:QUAD 2-INPUT NAND GATE,SEL	80009	156-0350-02
A5U5166	156-0350-00	B010100	B102647	MICROCKT,DI:QUAD 2-INPUT NAND GATE,SEL	80009	156-0350-00
	156-0350-02	B102648		MICROCKT,DI:QUAD 2-INPUT NAND GATE,SEL	80009	156-0350-02
A5U5227	156-0067-00	B010100	B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
	156-0067-12	B082050	R117277	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
	156-0067-01	R117278		MICROCKT,LI:OPNL AMPL,CHECKED	04713	MC1741CP1DS
A5U5252	156-0524-02			MICROCKT,DI: TRIPLE 3-INPUT NAND GATES	80009	156-0524-02

A6-POWER SUPPLY

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A6	670-3520-00	B010100	B020394	CKT BOARD ASSY:POWER SUPPLY	80009	670-3520-00
	670-3520-01	B020395	B102647	CKT BOARD ASSY:POWER SUPPLY	80009	670-3520-01
	670-3520-02	B102648		CKT BOARD ASSY:POWER SUPPLY	80009	670-3520-02
A6C6147	283-0177-00			CAP.,FXD,CER DI:1µ F,+80-20%,52V	59821	CZ30C105Z
A6C6219	290-0114-00			CAP.,FXD,ELCTLT:47µ F,20%,6V	05397	T110B476M006AS
A6C6224	283-0177-00			CAP.,FXD,CER DI:1µ F,+80-20%,52V	59821	CZ30C105Z
A6C6226	283-0177-00			CAP.,FXD,CER DI:1µ F,+80-20%,52V	59821	CZ30C105Z
A6C6228	290-0114-00			CAP.,FXD,ELCTLT:47µ F,20%,6V	05397	T110B476M006AS
A6C6233	290-0527-00			CAP.,FXD,ELCTLT:15µ F,20%,20V	TK0875	DTS2002-156M
A6C6243	290-0559-00			CAP.,FXD,ELCTLT:22µ F,20%,35V	05397	T368C226M035AS
A6C6246	290-0137-00			CAP.,FXD,ELCTLT:100µ F,+75-15%,30V	01002	69F355G6
A6C6323	290-0425-00			CAP.,FXD,ELCTLT:100µ F,20%,20V	05397	T110D107M02AS
A6C6326	290-0425-00			CAP.,FXD,ELCTLT:100µ F,20%,20V	05397	T110D107M02AS
A6C6329	290-0425-00			CAP.,FXD,ELCTLT:100µ F,20%,20V	05397	T110D107M02AS
A6C6336	290-0425-00			CAP.,FXD,ELCTLT:100µ F,20%,20V	05397	T110D107M02AS
A6C6341	290-0137-00			CAP.,FXD,ELCTLT:100µ F,+75-15%,30V	01002	69F355G6
A6C6342	283-0142-00	B020385		CAP.,FXD,CER DI:0.0027µ F,5%,200V	TK1134	875571Y5E0272
A6C6415	290-0701-00			CAP.,FXD,ELCTLT:470µ F,40%,16VDC	TK0900	16TAL470
A6C6416	290-0134-00			CAP.,FXD,ELCTLT;22µ F,20%,15V	05397	T110B226M015AS
A6C6426	290-0701-00			CAP.,FXD,ELCTLT:470µ F,40%,16VDC	TK0900	16TAL470
A6C6429	290-0425-00			CAP.,FXD,ELCTLT:100µ F,20%,20V	05397	T110D107M02AS
A6C6443	290-0701-00			CAP.,FXD,ELCTLT:470µ F,40%,16VDC	TK0900	16TAL470
A6C6444	283-0107-00			CAP.,FXD,CER DI:51pf,5%,200V	TK1356	RPE110COG510J
A6C6447	283-0111-00			CAP.,FXD,CER DI:0.1µ F,20%,50V	04222	SR215E104MAA
A6C6451	283-0047-00			CAP.,FXD,CER DI:270pf,5%,500V	59821	2DDH73L271J
A6C6455	283-0115-00	B020395		CAP.,FXD,CER DI:47pf,5%,200V	59821	2DDT60K470J
A6C6515	283-0000-00			CAP.,FXD,CER DI:0.001µ F,+100-0%,500V	51406	DD07512YP102P
A6C6425	290-0425-00			CAP.,FXD,ELCTLT:100µ F,20%,20V	05397	T110D107M02AS
A6C6527	290-0164-00			CAP.,FXD,ELCTLT:1µ F,+50-10%,150V	56289	500D105F150BA7
A6C6529	290-0658-00			CAP.,FXD,ELCTLT:4µ F,+50-10%,200V	09023	UHL1095
A6C6551	283-0077-00			CAP.,FXD,CER DI:330pf,5%,500V	TK1134	831-500B331J
A6CR6139	152-0400-00			SEMICOND DVC:SILICON,400V,1A	80009	152-0400-00
A6CR6157	152-0488-00			SEMICOND DVC:SILICON,200V,1500mA	04713	SDA317
A6CR6234	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6247	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6346	152-0400-00			SEMICOND DVC:SILICON,400V,1A	80009	152-0400-00
A6CR6347	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6414	152-0400-00			SEMICOND DVC:SILICON,400V,1A	80009	152-0400-00
A6CR6438	152-0400-00			SEMICOND DVC:SILICON,400V,1A	80009	152-0400-00
A6CR6439	152-0400-00			SEMICOND DVC:SILICON,400V,1A	80009	152-0400-00
A6CR6441	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6442	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6446	152-0400-00	B010100	B020394	SEMICOND DVC:SILICON,400V,1A	80009	152-0400-00
A6CR6448	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6452	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6534	152-0400-00			SEMICOND DVC:SILICON,400V,1A	80009	152-0400-00
A6CR6536	152-0586-00			SEMICOND DVC:SILICON,600V,500mA	14936	RGP10J-011
A6CR6537	152-0586-00			SEMICOND DVC:SILICON,600V,500mA	14936	RGP10J-011
A6CR6546	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6CR6551	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N54152R
A6F6112	159-0128-00			FUSE,CARTRIDGE:2A,125V,5SEC	75915	273002
A6F6113	159-0128-00			FUSE,CARTRIDGE:2A,125V,5SEC	75915	273002
A6F6122	159-0128-00			FUSE,CARTRIDGE:2A,125V,5SEC	75915	273002
A6F6123	159-0128-00			FUSE,CARTRIDGE:2A,125V,5SEC	75915	273002

A6-POWER SUPPLY(cont)

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A6L6344	108-0598-00			COIL,RF:200µ H,	80009	108-0598-00
A6L6423	108-0598-00			COIL,RF:200µ H,	80009	108-0598-00
A6L6428	108-0598-00			COIL,RF:200µ H,	80009	108-0598-00
A6L6532	108-0598-00			COIL,RF:200µ H,	80009	108-0598-00
A6L6538	108-0598-00			COIL,RF:200µ H,	80009	108-0598-00
A6Q6143	151-0508-00			XSTR:UJT,SI,TO-98	03508	X13T520
A6Q6155	151-0506-00			SCR:SILICON	TK0058	C106B2
A6Q6227	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A6Q6241	151-0188-00			XSTR:SILICON,PNP	TK0058	2N3906
A6Q6244	151-0188-00			XSTR:SILICON,PNP	TK0058	2N3906
A6Q6331	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A6Q6349	151-0390-00			XSTR:SILICON,NPN	04713	SPS3414
A6Q6357	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A6Q6427	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A6Q6435	151-0352-00			XSTR:SILICON,NPN	03508	X44C282
A6Q6445	151-0424-00			XSTR:SILICON,NPN	04713	SPS8246
A6Q6458	151-0424-00			XSTR:SILICON,NPN	04713	SPS8246
A6Q6547	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A6Q6548	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A6Q6549	151-0301-00			XSTR:SILICON,PNP	04713	ST898
A6Q6552	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A6Q6557	151-0302-00			XSTR:SILICON,NPN	04713	ST899
A6R6132	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A6R6133	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
A6R6134	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
A6R6135	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A6R6147	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
A6R6148	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A6R6149	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
A6R6214	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6215	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6222	315-0821-00	B010100	B049999	RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A6E6222	315-0181-00	B050000		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A6R6223	315-0202-00	B010100	B049999	RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A6R6223	315-0821-00	B050000	B050649	RES.,FXD,CMPSN:820 OHM,5%,0.25W	01121	CB8215
A6R6223	315-0431-00	B050650		RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
A6R6225	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6231	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6235	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A6R6254	304-0391-00			RES.,FXD,CMPSN:390 OHM,10%,1W	01121	GB3911
A6R6346	315-0101-00	B010100	B020394	RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A6R6346	315-0471-00	B020395		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A6R6356	315-0753-00	B010100	B020394	RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
A6R6356	315-0563-00	B020395	B118458	RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
	315-0753-00	B118459		RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
A6R6358	311-1268-00			RES.,VAR,NONWW:10K OHM,10%,0.50W	32997	3329P-L58-103
A6R6413	321-0352-00	B010100	B020384	RES.,FXD,FILM:45.3K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6413	321-0332-00	B020385		RES.,FXD,FILM:28K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6424	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A6R6426	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A6R6444	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB1035
A6R6445	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A6R6447	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015

A6-POWER SUPPLY(cont)

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A6R6449	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
A6R6451	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A6R6453	315-0513-00			RES.,FXD,CMPSN:53K OHM,5%,0.25W	01121	CB5135
A6R6454	315-0433-00			RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
A6R6455	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A6R6456	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A6R6457	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A6R6459	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
A6R6513	321-0346-00	B010100	B020384	RES.,FXD,FILM:39.2K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6513	321-0332-00	B020385		RES.,FXD,FILM:28K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6514	311-1268-00			RES.,VAR,NONWW:10K OHM,10%,0.50W	32997	3329P-L58-103
A6R6517	316-0156-00			RES.,FXD,CMPSN:15M OHM,10%,0.25W	01121	CB1561
A6R6518	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	01121	ORD BY DESCR
A6R6538	315-0153-00	B010100	B010155	RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A6R6538	315-0433-00	B010156		RES.,FXD,CMPSN:43K OHM,5%,0.25W	01121	CB4335
A6R6539	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A6R6544	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W	01121	CB2435
A6R6545	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
A6R6548	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A6R6549	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A6R6553	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A6R6554	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A6R6557	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	01121	CB2245
A6R6558	315-0103-00	B010100	B020394	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1-35
A6R6558	315-0102-00	B02095	B118458	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
	315-0103-00	B118459		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	315-0103-00
A6T6535	120-0976-00			XFMR,FLYBACK:POT CORE	80009	120-0976-00
A6U6138	156-0067-00	B010100	B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
	156-0067-12	B082050	R117277	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
	156-0067-01	R117278		MICROCKT,LI:OPNL AMPL,CHECKED	04713	MC1741CP1DS
A6U6222	156-0067-00	B010100	B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
	156-0067-12	B082050	R117277	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
	156-0067-01	R117278		MICROCKT,LI:OPNL AMPL,CHECKED	04713	MC1741CP1DS
A6U6236	156-0067-00	B010100	B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
	156-0067-12	B082050	R117277	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
	156-0067-01	R177278		MICROCKT,LI:OPNL AMPL,CHECKED	04713	MC1741CP1DS
A6U6515	156-0067-00	B010100	B082049	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0961	MICROPC741C
	156-0067-12	B082050	R117277	MICROCKT,LI:OPERATIONAL AMPLIFIER	TK0058	UPC151D
	156-0067-01	R117278		MICROCKT,LI:OPNL AMPL,CHECKED	04713	MC1741CP1DS
A6VR6134	152-0243-00			SEMICOND DVC:ZENER,0.4W,15V,5%	04713	SZ13203
A6VR6235	152-0278-00			SEMICOND DVC:ZENER,0.4W,3V,5%	04713	SZG35009K20
A6VR6252	152-0278-00			SEMICOND DVC:ZENER,0.4W,3V,5%	04713	SZG35009K20
A6VR6253	152-0127-00			SEMICOND DVC:ZENER,0.4W,7.5V,5%	04713	SZG35009K2
A6VR6318	152-0265-00			SEMICOND DVC:ZENER,0.4W,24V,5%	04713	SZG35009K8
A6VR6417	152-0195-00			SEMICOND DVC:ZENER,0.4W,5.1V,5%	04713	SZ11755
A6VR6419	152-0175-00			SEMICOND DVC:ZENER,0.4W,5.6V,5%	04713	SZG350008
A6VR6427	152-0195-00			SEMICOND DVC:ZENER,0.4W,5.1V,5%	04713	SZ11755
A6VR6459	152-0306-00			SEMICOND DVC:ZENER,0.4W,9.1V,5%	04713	SZ12812RL

A7-X-Y PLUG IN

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A7	670-3865-00	B010100	B102647	CKT BOARD ASSY:X-Y PLUG IN	80009	670-3865-00
	670-3865-01	B102648		CKT BOARD ASSY:X-Y PLUG IN	80009	670-3865-01
A7C7132	283-0059-00			CAP.,FXD,CER DI:1µ F,+80-20%,50V	51406	8131N031Z5UO
A7C7232	283-0059-00			CAP.,FXD,CER DI:1µ F,+80-20%,50V	51406	8131N031Z5UO
A7CR7247	152-0141-02			SEMICOND DVC:SILICON,30V,150mA	01295	1N4152R
A7Q7242	151-0302-00			XSTR:SILCON,NPN	04713	ST899
A7R7122	321-0301-00			RES.,FXD,FILM:13.3K OHM,1%,0.125W	01121	ORD BY DESCR
A7R7129	321-0288-00			RES.,FXD,FILM:9.76K OHM,1%,0.125W	01121	ORD BY DESCR
A7R7138	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	01121	ORD BY DESCR
A7R7146	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A7R7224	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A7R7225	315-1559-00			RES.,VAR,NONWW:10K OHM,20%,0.50W	32997	3352T-1-103
A7R7234	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
A7R7244	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A7R7245	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035

A9-POWER FUSE JACK

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
A9	670-6592-00	B110000		CKT BOARD ASSY:POWER FUSE JACK	80009	670-6592-00
A9F9100	159-0124-00	B110000	R116769	FUSE,WIRE LEAD:3A,125V	75915	272003
	159-0266-00	R116770		FUSE THERMAL:3A,125V AXIAL LEAD	75915	273-003

CHASSIS MOUNTED PARTS

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
BT0369	016-0595-00	B010100	B109999	BATTERY SET	80009	016-0595-00
	016-0595-01	B110000		BATTERY SET:	80009	016-0595-01
C0380	283-0279-00			CAP.,FXD,CER DI:0.001µF,20%,3000V	59660	878-521-S-Y5S-10
C0390	283-0279-00			CAP.,FXD,CER DI:0.001µF,20%,3000V	59660	878-521-S-Y5S-10
CR0282	150-1040-01			LED:W/LEADS AND DIODE HOLDER	80009	150-1040-01
F0401	159-0032-00	B010100	R117575	FUSE,CARTRIDGE:3AG,0.5A,250V,SLOW BLOW	71400	MDL1/2
	159-0282-00	R117576	R118372	FUSE,CARTRIDGE:0.5A	80009	159-0282-00
	150-0182-00	R118373		FUSE,CARTRIDGE:0.5A	80009	159-0281-00
F0491	159-0029-01	B010100	R117575	FUSE CARTRIDGE:BUSSMANN ONLY	71400	MDL3/10
	159-0281-00	R117576		FUSE CARTRIDGE:0.25A	80009	159-0281-00
J0421	131-2010-00	B040616		CONN 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%	21438	P-202
	149-0044-05	B050000		METER,BTRY LVL:1MA,345 OHM,0.5 DIA W/CONN	80009	146-0044-05
R0151	311-1806-00	B010100	B089999	RES.,VAR,NONWW:500 OHM,20%,1W	12697	381S-CM40942
	311-2010-01	B090000	B113138	RES.,VAR,WW:PNL MT,500 OHM,5%,1W W/SW	80009	311-2010-01
	311-2131-00	B113139		RES.,VAR,NONWW PNL:500 OHM,5%,1W,W/4SPT	80009	311-2131-00
R0165	315-0102-00	B010160		RES.,FXD,CMPSN:1K OHM,%,0.25W	57668	NTR25J E01K0
R0251	311-0678-00			RES.,VAR,NONWW:2X 50K OHM,10%,0.50W	71590	BA211-008
R0252	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J E47K0
R0262	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J E100K
R0263	311-0160-00			RES.,VAR,NONWW:50K OHM,10%,0.50W	12697	381-CM30918
R0271	311-1755-00	B010100	B039999	RES.,VAR WW,PNL:5K OHM,1.5W	32997	3610s-502-502
	311-1755-02	B040000		RES.,VAR,WW,PNL,5K OHM,1.5W W/KNOB	80009	311-1755-02
R0271	311-1800-00	B010100	B039999	RES.,VAR,WW,PNL:5K OHM,5%,1.5W (OPTION 5 ONLY)	32997	3610S-514-502
	311-1800-02	B040000		RES.,VAR,WW,PNL:5K OHM,5%,1.5W W/KNOB (OPTION 5 ONLY)	80009	311-1800-02
R0352	315-0473-00			RES.,FXD,CMPSN:46K OHM,5%,0.25W	57668	NTR25J E47K0
R0432	311-0690-01	B010100	B030549	RES.,VAR,NONWW:5M OHM,0.50W	000M	ORD BY DESCR
	311-1905-00	B030550		RES.,VAR,NONWW:5M OHM,20%,0.50W	12697	CM412712
R0442	311-0690-01	B010100	B030549	RES.,VAR,NONWW:5M OHM,0.50W	000M	ORD BY DESCR
	311-1906-00	B030550		RES.,VAR,NONWW:5M OHM,20%,0.25W	12697	CM41713
R0472	311-0091-00			RES.,VAR,NONWW:1K OHM,10%,0.50W	01121	W-3083E
S0151	260-1923-00			SWITCH,PUSH:4PST,0.4A,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
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
	154-0667-02	B010210		ELECTRON TUBE:CRT,P-31	80009	154-0667-02
V0235	154-0667-03	B030490		ELECTRON TUBE:CRT,P-7 (OPTION 76 ONLY)	80009	154-0667-03

WIRE ASSEMBLIES

Ckt.No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Name & Description	Mfr. Code	Mfr Part Number
	136-0644-00			SKT,PL-IN ELEC:ELECTRON TUBE,12 CONTACTS W/LEADS	80009	136-0644-00
	175-2492-00			CA ASSY,SP ELEC:4,22AWG,17.0L (TRANFORMER WIRE HARNESS)	80009	175-2492-00
	195-7239-00			LEAD ELEC:26 AWG,10.0L,9-03 (TO P29 ON VERTICAL CKT BOARD)	80009	195-7239-00
	198-2386-00			WIRE SET ELEC:HIGH VOLTAGE	80009	198-2386-00
	198-0551-00			WIRE SET ELEC:BATTERY PACK	80009	198-0551-00
	175-2544-00			CA ASSY,SP ELEC:3,26 AWG,8.0 L (TO ZERO REFERENCE POT)	80009	175-2544-00
	198-2257-00			WIRE SET ELEC:POWER SUPPLY	80009	198-2257-00
	198-2940-00			WIRE SET ELEC:MAIN BOARD	80009	198-2240-00
	179-2178-00			WIRE SET ELEC:FRONT PANEL WIRE HARNESS	80009	179-2178-00
	195-0389-00			LEAD ELEC:18 AWG,17.0 L (GROUND WIRE:CHASSIS)	80009	195-0389-00

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:

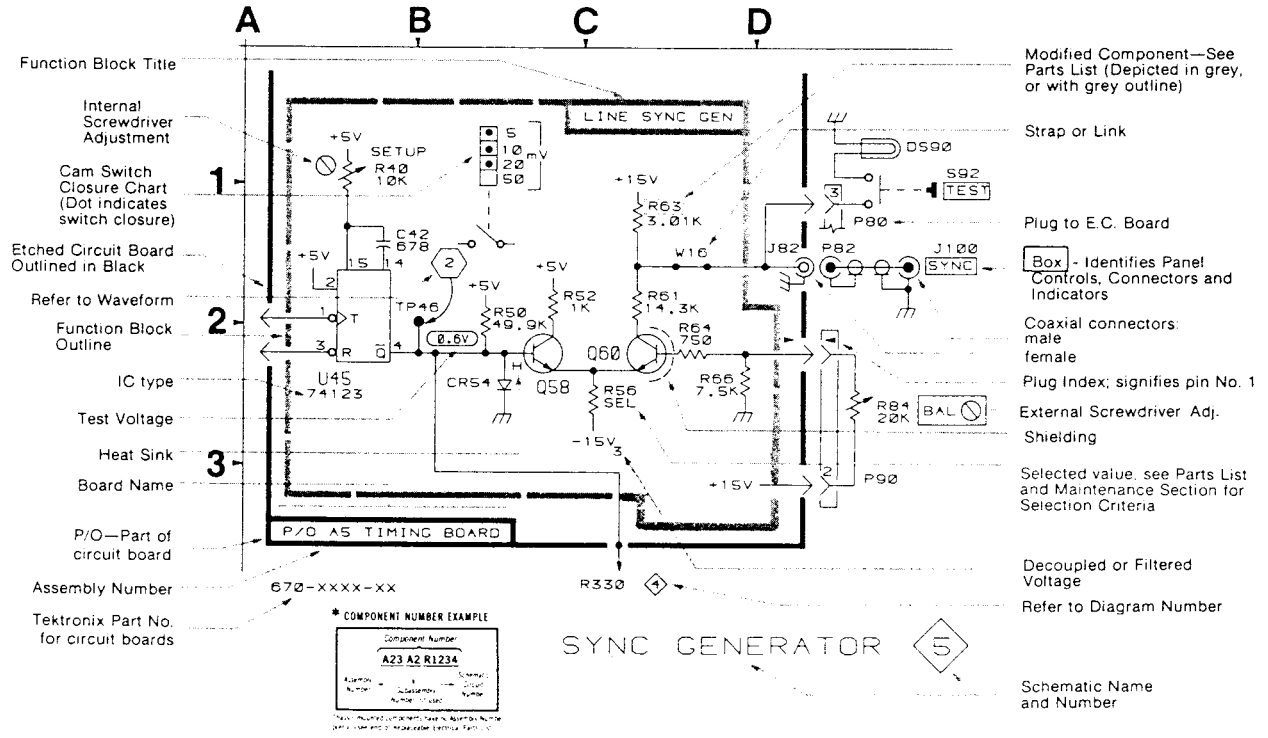
Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

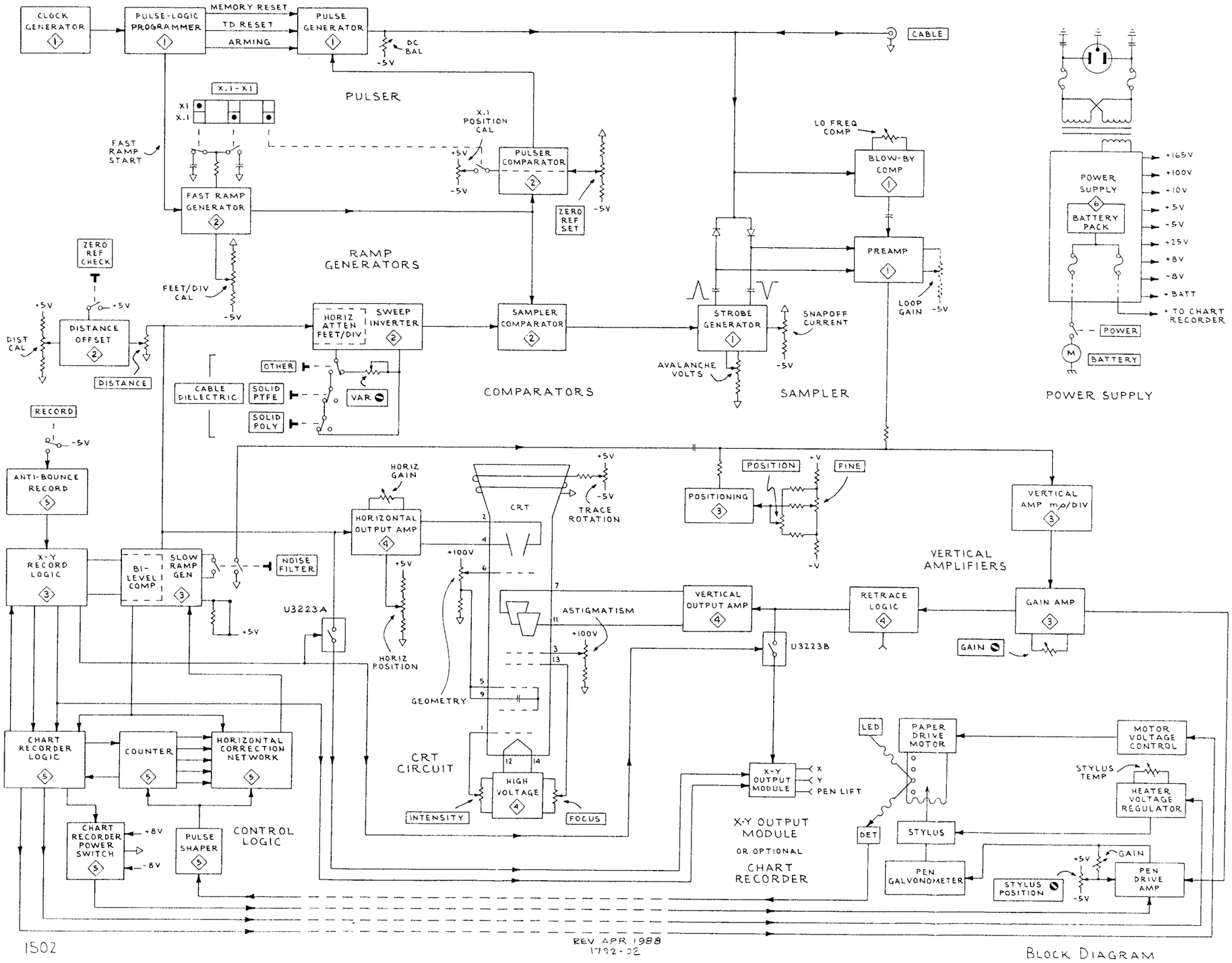
The information and special symbols below may appear in this manual.

Assembly Numbers and Grid Coordinates

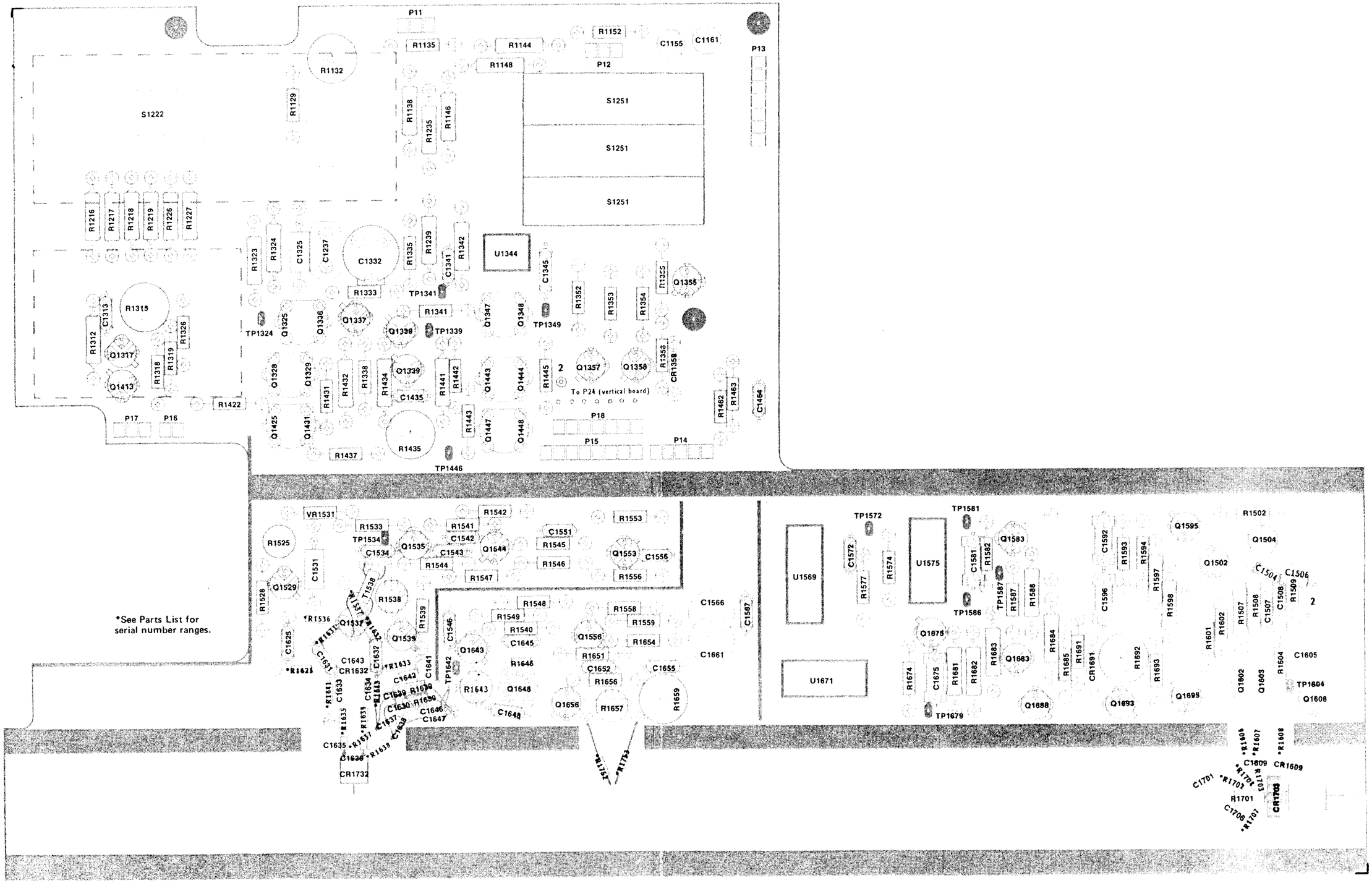
Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator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

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




CLOCK GENERATOR
PULSE-LOGIC PROGRAMMER
MEMORY RESET
TD RESET
ARMING
PULSE GENERATOR
DC BAL
-5V
CABLE
PULSER
X.1 - X1
X1
X.1
X.1 POSITION CAL
FAST RAMP START
PULSER COMPARATOR
FAST RAMP GENERATOR
ZERO REF SET
LO FREQ COMP
BLOW-BY COMP
PREAMP
LOOP GAIN
RAMP GENERATORS
ZERO REF CHECK
FEET/DIV CAL
DIST CAL
DISTANCE OFFSET
DISTANCE
HORIZ ATTEN FEET/DIV
SWEEP INVERTER
SAMPLER COMPARATOR
STROBE GENERATOR
SNAPOFF CURRENT
AVALANCHE VOLTS
CABLE DIELECTRIC
OTHER
SOLID PTFE
SOLID POLY
VAR
COMPARATORS
SAMPLER
RECORD
ANTI-BOUNCE RECORD
HORIZ GAIN
HORIZONTAL OUTPUT AMP
CRT
TRACE ROTATION
POSITION
FINE
POSITIONING
VERTICAL AMP mV/DIV
VERTICAL AMPLIFIERS
X-Y RECORD LOGIC
BI-LEVEL COMP
SLOW RAMP GEN
NOISE FILTER
U3223A
HORIZ POSITION
GEOMETRY
ASTIGMATISM
VERTICAL OUTPUT AMP
RETRACE LOGIC
GAIN AMP
GAIN
U3223B
CHART RECORDER LOGIC
COUNTER
HORIZONTAL CORRECTION NETWORK
CRT CIRCUIT
HIGH VOLTAGE
INTENSITY
FOCUS
X-Y OUTPUT MODULE
X
Y
PEN LIFT
LED
PAPER DRIVE MOTOR
MOTOR VOLTAGE CONTROL
STYLUS TEMP
HEATER VOLTAGE REGULATOR
CHART RECORDER POWER SWITCH
PULSE SHAPER
CONTROL LOGIC
DET
STYLUS
PEN GALVONOMETER
STYLUS POSITION
PEN DRIVE AMP
X-Y OUTPUT MODULE OR OPTIONAL CHART RECORDER
POWER SUPPLY
BATTERY PACK
+165V
+100V
+10V
+5V
-5V
+25V
+8V
-8V
+BATT
+ TO CHART RECORDER
POWER
BATTERY
1502
REV APR 1988
1792-02
BLOCK DIAGRAM

DIAGRAMS - 1502



REV MAY 1988

Main Board

ASSEMBLY A1 - MAIN BOARD

CIRCUIT NUMBER	BOARD LOCATION
C1155	F12
C1161	F12
C1237	E15
C1313	C1
C1325	E14
C1332	F15
C1341	E17
C1345	H17
C1435	F13
C1464	D12
C1504	C7
C1506	D1
C1507	D6
C1508	D1
C1531	F4
C1534	G4
C1542	G3
C1543	G2
C1546	G10
C1551	H2
C1556	H1
C1566	F11
C1567	D4
C1572	C1
C1581	B3
C1592	A3
C1596	B4
C1605	A6
C1609	E6
C1625	F5
C1630	H8
C1631	G5
C1632	G5
C1633	G6
C1634	G6
C1635	G6
C1636	G6
C1637	F8
C1638	H8
C1639	F8
C1641	H5
C1642	G5
C1643	G6
C1645	F9
C1646	G8
C1647	G8
C1648	F8
C1652	G10
C1655	E7
C1661	F11
C1675	D3
C1701	D6
C1706	E7
CR1359	D13
CR1609	E6
CR1632	G5
CR1691	C4
CR1703	E6
CR1732	E8

CIRCUIT NUMBER	BOARD LOCATION
Q1317	C13
Q1325	E17
Q1328	D17
Q1329	D16
Q1336	E16
Q1337	F14
Q1338	F13
Q1339	F13
Q1347	G16
Q1348	G17
Q1355	D12
Q1357	E12
Q1358	E12
Q1413	C14
Q1425	E16
Q1431	E16
Q1443	G16
Q1444	G16
Q1447	H16
Q1448	H16
Q1502	C5
Q1504	C7
Q1529	F4
Q1535	G3
Q1537	G4
Q1539	H5
Q1544	G2
Q1553	H1
Q1556	H9
Q1583	C4
Q1595	B5
Q1602	C6
Q1603	C6
Q1608	E1
Q1643	G10
Q1648	G9
Q1656	F7
Q1675	D3
Q1683	D4
Q1688	D5
Q1693	A5
Q1695	D5
R0151	H18
R0271	C15
R0472	F20
R1129	H15
R1132	H15
R1135	H15
R1138	H17
R1144	F19
R1146	F19
R1148	F19
R1152	E18
R1216	B16
R1217	B16
R1218	B17
R1219	B17
R1226	B18
R1227	B18
R1235	H17

CIRCUIT NUMBER	BOARD LOCATION
R1239	E17
R1312	C14
R1315	C13
R1318	D13
R1319	D13
R1323	B19
R1324	B19
R1326	C13
R1333	F15
R1335	F15
R1338	F13
R1341	F15
R1342	E17
R1352	F12
R1353	E12
R1354	E12
R1355	D12
R1358	D13
R1422	F16
R1431	E16
R1432	F14
R1434	F13
R1435	F13
R1437	F16
R1441	F13
R1442	H16
R1443	H16
R1445	G16
R1462	E12
R1463	D12
R1502	C6
R1507	B7
R1508	C7
R1509	D1
R1525	F4
R1528	F4
R1533	G3
R1536	F5
R1537	H4
R1538	H5
R1539	H5
R1540	G9
R1541	G3
R1542	F5
R1544	H3
R1545	H3
R1546	H2
R1547	H5
R1548	F9
R1549	G10
R1553	G1
R1556	H1
R1558	H9
R1559	H9
R1574	B1
R1577	B1
R1582	C3
R1587	D5
R1588	B4
R1593	A3
R1594	B4

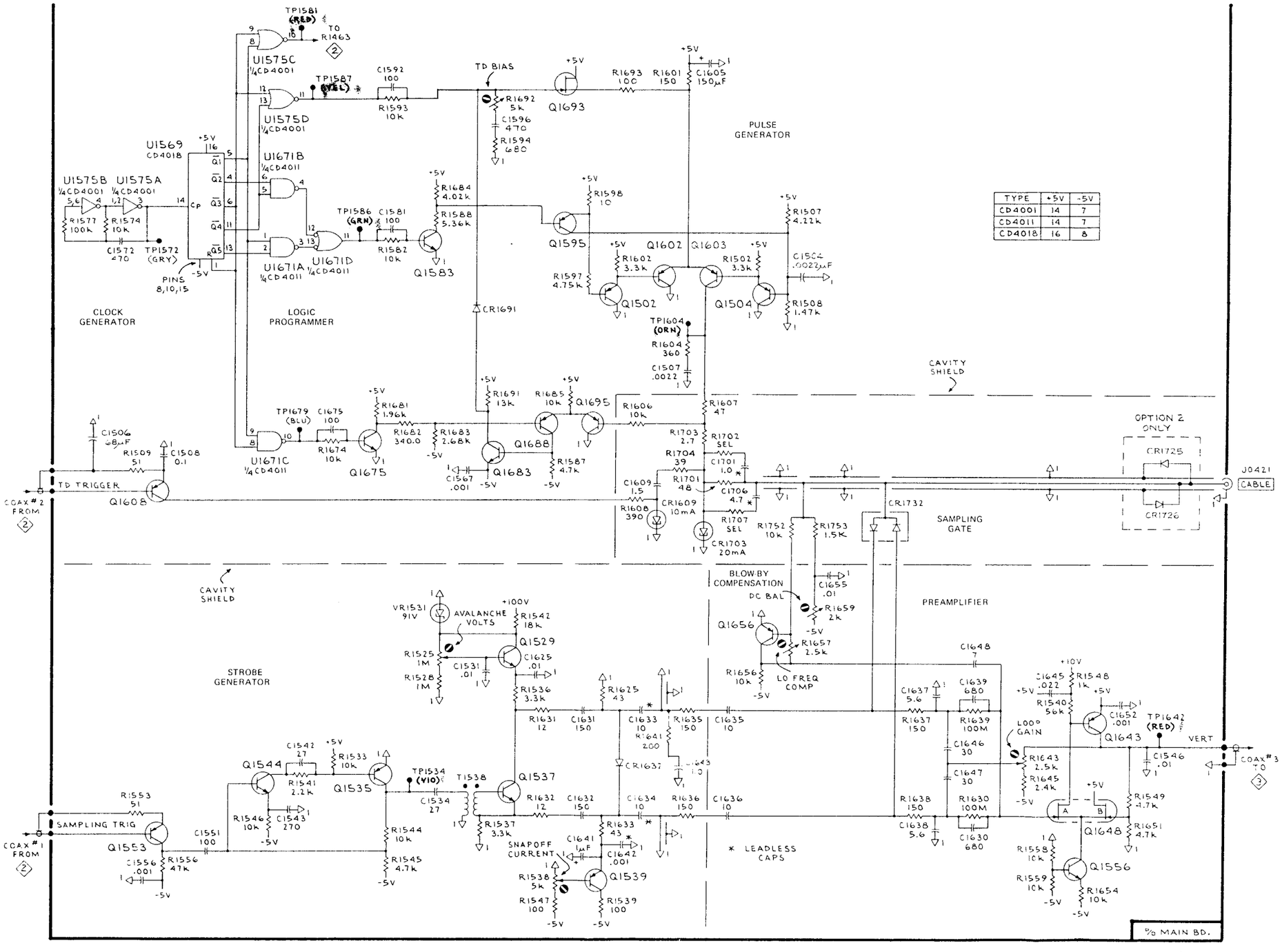
CIRCUIT NUMBER	BOARD LOCATION
R1597	C5
R1598	B5
R1601	A6
R1602	C5
R1604	C6
R1606	D5
R1607	D6
R1608	E5
R1625	F5
R1630	G8
R1631	G5
R1632	G5
R1633	H5
R1635	G6
R1636	G6
R1637	G8
R1638	G8
R1639	G8
R1641	G6
R1643	G9
R1645	G9
R1651	H10
R1654	H9
R1656	F7
R1657	F7
R1659	F7
R1674	D3
R1681	D3
R1682	D4
R1683	D4
R1684	B4
R1685	D5
R1691	D4
R1692	A4
R1693	A5
R1701	E6
R1702	D6
R1703	D6
R1704	D6
R1707	E6
R1752	E7
R1753	E7
S0151	D15
S1222F	A17
S1222R	E15
S1251	E18,F18
T1538	G4
TP1324	E17
TP1339	F14
TP1341	E17
TP1349	G17
TP1446	B14
TP1534	G4
TP1572	C1
TP1581	A3
TP1586	B3
TP1587	A3
TP1604	C6

CIRCUIT NUMBER	BOARD LOCATION
TP1642	G10
TP1679	D3
U1344	E19
U1569	B1
U1575	B1,A2
U1671	B2,C2,D2
VR1531	F4

NOTE: THIS GRID LOCATOR APPLIES TO BOTH DIAGRAMS  AND

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

A — B — C — D — E — F — G — H

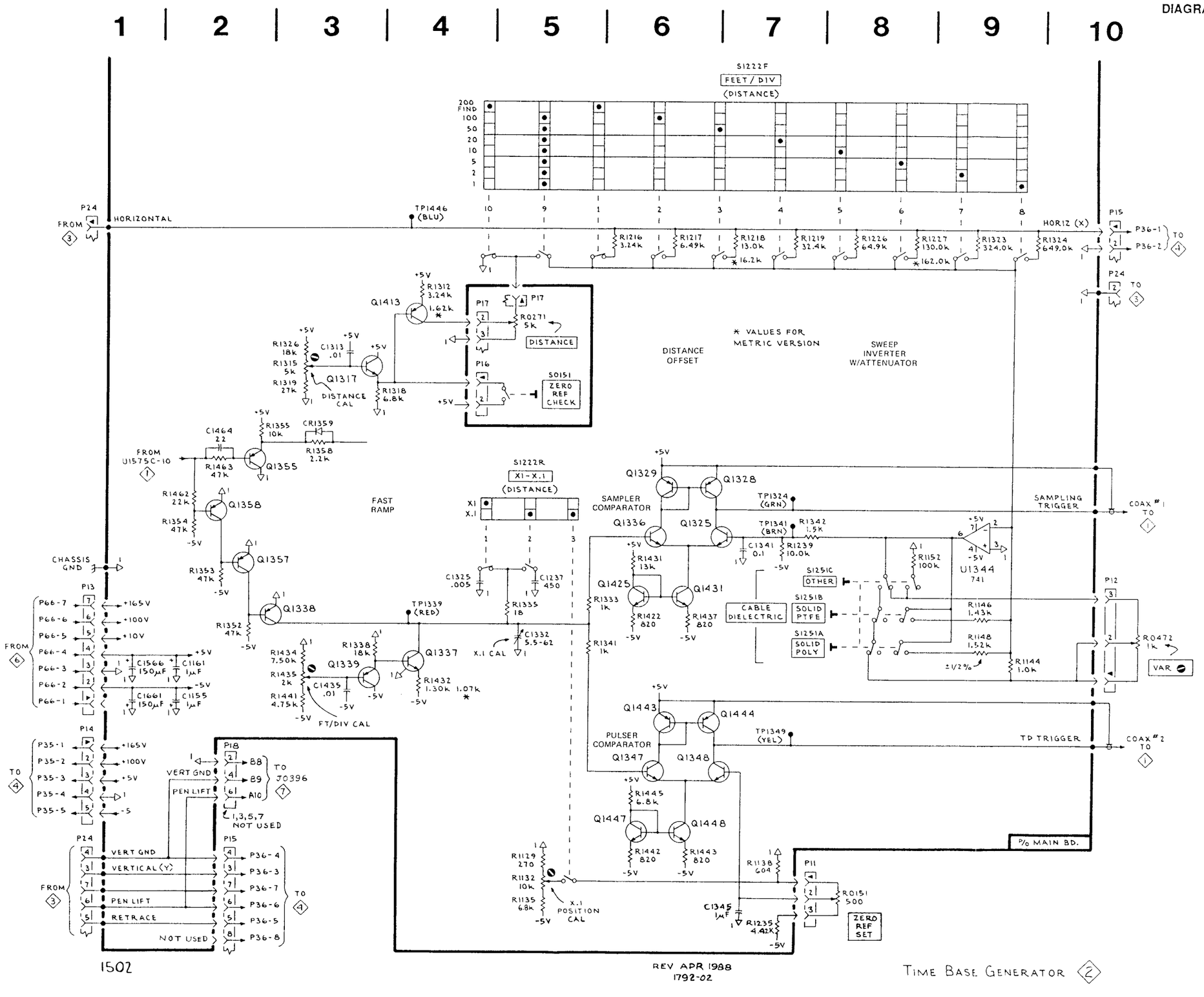


ASSEMBLY A1 - MAIN BOARD

CIRCUIT NUMBER	BOARD LOCATION	CIRCUIT NUMBER	BOARD LOCATION	CIRCUIT NUMBER	BOARD LOCATION	CIRCUIT NUMBER	BOARD LOCATION	CIRCUIT NUMBER	BOARD LOCATION
C1155	F12	Q1317	C13	R1239	E17	R1597	C5	TP1642	G10
C1161	F12	Q1325	E17	R1312	C14	R1598	B5	TP1679	D3
C1237	E15	Q1328	D17	R1315	C13	R1601	A6		
C1313	C1	Q1329	D16	R1318	D13	R1602	C5	U1344	E19
C1325	E14	Q1336	E16	R1319	D13	R1604	C6	U1569	B1
C1332	F15	Q1337	F14	R1323	B19	R1606	D5	U1575	B1,A2
C1341	E17	Q1338	F13	R1324	B19	R1607	D6	U1671	B2,C2,D2
C1345	H17	Q1339	F13	R1326	C13	R1608	E5		
C1435	F13	Q1347	G16	R1333	F15	R1625	F5	VR1531	F4
C1464	D12	Q1348	G17	R1335	F15	R1630	G8		
C1504	C7	Q1355	D12	R1338	F13	R1631	G5		
C1506	D1	Q1357	E12	R1341	F15	R1632	G5		
C1507	D6	Q1358	E12	R1342	E17	R1633	H5		
C1508	D1	Q1413	C14	R1352	F12	R1635	G6		
C1531	F4	Q1425	E16	R1353	E12	R1636	G6		
C1534	G4	Q1431	E16	R1354	E12	R1637	G8		
C1542	G3	Q1443	G16	R1355	D12	R1638	G8		
C1543	G2	Q1444	G16	R1358	D13	R1639	G8		
C1546	G10	Q1447	H16	R1422	F16	R1641	G6		
C1551	H2	Q1448	H16	R1431	E16	R1643	G9		
C1556	H1	Q1502	C5	R1432	F14	R1645	G9		
C1566	F11	Q1504	C7	R1434	F13	R1651	H10		
C1567	D4	Q1529	F4	R1435	F13	R1654	H9		
C1572	C1	Q1535	G3	R1437	F16	R1556	F7		
C1581	B3	Q1537	G4	R1441	F13	R1657	F7		
C1592	A3	Q1539	H5	R1442	H16	R1659	F7		
C1596	B4	Q1544	G2	R1443	H16	R1674	D3		
C1605	A6	Q1553	H1	R1445	G16	R1681	D3		
C1609	E6	Q1556	H9	R1462	E12	R1682	D4		
C1625	F5	Q1583	C4	R1463	D12	R1683	D4		
C1630	H8	Q1595	B5	R1502	C6	R1684	B4		
C1631	G5	Q1602	C6	R1507	B7	R1685	D5		
C1632	G5	Q1603	C6	R1508	C7	R1691	D4		
C1633	G6	Q1608	E1	R1509	D1	R1692	A4		
C1634	G6	Q1643	G10	R1525	F4	R1693	A5		
C1635	G6	Q1648	G9	R1528	F4	R1701	E6		
C1636	G6	Q1656	F7	R1533	G3	R1702	D6		
C1637	F8	Q1675	D3	R1536	F5	R1703	D6		
C1638	H8	Q1683	D4	R1537	H4	R1704	D6		
C1639	F8	Q1688	D5	R1538	H5	R1707	E6		
C1641	H5	Q1693	A5	R1539	H5	R1752	E7		
C1642	G5	Q1695	D5	R1540	G9	R1753	E7		
C1643	G6			R1541	G3				
C1645	F9	R0151	H18	R1542	F5	S0151	D15		
C1646	G8	R0271	C15	R1544	H3	S1222F	A17		
C1647	G8	R0472	F20	R1545	H3	S1222R	E15		
C1648	F8	R1129	H15	R1546	H2	S1251	E18,F18		
C1652	G10	R1132	H15	R1547	H5				
C1655	E7	R1135	H15	R1548	F9	T1538	G4		
C1661	F11	R1138	H17	R1549	G10				
C1675	D3	R1144	F19	R1553	G1	TP1324	E17		
C1701	D6	R1146	F19	R1556	H1	TP1339	F14		
C1706	E7	R1148	F19	R1558	H9	TP1341	E17		
		R1152	E18	R1559	H9	TP1349	G17		
CR1359	D13	R1216	B16	R1574	B1	TP1446	B14		
CR1609	E6	R1217	B16	R1577	B1	TP1534	G4		
CR1632	G5	R1218	B17	R1582	C3	TP1572	C1		
CR1691	C4	R1219	B17	R1587	D5	TP1581	A3		
CR1703	E6	R1226	B18	R1588	B4	TP1586	B3		
CR1732	E8	R1227	B18	R1593	A3	TP1587	A3		
		R1235	H17	R1594	B4	TP1604	C6		

NOTE: THIS GRID LOCATOR APPLIES TO BOTH DIAGRAMS

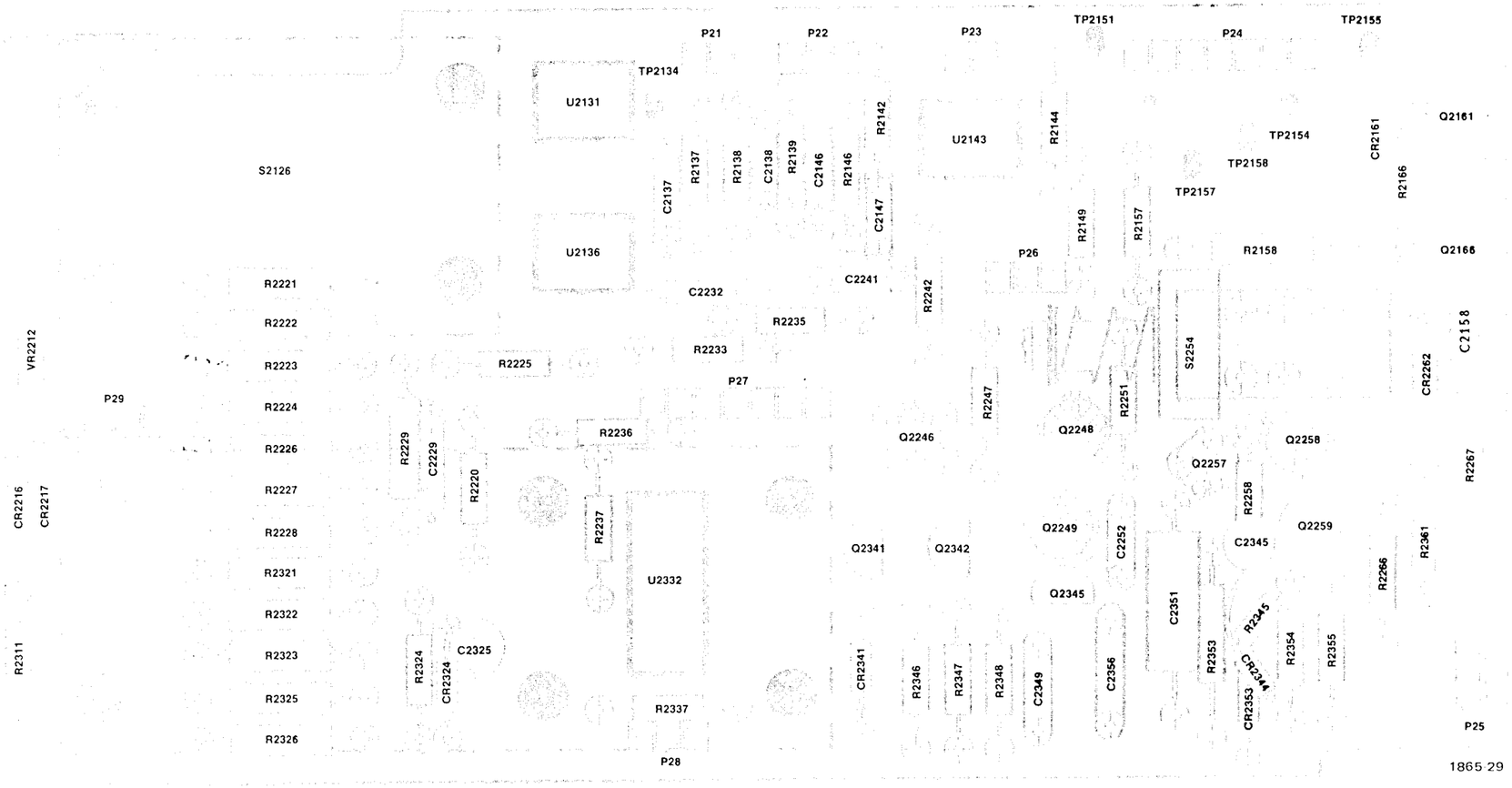
(1) AND (2)



1502

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1792-02

TIME BASE GENERATOR 2



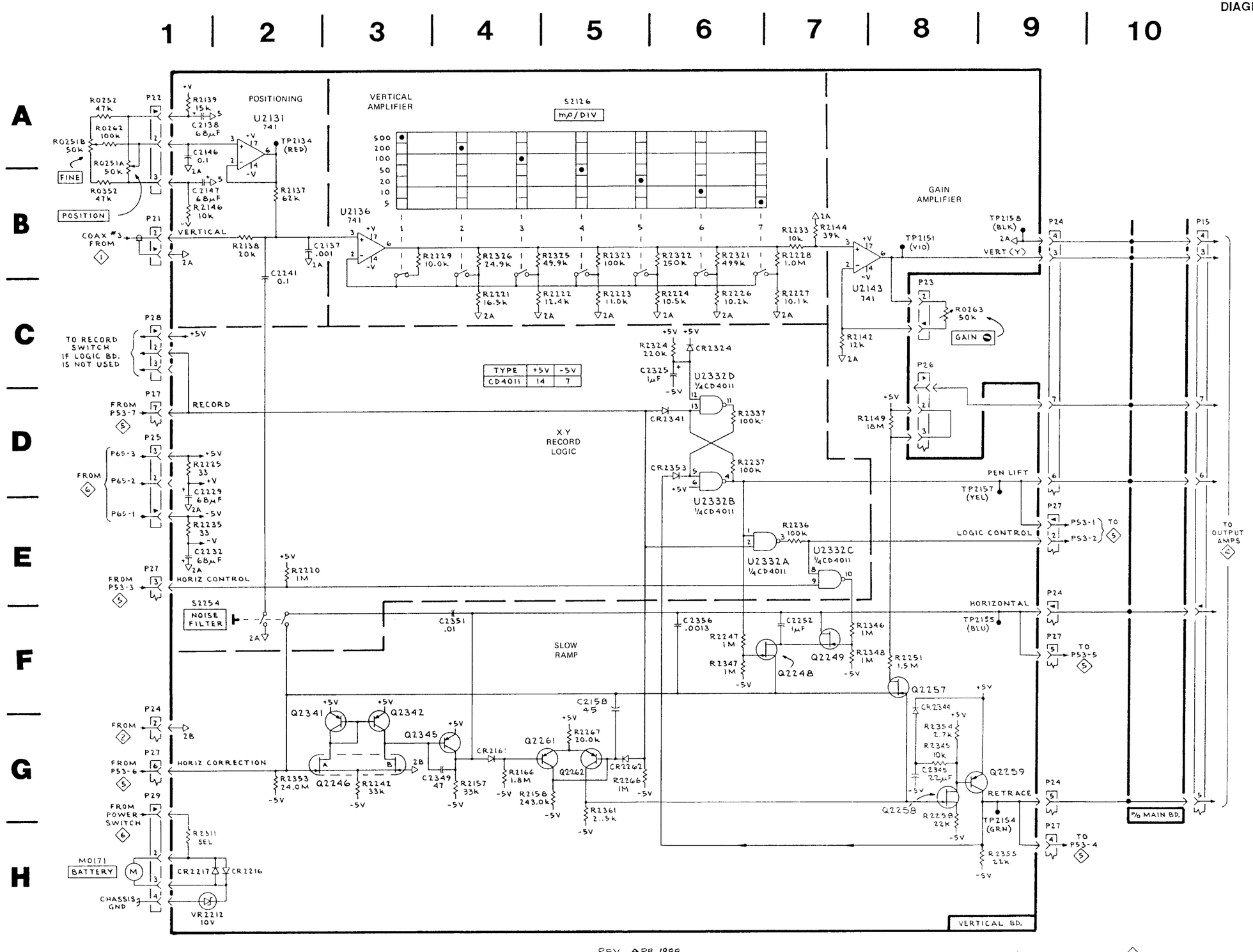
1865-29

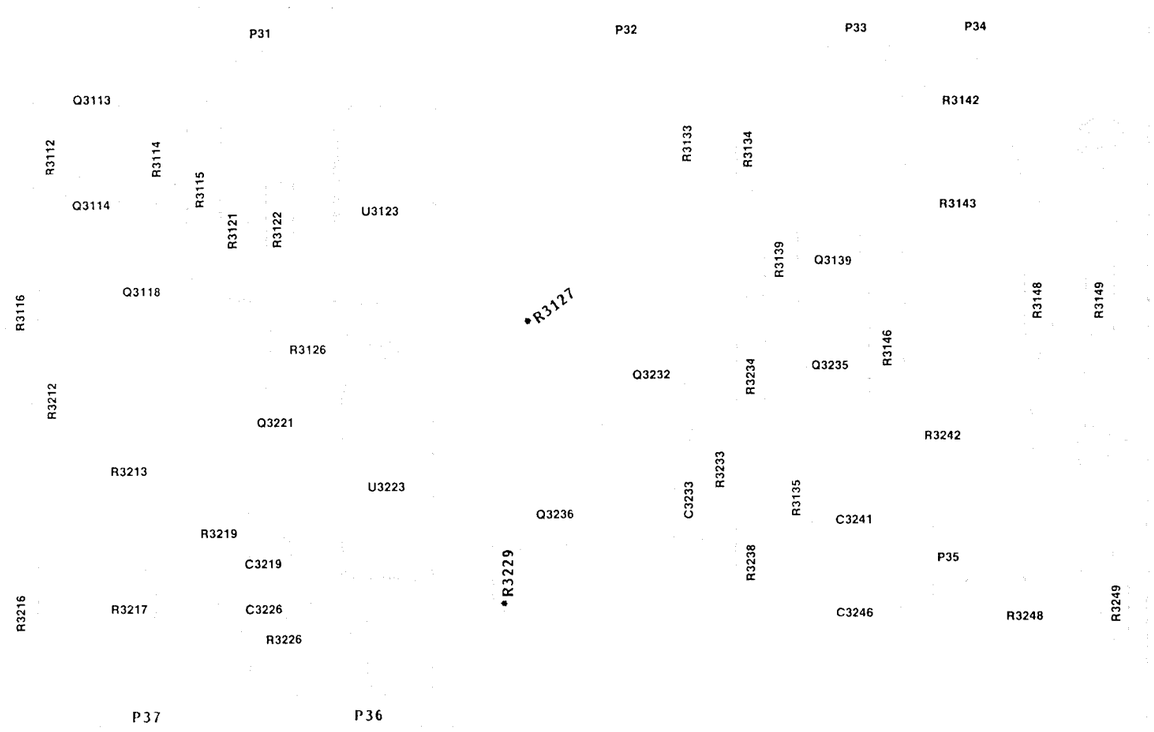
Vertical Amplifier/Slow Ramp Board

VERTICAL AMP/SLOW RAMP COMPONENTS

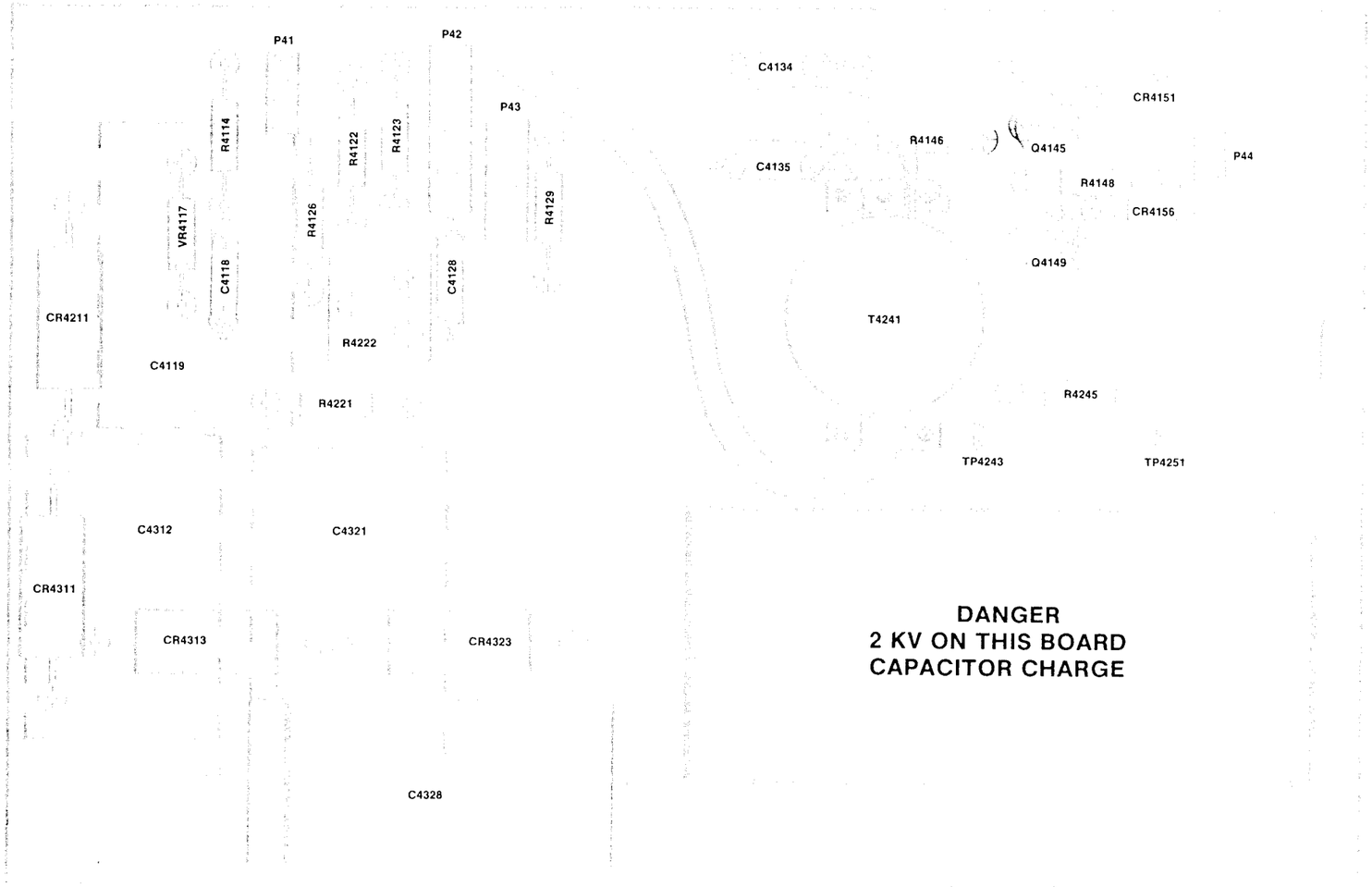
ASSEMBLY A2 - VERTICAL AMP/SLOW RAMP BOARD

CIRCUIT NUMBER	BOARD LOCATION	CIRCUIT NUMBER	BOARD LOCATION
C2137	B2	R2220	E2
C2138	A1	R2221	C4
C2146	A1	R2222	C5
C2147	B1	R2223	C5
C2158	F5	R2224	C6
C2229	D1	R2225	D1
C2232	E1	R2226	C6
C2241	B2	R2227	C7
C2252	F7	R2228	B7
C2325	C6	R2229	B3
C2345	G8	R2233	B7
C2349	G4	R2235	E1
C2351	F4	R2236	E7
C2356	F6	R2237	D6
		R2242	G3
CR2161	G4	R2247	F6
CR2216	H2	R2251	F8
CR2217	H2	R2258	G8
CR2262	G5	R2266	G5
CR2324	C6	R2267	G5
CR2341	D6	R2311	H1
CR2344	F8	R2321	B6
CR2353	D6	R2322	B6
		R2323	
M0171	H1	R2324	C6
		R2325	
Q2246	G3	R2326	B4
Q2248	F7	R2337	D6
Q2249	F7	R2345	G8
Q2257	F8	R2346	F7
Q2258	G8	R2347	F6
Q2259	G9	R2348	F7
Q2261	G5	R2353	G2
Q2262	G5	R2354	G8
Q2341	G3	R2355	H9
Q2342	G3	R2361	G5
Q2345	G4		
R0251	A1	S2126	A5
R0252	A1	S2254	F2
R0262	A1		
R0263	C8	TP2134	A2
R0352	B1	TP2151	B8
R2137	B2	TP2154	G9
R2138	B2	TP2155	F9
R2139	A1	TP2157	D9
R2142	C7	TP2158	B9
R2144	B7	U2131	A2
R2146	B1	U2136	B3
R2149	D8	U2143	B7
R2157	G4	U2332	D6,E7
R2158	G5	VR2212	H1
R2166	G4		


1
2
3
4
5
6
7
8
9
10
A
B
C
D
E
F
G
H
POSITIONING
VERTICAL AMPLIFIER
S2126
mV/DIV
500
200
100
50
20
10
5
U2131
741
U2136
741
U2143
741
GAIN AMPLIFIER
R0252 47k
R0262 100k
R0251B 50k
R0251A 50k
R0352 47k
FINE
POSITION
R2139 15k
C2138 68µF
C2146 0.1
C2147 68µF
R2146 10k
R2137 62k
TP2134 (RED)
P22
P21
COAX #3 FROM
VERTICAL
R2138 20k
C2137 .001
C2241 0.1
R2229 10.0k
R2326 24.9k
R2325 49.9k
R2323 100k
R2322 250k
R2321 499k
R2228 1.0M
R2221 16.5k
R2222 12.4k
R2223 11.0k
R2224 10.5k
R2226 10.2k
R2227 10.1k
R2233 10k
R2144 39k
R2142 12k
TP2151 (V10)
TP2158 (BLK)
VERT (Y)
P24
P15
P23
R0263 50k
GAIN
P28
TO RECORD SWITCH IF LOGIC BD. IS NOT USED
P27
FROM P53-7
RECORD
P25
FROM
P65-3
P65-2
P65-1
R2225 33
C2229 68µF
R2235 33
C2232 68µF
TYPE | +5V | -5V
CD4011 | 14 | 7
R2324 220k
CR2324
C2325 1µF
U2332D
¼CD4011
CR2341
R2337 100k
CR2353
R2237 100k
U2332B
¼CD4011
R2236 100k
U2332A
¼CD4011
U2332C
¼CD4011
XY RECORD LOGIC
P26
R2149 18M
PEN LIFT
TP2157 (YEL)
LOGIC CONTROL
P53-1
P53-2
TO 5
TO OUTPUT AMPS 12
HORIZ CONTROL
R2220 1M
S2254
NOISE FILTER
C2351 .01
SLOW RAMP
C2356 .0013
C2252 1µF
R2247 1M
R2347 1M
Q2248
Q2249
R2346 1M
R2348 1M
R2251 1.5M
Q2257
HORIZONTAL
TP2155 (BLU)
P53-5
Q2341
Q2342
Q2345
Q2246
R2353 24.0M
R2242 33k
C2349 47
R2157 33k
CR2161
Q2261
Q2262
R2267 20.0k
C2158 45
R2166 1.8M
R2158 243.0k
R2361 2.5k
CR2262
R2266 1M
CR2344
R2354 2.7k
R2345 10k
C2345 22µF
Q2259
RETRACE
Q2258
R2258 22k
TP2154 (GRN)
R2355 22k
P53-4
P24
HORIZ CORRECTION
P29
FROM POWER SWITCH
R2311 SEL
M0171
BATTERY
CR2217
CR2216
CHASSIS GND
VR2212 10V
TO MAIN BD.
VERTICAL BD.



Output Amplifier Board

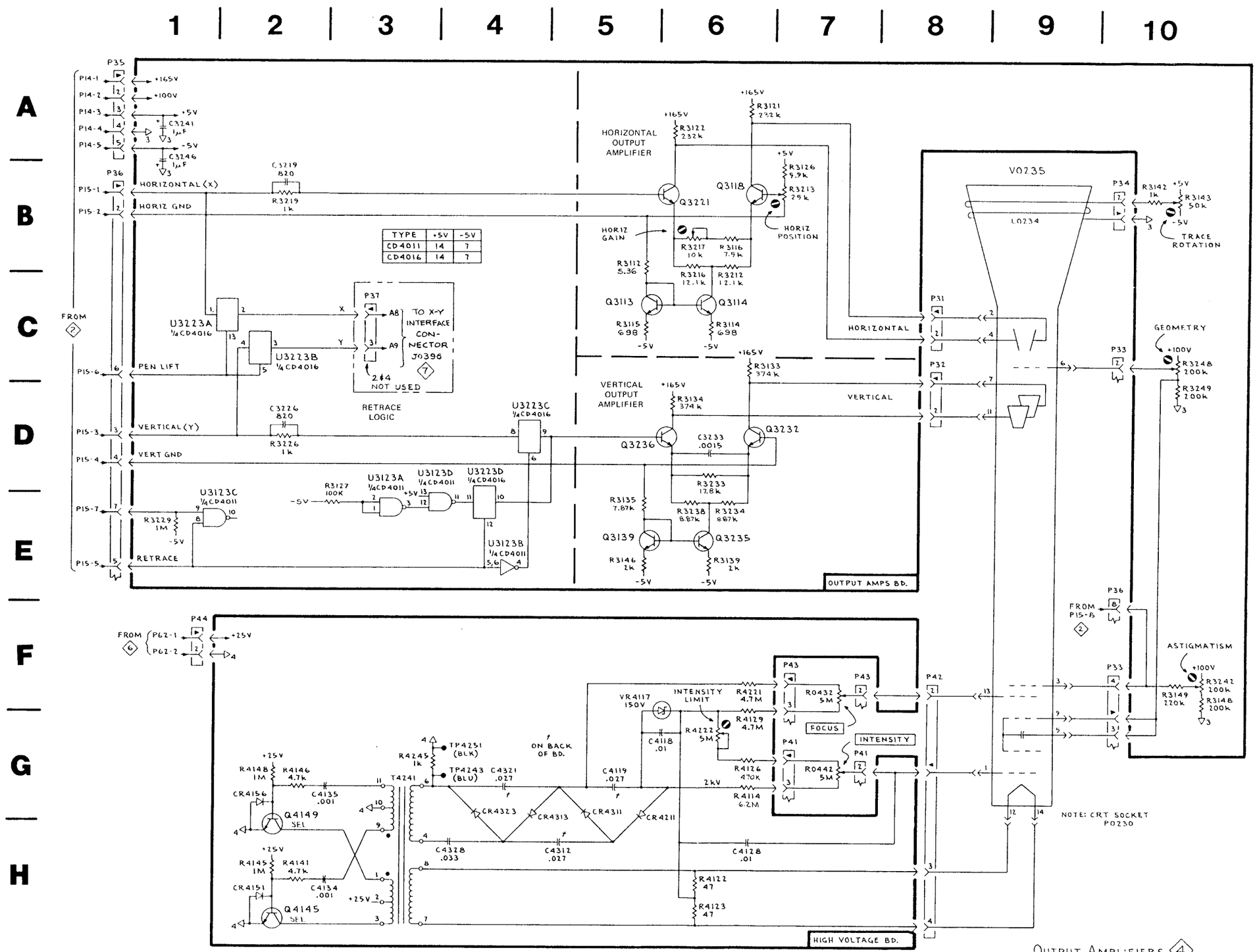


Rev Apr 1988

High Voltage Board

ASSEMBLY A3/A4 - OUTPUT AMPLIFIER AND HIGH VOLTAGE BOARD

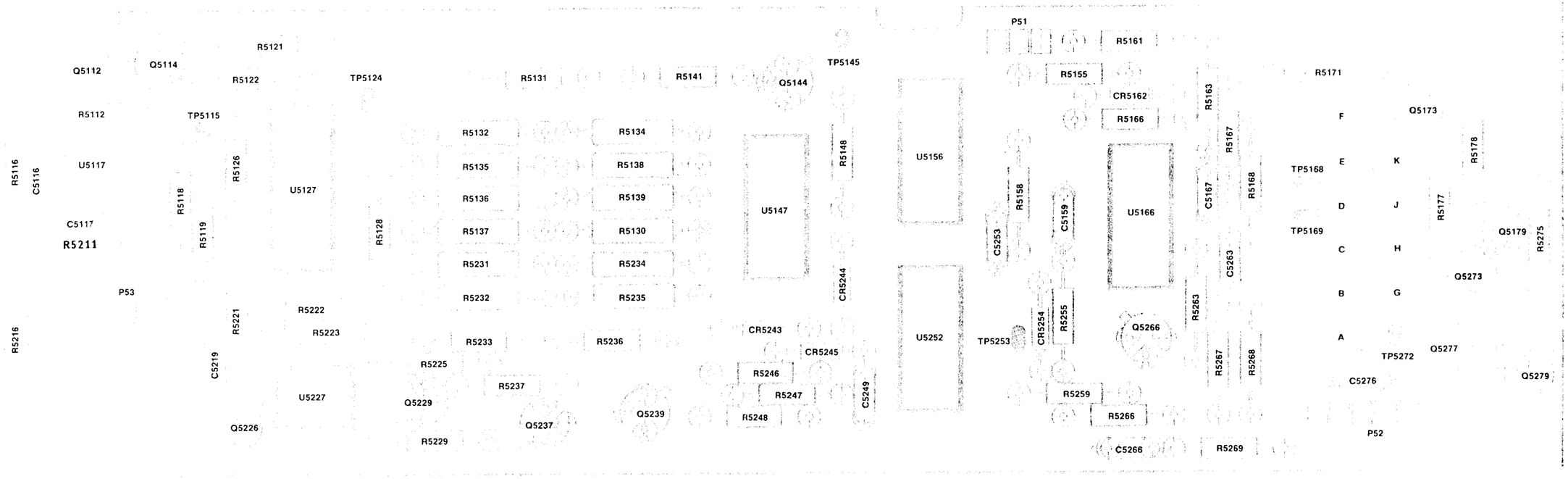
CKT NO	GRID LOC
C3219	B2
C3226	D2
C3233	D6
C3241	A1
C3246	A1
C4118	G5
C4119	G5
C4128	H6
C4134	H2
C4135	G2
C4312	H4
C4321	G4
C4328	H3
CR4151	H2
CR4156	G2
CR4211	G5
CR4311	G5
CR4313	G4
CR4323	G4
L0234	B9
P0230	G9
Q3113	C5
Q3114	C6
Q3118	B6
Q3139	E5
Q3221	B6
Q3232	D6
Q3235	E6
Q3236	D6
Q4145	H2
Q4149	G2
R0432	F7
R0442	G7
R3112	B5
R3114	C6
R3115	C5
R3116	B6
R3121	A6
R3122	A6
R3126	B7
R3127	D3
R3133	C6
R3134	D6
R3135	E5
R3139	E6
R3142	B10
R3143	B10
R3146	E5
R3148	F10
R3149	F10
R3212	B6
R3213	B7
R3216	B6
R3217	B6
R3219	B2
R3226	D2
R3229	E1
R3233	D6
R3234	E6
R3238	E6
R3242	F10
R3248	C10
R3249	D10
R4114	G6
R4122	H6
R4123	H6
R4126	G6
R4129	G6
R4141	H2
R4145	H2
R4146	G2
R4148	G2
R4221	F6
R4222	G6
R4245	G3
T4241	G3
TP4243	G4
TP4251	G4
U3123	E1,E3
U3223	C2,D4
V0235	B9
VR4117	F5



1502/1503

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OUTPUT AMPLIFIERS 4 & HIGH VOLTAGE

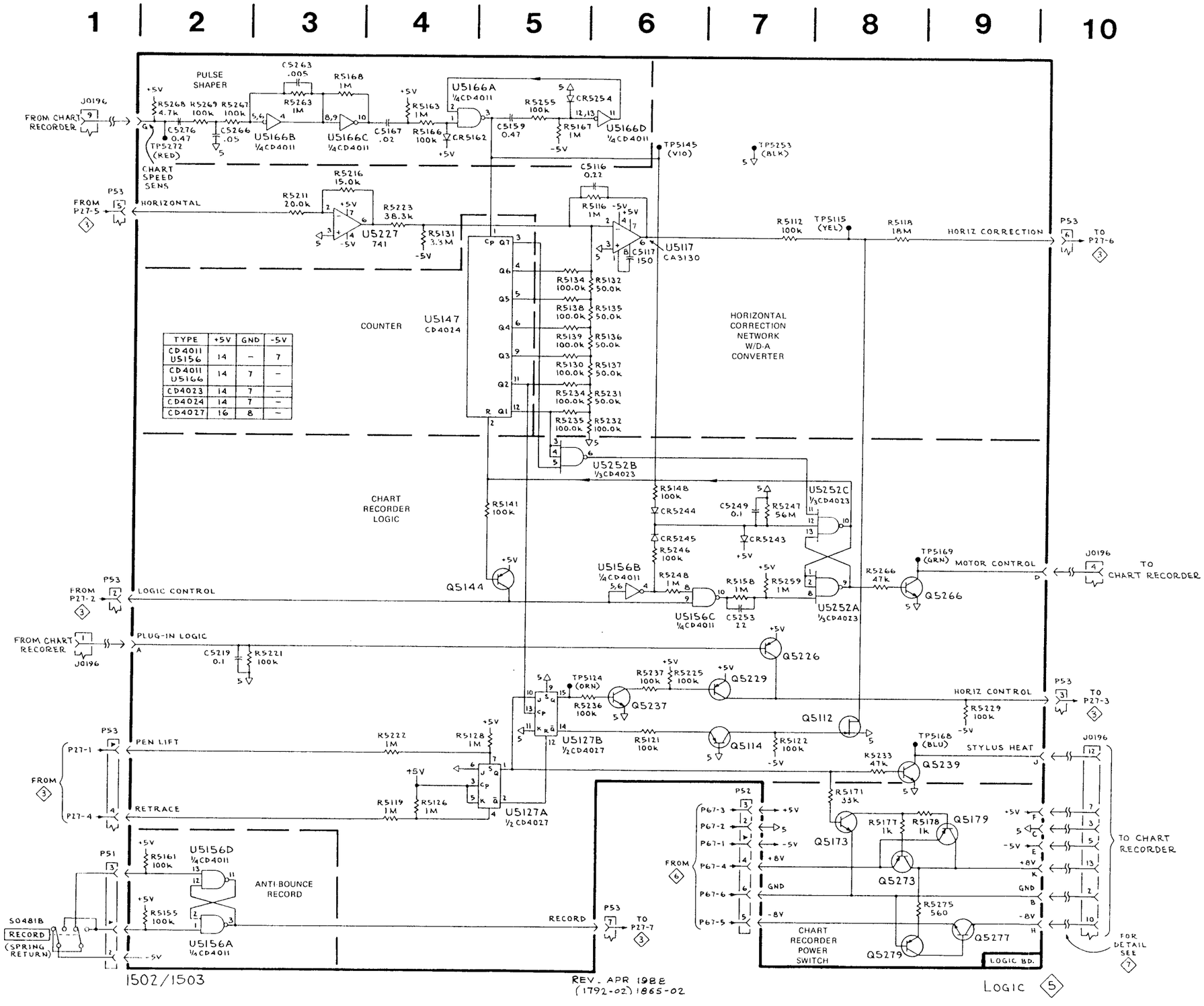


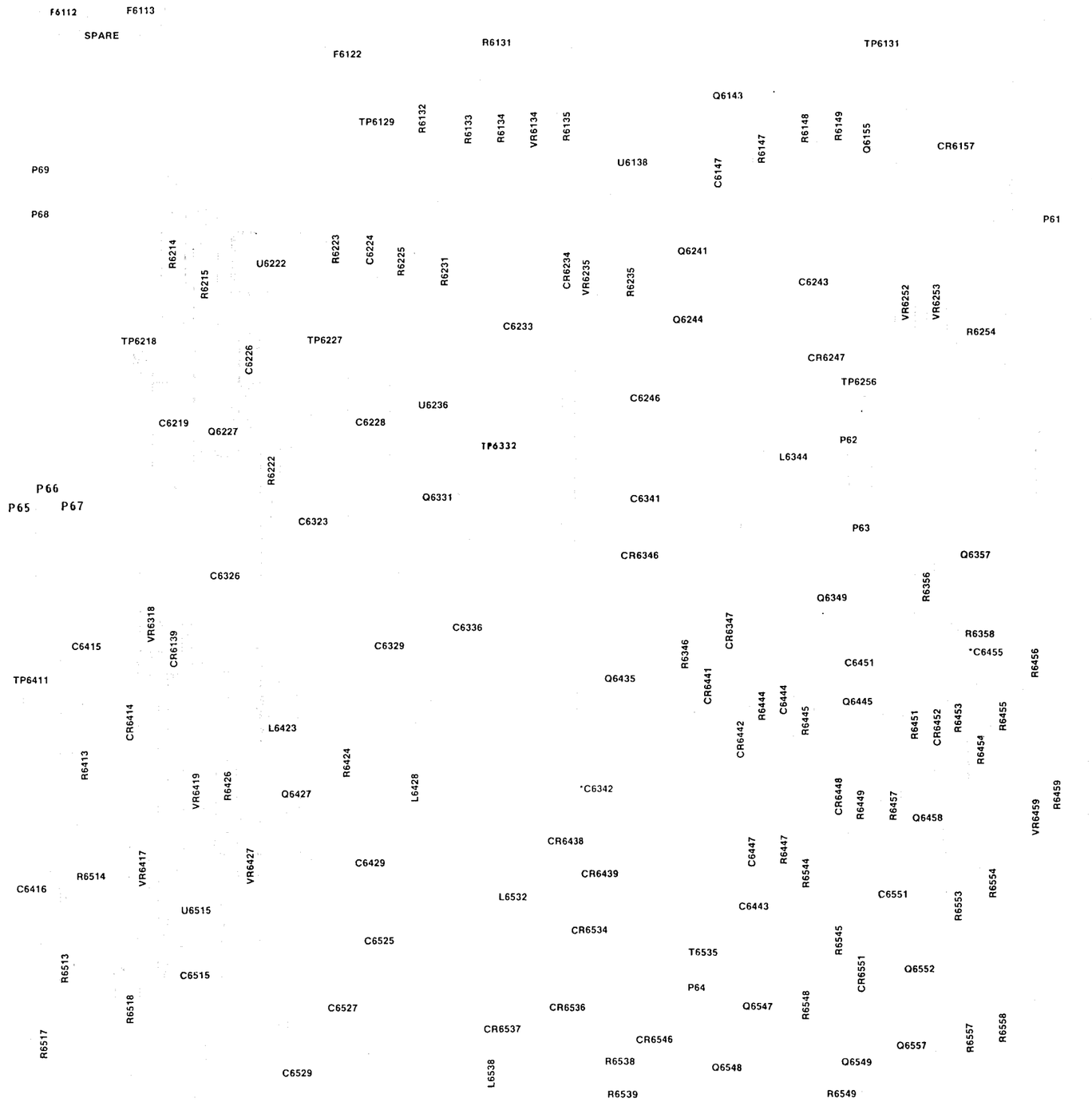
REV MAY 1988

Logic Board

ASSEMBLY A5 - CHART RECORDER LOGIC BOARD

CKT NO	GRID LOC
C5116	B5
C5117	B6
C5159	A5
C5167	A4
C5219	F2
C5249	E7
C5253	F6
C5263	A3
C5266	A2
C5276	A2
CR5162	A4
CR5243	E7
CR5244	E6
CR5245	E6
CR5254	A6
Q5112	F8
Q5114	G7
Q5144	E5
Q5173	G8
Q5179	G9
Q5226	F7
Q5229	F7
Q5237	F6
Q5239	G8
Q5266	E8
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	E5
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	B3
R5221	F2
R5222	G4
R5223	B4
R5225	F6
R5229	F9
R5231	D6
R5232	D6
R5233	G8
R5234	D5
R5235	D5
R5236	F5
R5237	F6
R5246	E6
R5247	E7
R5248	E6
R5255	A5
R5259	E7
R5263	A3
R5266	E8
R5267	A2
R5268	A2
R5269	A2
R5275	H9
S0481B	H1
TP5115	B8
TP5124	F5
TP5145	A6
TP5168	G9
TP5169	E9
TP5253	A7
TP5272	A2
U5117	B6
U5127	G5
U5147	C4
U5156	H2,E6
U5166	A3,A5
U5227	B3
U5252	D5,E8


1 2 3 4 5 6 7 8 9 10
A B C D E F G H
PULSE SHAPER
J0196
FROM CHART RECORDER
C5263 .005
R5268 4.7k
R5269 100k
R5267 100k
C5276 0.47
C5266 .05
TP5272 (RED)
CHART SPEED SENS
U5166B ¼CD4011
R5168 1M
R5263 1M
U5166C ¼CD4011
C5167 .02
R5163 1M
R5166 100k
CR5162
U5166A ¼CD4011
C5159 0.47
R5255 100k
CR5254
R5167 1M
U5166D ¼CD4011
TP5145 (V10)
TP5253 (BLK)
C5116 0.22
P53
FROM P27-5
HORIZONTAL
R5216 15.0k
R5211 20.0k
U5227 741
R5223 38.3k
R5131 3.3M
R5116 1M
U5117 CA3130
C5117 150
R5112 100k
TP5115 (YEL)
R5118 18M
HORIZ CORRECTION
TO P27-6
TYPE | +5V | GND | -5V
CD4011 U5156 | 14 | – | 7
CD4011 U5166 | 14 | 7 | –
CD4023 | 14 | 7 | –
CD4024 | 14 | 7 | –
CD4027 | 16 | 8 | –
COUNTER U5147 CD4024
R5134 100.0k
R5132 50.0k
R5138 100.0k
R5135 50.0k
R5139 100.0k
R5136 50.0k
R5130 100.0k
R5137 50.0k
R5234 100.0k
R5231 50.0k
R5235 100.0k
R5232 100.0k
HORIZONTAL CORRECTION NETWORK W/D-A CONVERTER
U5252B ⅓CD4023
CHART RECORDER LOGIC
R5141 100k
R5148 100k
CR5244
CR5245
R5246 100k
C5249 0.1
R5247 56M
CR5243
U5252C ⅓CD4023
U5156B ¼CD4011
R5248 1M
R5158 1M
R5259 1M
U5156C ¼CD4011
C5253 22
U5252A ⅓CD4023
Q5144
TP5169 (GRN) MOTOR CONTROL
R5266 47k
Q5266
J0196
TO CHART RECORDER
P53
FROM P27-2
LOGIC CONTROL
FROM CHART RECORER
J0196
PLUG-IN LOGIC
C5219 0.1
R5221 100k
Q5226
TP5124 (ORN)
R5237 100k
R5225 100k
Q5229
R5236 100k
Q5237
HORIZ CONTROL
R5229 100k
TO P27-3
Q5112
U5127B ½CD4027
R5121 100k
Q5114
R5122 100k
TP5168 (BLU)
STYLUS HEAT
Q5239
R5233 47k
P53
PEN LIFT
P27-1
FROM
RETRACE
P27-4
R5222 1M
R5128 1M
R5119 1M
R5126 1M
U5127A ½ CD4027
P52
R5171 33k
Q5173
R5177 1k
R5178 1k
Q5179
Q5273
R5275 560
Q5277
Q5279
FROM
P67-3 +5V
P67-2 5
P67-1 -5V
P67-4 +8V
P67-6 GND
P67-5 -8V
TO CHART RECORDER
CHART RECORDER POWER SWITCH
LOGIC BD.
FOR DETAIL SEE
P51
S0481B
RECORD
(SPRING RETURN)
U5156D ¼CD4011
R5161 100k
ANTI-BOUNCE RECORD
R5155 100k
U5156A ¼CD4011
RECORD
TO P27-7
1502/1503
REV. APR 1988
(1792-02) 1865-02
LOGIC 5



*See Parts List for serial number ranges.

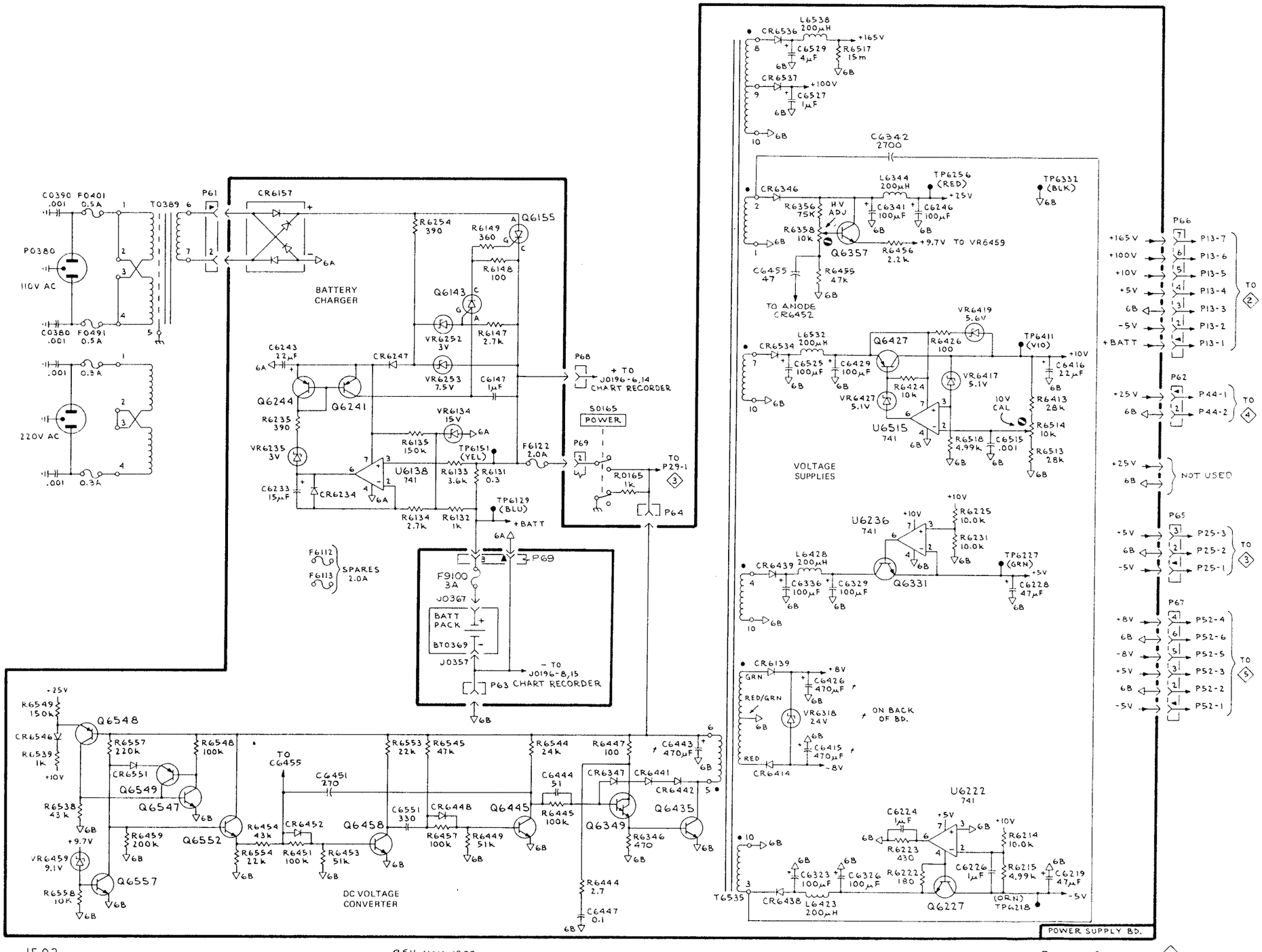
Rev Apr 1988

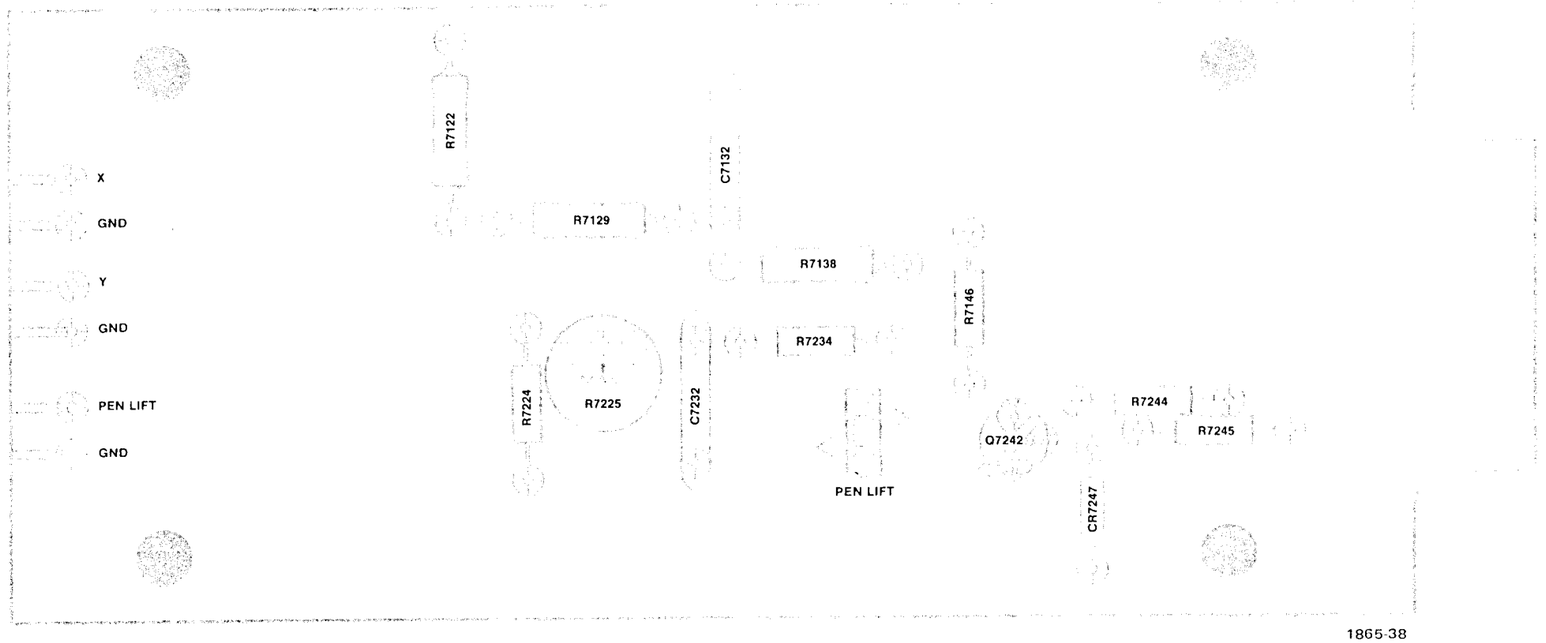
ASSEMBLY A6 - POWER SUPPLY BOARD

CIRCUIT NUMBER	BOARD LOCATION
C0380	C1,E1
C0390	B1,D1
C6147	D4
C6219	H9
C6224	H8
C6226	H9
C6228	F9
C6233	E3
C6243	D2
C6246	B8
C6323	H7
C6326	H7
C6329	F7
C6336	F7
C6341	B8
C6342	B8
C6415	G7
C6416	D9
C6426	G7
C6429	D7
C6443	G6
C6444	G5
C6447	H5
C6451	G4
C6455	C7
C6515	D8
C6525	D7
C6527	A7
C6529	A7
C6551	H3
CR6139	F7
CR6157	B2
CR6234	E3
CR6247	D3
CR6346	B7
CR6347	G5
CR6414	G7
CR6438	H7
CR6439	F7
CR6441	G6
CR6442	G6
CR6448	H4
CR6452	H3
CR6534	D7
CR6536	A7
CR6537	A7
CR6546	G1
CR6551	G1
F0401	B1,D1
F0491	C1,E1
F6112	E3
F6113	E3
F6122	E5
F9100	F4
L6344	B8
L6423	H7
L6428	E7
L6532	D7
L6538	A7
Q6143	C4
Q6155	C4
Q6227	H8
Q6241	D3
Q6244	D3
Q6331	E8
Q6349	H5
Q6357	C7
Q6427	D8
Q6435	H6
Q6445	H5
Q6458	H4
Q6547	G2
Q6548	G1
Q6549	G1
Q6552	H2
Q6557	H1
R0165	E5
R6131	E4
R6132	E4
R6133	E4
R6134	E4
R6135	D4
R6147	C4
R6148	C4
R6149	C4
R6214	H9
R6215	H9
R6222	H8
R6223	H8
R6225	E8
R6231	E8
R6235	D3
R6254	C4
R6346	H6
R6356	B7
R6358	B7
R6413	D9
R6424	D8
R6426	C8
R6444	H5
R6445	H5
R6447	G5
R6449	H4
R6451	H3
R6453	H3
R6454	H2
R6455	C7
R6456	C8
R6457	H4
R6459	H1
R6513	E9
R6514	D9
R6517	A7
R6518	D8
R6538	H1
R6539	G1
R6544	G5
R6545	G4
R6548	G2
R6549	G1
R6553	G3
R6554	H2
R6557	G1
R6558	H1
S0165	E5
T0389	C1,D1
T6535	A-H6
TP6129	E4
TP6151	D4
TP6218	H9
TP6227	E9
TP6256	B8
TP6332	B9
TP6411	D9
U6138	E3
U6222	H8
U6236	E8
U6515	D8
VR6134	D4
VR6235	E3
VR6252	C4
VR6253	D4
VR6318	G7
VR6417	D8
VR6419	C8
VR6427	D8
VR6459	H1

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

A — B — C — D — E — F — G — H





X-Y OUTPUT MODULE

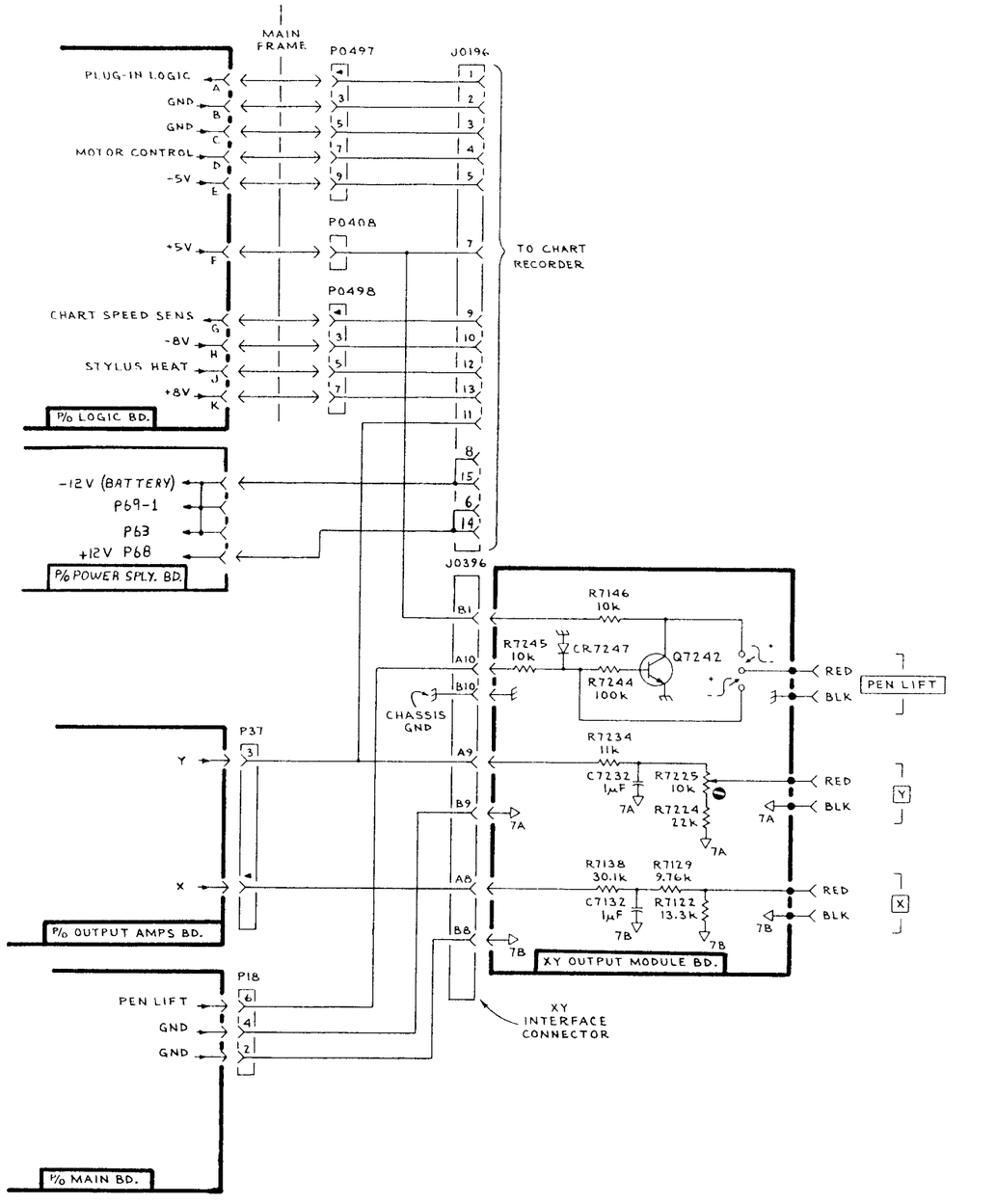
X-Y OUTPUT MODULE COMPONENTS

ASSEMBLY A7 - X-Y MODULE BOARD

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	D6

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

A — B — C — D — E — F — G — H



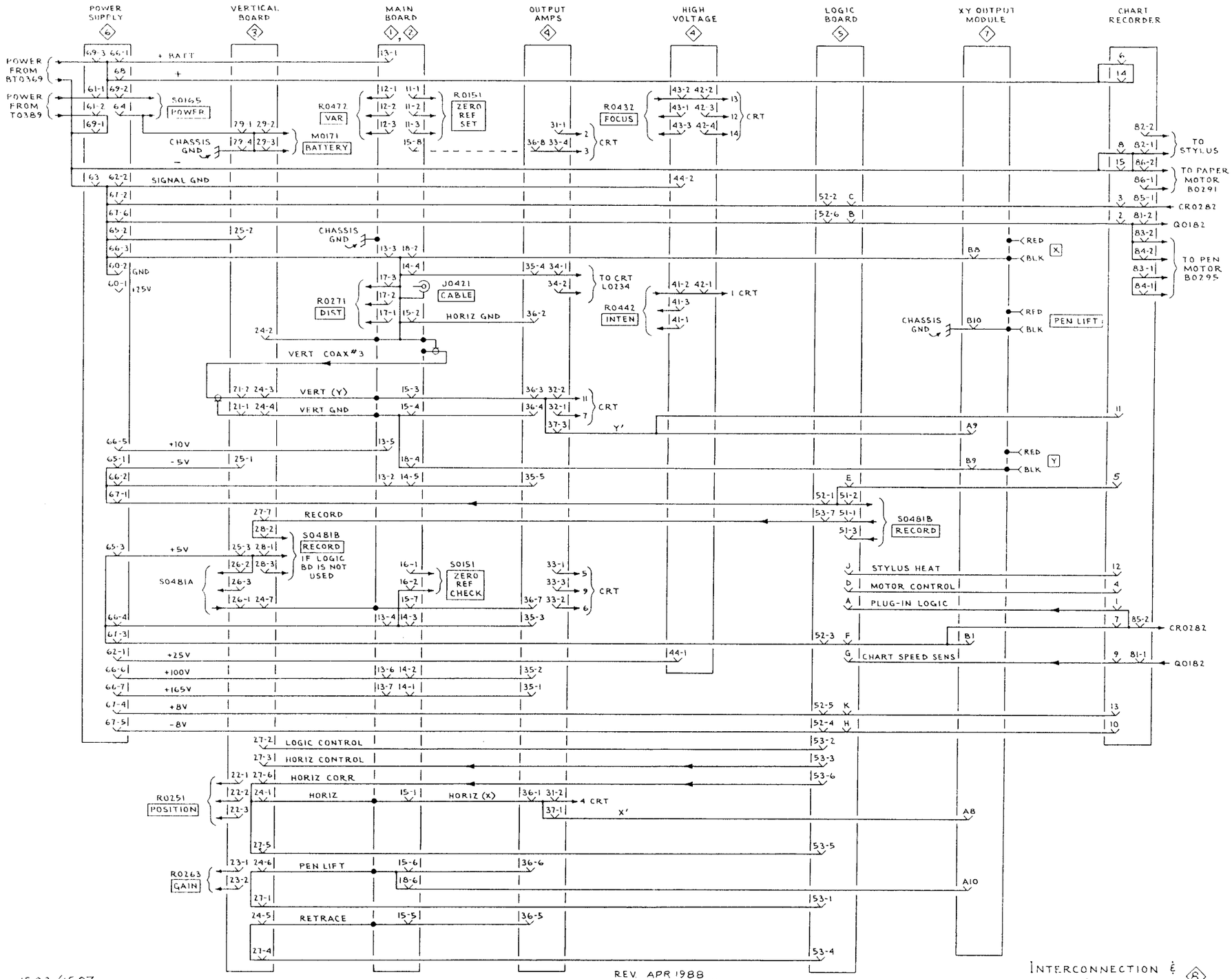
1502/1503

REV APR 1988
(1792-02) 1865-02

X-Y Output Module & Chart Recorder Interconnect ⟨7⟩

X-Y OUTPUT MODULE CIRCUIT

⟨7⟩


POWER SUPPLY
VERTICAL BOARD
MAIN BOARD
OUTPUT AMPS
HIGH VOLTAGE
LOGIC BOARD
XY OUTPUT MODULE
CHART RECORDER
POWER FROM BT0369
POWER FROM T0389
+ BATT
+
S0165 POWER
CHASSIS GND
M0171 BATTERY
R0472 VAR
R0151 ZERO REF SET
R0432 FOCUS
CRT
SIGNAL GND
GND
+25V
CHASSIS GND
J0421 CABLE
HORIZ GND
R0271 DIST
TO CRT L0234
R0442 INTEN
1 CRT
VERT COAX #3
VERT (Y)
VERT GND
Y'
+10V
-5V
RECORD
S0481B RECORD
IF LOGIC BD IS NOT USED
+5V
S0481A
S0151 ZERO REF CHECK
LOGIC CONTROL
HORIZ CONTROL
HORIZ CORR
R0251 POSITION
HORIZ
HORIZ (X)
4 CRT
X'
PEN LIFT
R0263 GAIN
RETRACE
TO STYLUS
TO PAPER MOTOR B0291
CR0282
Q0182
TO PEN MOTOR B0795
RED
BLK
X
Y
PEN LIFT
STYLUS HEAT
MOTOR CONTROL
PLUG-IN LOGIC
CHART SPEED SENS

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from your Tektronix Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to provide benefit of the latest circuit improvements developed by our engineering department. It is important when ordering parts to include the following information: part number, instrument type, serial number and modification number (if applicable).

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

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 showing that part.

INDENTATION SYSTEM

This parts list is indented to indicate item relationships. The following is an example of the indentation system:

```
    Name & Description

Assembly and/or component
Attaching parts for this assembly or component
        - - - * - - -
. Detail part of assembly or component
. Attaching parts for detail part
        - - - * - - -
. . Parts of detail part
. . Attaching parts for parts of detail part
        - - - * - - -
```

Attaching parts are indented the same as the host part; detail parts are indented to the right. Indented parts 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 this parts list, an item name is separated from its description by a colon (:). Because of space limitations an item name may sometimes appear to be incomplete. For additional item name identification, refer to the U.S. Federal Cataloging Handbook H6-1.

ABBREVIATIONS

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State,Zip
00779	AMP INC	P.O.BOX 3608	HARRISBURG, PA 17105
01536	TEXTRON INC/CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD, IL 61108
03038	LONG-LOK FASTENER CORP	13709 S.NORMANDIE AV	GARDENA, CA 90249-2609
05574	VIKING CONNECTORS INC	21001 NORDHOFF STREET	CHATSWORTH, CA 91311
06090	RAYCHEM CORP	300 CONSTITUTION DRIVE	MENLO PARK, CA 94025
07322	MINNESOTA RUBBER CO	3630 WOODDALE AVE	MINNEAPOLIS, MN 55416
07707	USM CORP/EMHART INDUSTRIES INC USM FASTENER DIVISION	510 RIVER ROAD	SHELTON, CT 06484
08530	MICA RELIANCE/MICA CORP	341 39TH STREET	BROOKLYN, NY 11232
09353	C AND K COMPONENTS INC	15 RIVERDALE AVE	NEWTON, MA 02158
12327	FREEWAY CORP	9301 ALLEN DRIVE	CLEVELAND, OH 44125
16428	COOPER BELDEN WIRE AND CABLE SUB OF COOPER INDUSTRIES	NW N.ST	RICHMOND, IN 47374
18203	ENGELMANN MICROWAVE CO	SKYLINE DRIVE	MONTVILLE, NJ 07045
22526	DU PONT EI DE NEMOURS CO INC DU PONT CONNECTORS SYSTEMS	30 HUNTER LANE	CAMP HILL, PA 17011
22599	AMERACE CORP/ESNA DIVISION	15201 BURBANK BLVD SUITE C	VAN NUYS, CA 91411
24931	SPECIALTY CONNECTOR CO INC	2620 ENDRESS PLACE	GREENWOOD, IN 46142
36294	H.A. GUDEN CO INC	99 RAYNOR AVE	RONKONKOMA, NY 11779
42689	NATIONAL LOCK CO	1902 7TH	ROCKFORD, IL 61101
52152	MINNESOTA MINING AND MFG CO INDUSTRIAL SPECIALTIES DIVISION	3M CENTER	ST PAUL, MN 55144
53718	GRACE WR & CO POLYFIBRON DIV/AIRMOLD	BECKER FARMS INDUSTRIAL PARK P.O. BOX 610	ROANOKE RAPIDS, NC 27870
59730	THOMAS AND BETTS CORP	HIGHWAY 218 S	IOWA CITY, IA 52240
60172	PHILLIP J INDUSTRIES INC	5410 W.ROOSEVELT RD	CHICAGO, IL 60650
61935	SCHURTER INC	1016 CLEGG COURT	PETALUMA, CA 94952-1152
71126	BRONSON HOMER D. CO	250 MAIN STREET P.O.BOX 98	BEACON FALLS, CT 06403
71400	McGRAW-EDISON CO BUSSMANN MFG DIVISION	502 EARTH CITY PLAZA P.O.BOX 14460	ST LOUIS, MO 63178
71468	ITT CANNON ELECTRIC DIVISION	666 E DYER ROAD	SANTA ANA, CA 92702
71785	TRW INC/CINCH CONNECTORS	1501 MORSE AVE	ELK GROVE VILLAGE, IL 60007
72228	AMCA INTERNATIONAL CORP	459 MT PLEASANT	NEW BEDFORD, MA 02742
73743	FISCHER SPECIAL MANUFACTURING CO	446 MORGAN ST	CINCINNATI, OH 45206
73803	TEXAS INSTRUMENTS INC METALLURGICAL MATERIALS DIVISION	34 FOREST STREET	ATTLEBORO, MA 02703
74445	HOLO-KROME CO	31 BROOK STREET	WEST HARTFORD, CT 06110
74970	JOHNSON E F CO	229 10TH AVE SW	WASECO, MN 56093
75915	LITTLEFUSE INC	800 NORTHWEST HWY	DES PLAINES, IL 60016
77250	ALLIED PRODUCTS CORP	5700 ROOSEVELT RD	CHICAGO, IL 60650-1156
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST.CHARLES ROAD	ELGIN, IL 60120
78584	STEWART STAMPING DIVISION OF INSILICO CORP	630 CENTRAL PARK AVE	YONKERS, NY 10704

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
79136	WALDES KOHINOOR INC	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
79807	WROUGHT WASHER MFG CO	2100 S.O.BAY STREET	MILWAUKEE, WI 53207
80009	TEKTRONIX INC	P.O.BOX 500	BEAVERTON, OR 97077
83330	DIALIGHT CORP	1913 ATLANTIC AVE	MANASQUAN, NJ 08736-1005
83385	MICRODOT MANUFACTURING CO GREER CENTRAL DIVISION	3221 W BIG BEAVER ROAD	TROY, MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON ROAD	ROCKFORD, IL 61101
83553	ASSOCIATED SPRING BARNES GROUP INC	15001 S BROADWAY P.O. BOX 231	GARDENA, CA 90248-1819
85471	BOYD INDUSTRIAL RUBBER DIVISION OF A B BOYD CO	2527 GRANT AVE	SAN LEANDRO, CA 94579
86928	SEASTROM MANUFACTURING CO	701 SONORA AVE	GLENDALE, CA 91211
87308	N L INDUSTRIES INC N L FASTENERS	BARKLEY ROAD P.O.BOX 1360	STATESVILLE, NC 28677
89663	REESE,J RAMSEY INC	71 MURRAY STREET	NEW YORK, NY 10007
91836	KINGS ELECTRONICS CO INC	40 MARBLEDALE ROAD	TUCKAHOE, NY 10707
93410	ESSEX GROUP INC/CONTROLS DIV	45-55 PLYMOUTH STREET	LEXINGTON, OH 44904
93907	TEXTRON INC/CAM CAR DIV	600 18TH AVE	ROCKFORD, IL 61101
97539	APM-HEXSEAL CORP	44 HONECK STREET	ENGLEWOOD, NJ 07631

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr. Part Number
1-	437-0190-01			1	CAB.,TDR ACCESS:	80009	437-0190-01
-1	105-0684-00	B010100	B092239	2	LATCH ASSEMBLY	80009	105-0684-00
	105-0684-01	B092240		2	LATCH ASSEMBLY:	80009	105-0684-01
					(ATTACHING PARTS)		
-2	211-0510-00			4	. SCR,MACH:6-32 X 0.375",PNH,STL	83385	
					- - - * - - -		
-3	214-0787-00			1	STEM,LATCH:ACCESS BOX	80009	214-0787-00
-4	204-0282-00			1	BODY,LATCH:ACCESS BOX,DELRIN	80009	204-0282-00
-5	214-2389-00			2	PIN,ACTR:POWER SWITCH	80009	214-2389-00
					(ATTACHING PARTS)		
-6	211-0008-00	B010100	R116468	2	. SCR,MACH:4-40 X 0.250 PNH	83385	ORD BY DESCR
	211-0033-00	R116469		2	. SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
-7	200-1778-01			1	DOOR,ACCESS:FRONT COVER,AL	80009	200-1778-01
-8	211-0538-00	B010100	R116860	2	. SCR,MACH:6-32 X 0.312,FLH	83385	ORD BY DESCR
	211-0007-00	R116861		2	. SCR,MACH:4-40 X 0.188,PNH,STL	83385	ORD BY DESCR
-9	210-0586-00			2	. NUT,W/ASSEM WSHR:4-40 X 0.25,STL	78189	211-041800-00
					- - - * - - -		
-10	214-0001-00	B010100	R116860	1	. HINGE,BUTT:1.5 X 1.0,BRS	71126	B78
	214-0001-03	R116861		1	. HINGE,BUTT:1.5 X 1.0,BRS NP	36294	73138-0886
					(ATTACHING PARTS)		
-11	213-0068-00	B010100	R116860	2	. SCR,TPG,TC:6-32 X 0.312,TYPE T	83486	ORD BY DESCR
	213-0119-00	R116861	R117143	2	. SCR,TPG:TYPE B,PNH,STL	93907	ORD BY DESCR
	213-0264-00	R117144	R020799	2	. SCR,TPG,TC:4-24 X 0.625,PNH,STL	80009	213-0264-00
	213-0838-00	R020800		1	. SCR,TPG,TR:4-20 X 0.5 PNH,STL	01536	224-09720-024
					- - - * - - -		
-12	386-3216-00			1	SUPPORT,HINGE:ACCESS DOOR	80009	386-3216-00
-13	105-0652-00			1	STRIKE, CATCH:ACCESS DOOR	80009	105-0652-00
					(ATTACHING PARTS)		
-14	213-0068-00	B010100	R117143	2	. SCR,TPG,TC:6-32 X 0.312,TYPE T	83486	ORD BY DESCR
	213-0839-00	R117144		2	. SCR,TPG,TF:4-24 X 0.5 L,FLH,STL	80009	213-0839-00
					- - - * - - -		
-15	200-1759-00			1	COVER,TDR UNIT:FRONT	80009	200-1759-00
-16	200-1805-00			1	COVER,HDL,LATCH	80009	200-1805-00
					(ATTACHING PARTS)		
-17	213-0739-00			4	. SCR,MACH:10-32 X 0.375",HEX HD	03038	ORD BY DESCR
					- - - * - - -		
-18	210-1231-00			2	WSHR,FLAT:0.203 ID X 0.875 OD,STL	86928	5712-82-60-C2
-19	386-3303-01			2	PLATE,SECURING:HANDLE,STL	80009	386-3303-01
-20	107-0035-00			4	DISC,FRICTION:0.38 ID X 1.865 OD	80009	107-0035-00
-21	334-2467-00			1	PLATE,IDENT:	80009	334-2467-00
-22	367-0204-01			1	HANDLE,CARRYING:W/HDWE	80009	367-0204-01

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
1-23	437-0188-00			1	CAB.,TDR UNIT:	80009	437-0188-00
-24	348-0419-00			2	.FOOT,CABINET:FRONT (ATTACHING PARTS)	80009	348-0419-00
-25	211-0507-00			4	. SCR,MACH:6-32 X 0.312 PNH,STL - - - * - - -	83385	ORD BY DESCR
-26	213-0451-00	B010100	B102826	4	. SCR,EXT,RLV:FOOT RETAINING	80009	213-0451-00
	213-0451-01	B102827		4	. SCR,EXT,RLV:FOOT,RETAINING (ATTACHING PARTS)	80009	213-0451-00
-27	354-0175-00			4	. RING,RTNG:TYPE EXT,U/O 0.188 ID SFT - - - * - - -	79136	5133-18-MI
-28	348-0420-01			2	FOOT,CABINET:REAR (ATTACHING PARTS)	80009	348-0420-01
-29	213-0183-00			2	. SCR,TPG,TF:6-20 X 0.5,PNH,STL - - - * - - -	93907	ORD BY DESCR
-30	386-4074-00			2	. PLATE,REINF:3.8 X 0.434,STL	80009	386-4074-00
-31	348-0444-00			2	. SEAL,BOLT:0.186 X 0.443 OD	80009	348-0444-00
	334-2666-00	B010100	B1025969	1	MRKR,IDENT:MKD 110V	80009	334-2666-00
	334-2666-01	B102570		1	MRKR,IDENT:MKD 115VAC	22670	ORD BY DESCR
	334-2529-00	B010100	R116477	1	MRKR,IDENT:MKD CAUTION	80009	334-2529-00
	334-2529-01	R116478		1	MRKR,IDENT:MKD CAUTION,BTRY PACK	80009	334-2529-01
	334-2667-00	B010100	B102569	1	MRKR:IDENT:MKD 230V (OPTION 6 ONLY)	80009	334-2667-00
	334-2667-01	B102570		1	MRKR,IDENT:MKD 230VAC (OPTION 6 ONLY)	80009	334-2667-01

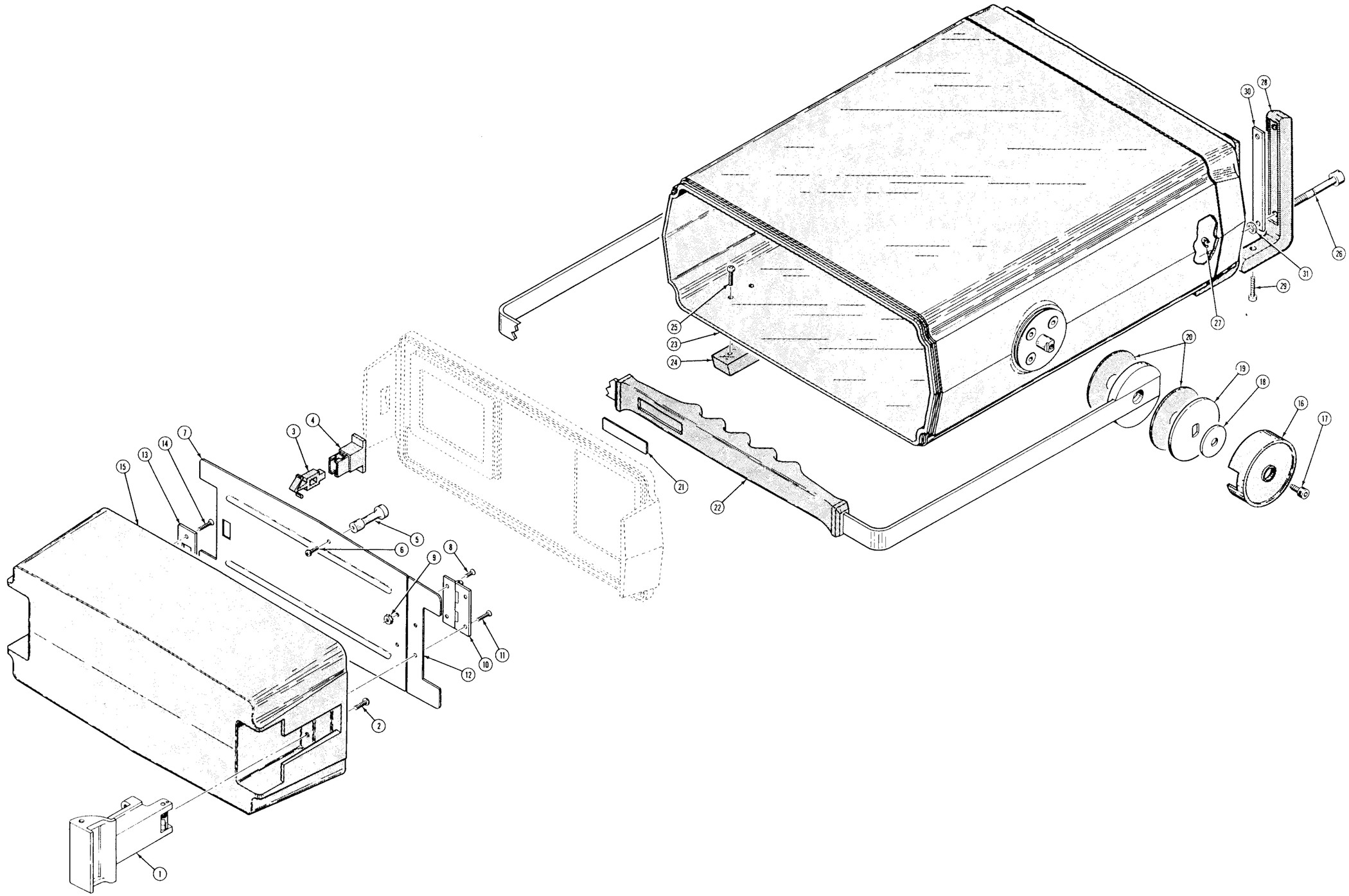


Fig. 9-1. 1502 Cabinet and Access Box.

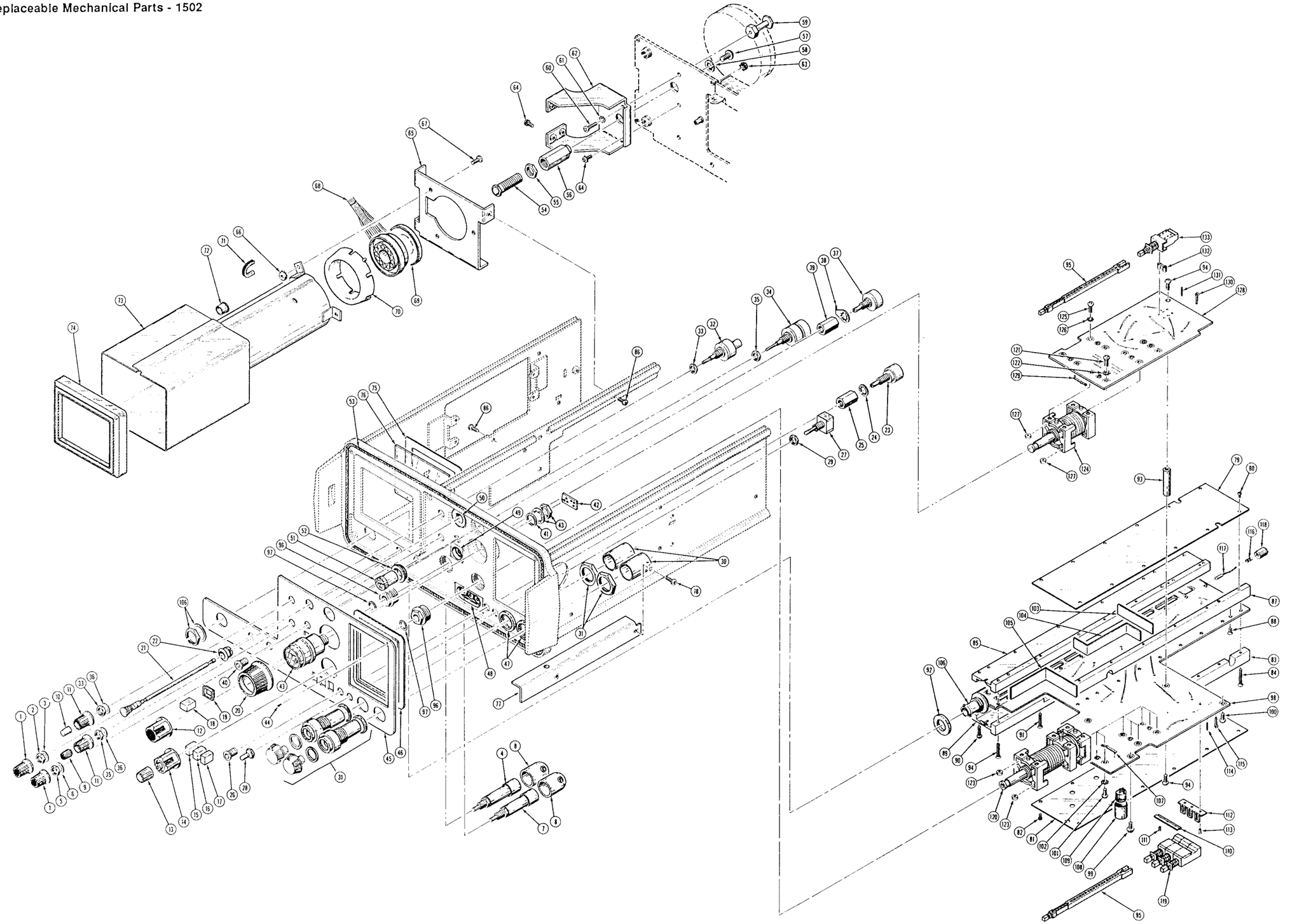


Fig. 9-2. 1502 Chassis.

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
2-1	366-0494-00			2	KNOB:GRAY	80009	366-0949-00
	213-0153-00			2	. SETSCREW:5-40 X0.125,STL HEX	74445	ORD BY DESCR
-2	210-0583-00			1	NUT,PL HEX:0.25-32 X 0.312 BRS	73743	2X-20319-402
-3	210-0940-00			1	WSHR,FLAT:0.25 ID X 0.375,AL	79807	ORD BY DESCR
-4	----- -----			1	RES.,VAR:(SEE R0432 REPL)		
-5	210-0583-00			1	NUT,PL HEX:0.25-32 X 0.312 BRS	73743	2X-20319-402
-6	210-0940-00			1	WSHR,FLAT:0.25 ID X 0.375,AL	79807	ORD BY DESCR
-7	----- -----			1	RES.,VAR:(SEE R0442 REPL)		
-8	200-1341-00			2	SHLD,RES:BLACK VINYL	80009	200-1341-00
-9	366-1319-02			1	KNOB,GRAY:0.79 ID X 0.280	80009	366-1319-02
	213-0075-00			1	. SETSCREW:4-40 X 0.094,STL,HEX	74445	ORD BY DESCR
-10	366-1059-00			1	PUSH BUTTON:GRAY	80009	366-1059-00
-11	366-1334-00			2	KNOB:GRAY	80009	366-1334-00
	213-0153-00			2	. SETSCREW:5-40 X 0.125,STL HEX	74445	ORD BY DESCR
-12	366-1190-00			1	KNOB:GRAY	80009	366-1190-00
	213-0153-00			2	. SETSCREW:5-40 X 0.125,STL HEX	74445	ORD BY DESCR
-13	366-1031-00			1	KNOB:RED	80009	366-1031-00
	213-0153-00			2	. SETSCREW:5-40 X 0.125,STL HEX	74445	ORD BY DESCR
-14	366-1408-00			1	KNOB:GRAY	80009	366-1408-00
	213-0153-00			2	. SETSCREW:5-40 X 0.125,STL HEX	74445	ORD BY DESCR
-15	366-1620-11			1	PUSH BTN:GRAY-SOLID POL	80009	366-1620-11
-16	366-1620-10			1	PUSH BTN:SIL GRAY-SOLID PTFE	80009	366-1620-10
-17	366-1620-08			1	PUSH BTN:SIL GRAY,OTHER	80009	366-1620-08
-18	366-1620-02			1	PUSH BTN:GRAY-NOISE FILTER	80009	366-1620-02
-19	426-0681-00			4	FR,PUSH BTN:GRAY PLSTC	80009	426-0681-00
-20	366-1268-00	B010100	B039999	1	KNOB:SIL GRAY,SLIDE LATCH	80009	366-1268-00
	366-1269-05	B040000		1	SHELL,KNOB:GRAY,0.041 X 0.7 H,W/LE	80009	366-1269-05
-21	384-1159-01			1	EXTENSION SHAFT:4.5 L W/KNOB	80009	384-1159-01
-22	358-0216-00			1	BUSHING,PLSTC:0.257 X 0.412	80009	358-0216-00
-23	----- -----			1	RES.,VAR:(SEE R0472 REPL) (ATTACHING PARTS)		
-24	210-0046-00			1	. WSHR,LOCK:0.261 X 0.018 THK	78189	1214-05-00-0541C
-25	129-0290-00			1	. POST,ELEC-MECH:0.635 L,HEX	80009	129-0290-00
-26	358-0342-00			1	. BSHG,MACH,THD:0.25 -32 X 0.352	80009	358-0342-00
-27	----- -----			1	SW,TOGGLE:(SEE S0481 REPL) (ATTACHING PARTS)		
-28	200-1744-00			1	. CAP.,TOGGLE SW:SEAL,25-40 THD	97539	N5040
-29	210-0583-00			1	. NUT,PL HEX:0.25-32 X 0.312,BRS	73743	2X-20319-402
-30	162-0593-00	B010100	B081319	AR	INSUL SLVG,ELEC:HT SHRINK,BL	06090	TATBK500
	162-0676-01			AR	INS SLVG,ELEC:HT SHRINK 0.75 ID,1.25 L	93410	TL02590
-31	352-0362-00	B010100	R117575	2	FUHLR,EXTR POST:3AG,20A,300V	75915	345603
	352-0766-00	R117576		2	FUSEHOLDER:WATERTIGHT	80009	352-0766-00
-32	----- -----			1	RES.,VAR,WW:(SEE R0151 REPL) (ATTACHING PARTS)		
-33	210-0583-00			2	. NUT,PL HEX:0.25-32 X 0.312	73743	2X-20319-402
	220-0484-00			1	. NUT,PL HEX:0.25 X 0.312,BRS	80009	220-0484-00
	----- -----			1	. SW,PUSH:(SEE S0151 REPL)		
-34	----- -----			1	RES.,VAR:(SEE R0251 REPL) (ATTACHING PARTS)		
-35	210-0583-00			2	. NUT,PL HEX:0.25-32 X 0.312	73743	2X-20319-402

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
2-36	210-0940-00			2	. WSHR,FLAT:0.25 ID X0.375,AL	79807	ORD BY DESCR
					- - - * - - -		
-37	----- -----			1	RES.,VAR:(SEE R0263 REPL)		
					(ATTACHING PARTS)		
-38	210-0223-00			1	. TERM LUG:0.25 DIA SE	86928	A313-136
-39	129-0290-00			1	. POST,ELEC-MECH:0.635 L HEX	80009	129-0290-00
-40	358-0342-00			1	. BSHG,MACH THD:0.25 X 32 X 0.352 L	80009	385-0342-00
					- - - * - - -		
-41	354-0563-00	B040000		1	O-RING:0.65 X 0.045 XSECT	80009	354-0563-00
-42	----- -----			1	CKT BD ASSY:RESISTANCE SOCKET(SEE A10 REPL)		
	136-0261-00			3	. SKT PIN TERM:U/W 0.022 TO 0.225 PIN	00779	1-331677-6
-43	----- -----			1	RES.,VAR:(SEE R0271 REPL)		
					(ATTACHING PARTS)		
	210-1085-00			1	. WSHR,FLAT:0.375 X 0.75 OD,STL	12327	ORD BY DESCR
	210-0845-00			1	. WSHR,FLT:0.5 ID X 0.625 OD STL	89663	634-R
					- - - * - - -		
-44	211-0160-00			1	SCR,MACH:0-80 X 0.188 FILH SST SLOT	83385	ORD BY DESCR
-45	333-1991-03	B010100	B102694	1	PANEL,FRONT:1502	80009	333-1991-03
	333-1991-05	B102695		1	PANEL,FRONT	80009	333-1991-05
	333-2119-02	B010100	B102694	1	PANEL,FRONT:(OPT 05 ONLY)	80009	333-2119-02
	333-2119-04	B102695		1	PANEL,FRONT:(OPT 05 ONLY)	80009	333-2119-04
-46	----- -----			1	(REPLACEABLE W/FR PANEL ASSY		
					(ATTACHING PARTS)		
-47	210-1246-00			2	. WSHR,FLT:0.5 ID X 0.688 OD,STL	80009	210-1246-00
	211-0160-00	B102695		1	. SCR,MACH:0.80 X 0.188,FILH,SST,SLOT	83385	ORD BY DESCR
					- - - * - - -		
-48	348-0409-03			1	SEAL,PB:3 BTN	80009	348-0409-03
-49	348-0409-01			1	SEAL,PB:1 BTN	80009	348-0409-01
-50	348-0422-00			1	SEAL,SW:POWER	80009	348-0422-00
-51	----- -----			1	METER,ELEC FREQ:(SEE M0171 REPL)		
-52	352-0243-00			1	HLDR,IND:BTRY LEVEL,PLSTC	80009	353-0243-00
-53	348-0477-00			2	SEAL,RBR STRIP:0.94 X 28 L	85471	ORD BY DESCR
					- - - * - - -		
-54	213-0738-00	B010210		1	SCR,ADJUSTING:0.188 L	80009	213-0738-00
-55	220-0415-00	B010210		1	NUT,PL HEX:0.312-32 ,BRS	73743	2X-28046-402
-56	129-0602-00	B010210		1	SPCR POST:1.14 L HEX BRS	80009	129-0602-00
					(ATTACHING PARTS)		
-57	212-0507-00	B010210		1	. SCR,MACH:10-32 X 0.375 PNH,STL	83385	ORD BY DESCR
-58	210-0009-00	B010210		1	. WSHR,LOCK:EXT,0.193 ID X 0.40 OD,STL	78189	1110-00
					- - - * - - -		
-59	129-0562-00	B010210		1	POST,RTNR:0.892 L X 0.375 HEX	80009	129-0562-00
					(ATTACHING PARTS)		
-60	211-0198-00	B010210		1	. SCR,MACH:4-40 X 0.438 PNH,STL	77250	ORD BY DESCR
-61	210-0003-00			1	. WSHR,LOCK:#6 EXT	78189	1104-00-00-0541C
					- - - * - - -		
-62	386-3520-00	B010210		1	SUPPORT,CRT:REAR	80009	386-3520-00
					(ATTACHING PARTS)		
-63	210-0586-00	B010210		1	. NUT,ASSEM WSHR:4-40 X 0.25,STL	78189	211-041800-00
-64	211-0033-00	B010210		5	. SCR,ASSEM WSHR:4-40 X 0.312 PNH,STL	83385	ORD BY DESCR
					- - - * - - -		

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
2-65	386-3153-00			1	SUPPORT,CRT SHIELD:REAR	80009	386-3153-00
					(ATTACHING PARTS)		
-66	210-0586-00			3	. NUT,ASSEM WSHR:4-40 X 0.25 STL	78189	211-041800-00
-67	211-0008-00			6	. SCR,MACH:4-40 X 0.250,PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
-68	136-0644-00			1	SKT ASSY:CRT	80009	136-0644-00
-69	386-1316-00			1	SUPPORT,CRT:REAR	80009	386-1316-00
-70	386-3113-00			1	SUPPORT,CRT:REAR	80009	386-3113-00
-71	348-0239-00			1	GROMMET,PLSTC:DK GRAY,U-SHAPE	80009	348-0239-00
-72	348-0067-00			1	GROMMET,PLSTC:0.312 DIA	80009	348-0067-00
-73	337-2085-00			1	SHIELD,CRT:	80009	337-2085-00
-74	386-3112-00			1	SUPPORT,CRT:FRONT	80009	386-3112-00
-75	343-0610-00			1	SHLD,RTNR:IMPLOSION	80009	343-0610-00
-76	337-2206-02			1	SHLD,IMPLOSION:CRT,CLEAR	80009	337-2206-02
-77	407-1589-00			1	BRKT,ANGLE:PL-IN GUIDE,AL	80009	407-1589-00
					(ATTACHING PARTS)		
-78	211-0008-00			2	. SCR,MACH:4-40 X 0.250,PNH,STL	80009	ORD BY DESCR
					- - - * - - -		
-79	337-2137-00			1	SHLD,ELEC:PULSE SAMPLER,BTM	80009	337-2137-00
					(ATTACHING PARTS)		
-80	211-0136-00	B010100	R116794	12	. SCR,MACH:2-56 X 0.094,PNH,STL,POZ	83385	ORD BY DESCR
	211-0108-00	R116795		12	. SCR,MACH:2-56 X 0.156,PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
-81	337-2138-00			1	SHLD,ELEC:PULSE SAMPLER,TOP	80009	337-2138-00
					(ATTACHING PARTS)		
-82	211-0136-00	B010100	R116794	12	. SCR,MACH:2-56 X 0.094,PNH,STL,POZ	83385	ORD BY DESCR
	211-0108-00	R116795		12	. SCR,MACH:2-56 X 0.156,PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
-83	381-0359-00			1	BAR,SUPPORT:PULSE SAMPLER,TOP,AL	80009	381-0359-00
					(ATTACHING PARTS)		
-84	213-0202-00			9	. SCR,MACH:2-56 X 0.625,FLH,STL	83385	ORD BY DESCR
					- - - * - - -		
-85	337-2133-00			1	SHLD,ELEC:50 OHM STRIP LINE,BTM	80009	337-2133-00
					(ATTACHING PARTS)		
-86	211-0008-00			4	. SCR,MACH:4-40 X 0.250,PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
-87	381-0358-00			1	BAR,SUPPORT:PULSE SAMPLER BTM,AL	80009	381-0858-00
					(ATTACHING PARTS)		
-88	211-0030-00			2	. SCR,MACH:2-56 X 0.25 FLH,STL	83385	ORD BY DESCR
					- - - * - - -		
-89	337-2134-00			1	SHLD,ELEC:50 OHM STRIP LINE,TOP	80009	337-2134-00
					(ATTACHING PARTS)		
-90	211-0159-00			6	. SCR,MACH;2-56 X 0.375,PNH,STL	87308	ORD BY DESCR
-91	211-0100-00	B010100	B040622	6	2-56 X 0.750,PNH,STL,POZ	83385	ORD BY DESCR
	213-0202-00	B040623		6	. SCR,MACH:2-56 X 0.625 FLH,STL	83385	ORD BY DESCR
					- - - * - - -		
-92	210-1251-00			1	WSHR,FLT:0.5 ID,SPONGE	80009	210-1251-00
-93	129-0554-00	B010100	B113859	1	SPACER,POST:0.975L W/4-40	80009	129-0554-00
	129-0554-01	B113860		1	SPCR POST:0.975 L W/0.094 ID	80009	129-0554-01
					(ATTACHING PARTS)		
-94	211-0008-00	B010100	B113859	2	SCR,MACH:4-40 X 0.25 PNH,STL,POZ	83385	ORD BY DESCR
	213-0912-00	B113860		2	. SCR,TPG,TF:4-20 X 0.25,PNH,STL	72228	0004969
					- - - * - - -		
-95	384-1011-00			4	SHAFT,EXT:4.14 L	80009	103-1011-00
	672-0487-03			1	CKT BOARD ASSY:MAIN	80009	672-0487-03
	672-0570-03			1	CKT BOARD ASSY:MAIN-VERT	80009	672-0570-03

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
2 -96	377-0451-00			2	INSERT,SFT SEAL:0.625 X 0.407	80009	377-0451-00
-97	354-0555-00			2	PCKG,PREFMD:0.25 X 0.375	07322	ORD BY DESCR
-98	----- -----			1	CKT BD ASSY:MAIN(SEE A1 REPL)		
					(ATTACHING PARTS)		
-99	211-0116-00			1	. SCR,ASSEM WSHR:4-40 X 0.312 PNH,BRS	83385	ORD BY DESCR
-100	213-0088-00			1	. SCR,TPG,THD CTG:4-24 X 0.25,PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
					CKT BOARD ASSY INCLUDES:		
	346-0160-00	B060986		1	. STRAP,GNDG:0.625 L	80009	346-0160-00
-101	211-0147-00			10	. SCR,MACH:4-40 X 0.25 PNH,STL	83385	ORD BY DESCR
-102	210-0003-00			10	. WSHR,LOCK:EXT 0.123 X 0.245	78189	ORD BY DESCR
-103	337-2157-00			2	. SHLD,ELEC:PULSE SAMPLER	80009	337-2157-00
-104	337-2158-00			2	. SHLD,ELEC:STROBE/PREAMPL	80009	337-2158-00
-105	337-2135-00			1	. SHLD,ELEC:PULSE SAMPLER,	80009	337-2135-00
-106	131-1097-00	B010100	B040615	1	. CONN,RCPT,ELEC:BNC FEMALE	24931	28JR220-2
	131-2010-00	B040616		1	. CONN RCPT:BNC FEMALE	91836	KC79-225
	200-2069-00	B040616		1	. . CAP,PROT:BNC RCPT	24931	28PC110-2
-107	131-0604-00			13	. CONTACT,ELEC:CKT BD SW	80009	131-0604-00
-108	200-0687-01			6	. . CVR,XSTR:0.438 X 0.47 H	80009	
-109	136-0235-00			6	SKT,PL-IN:6 CNCT,RND	71785	133-96-12-062
-110	343-0497-03			1	CLIP,SW:FRONT	80009	343-0497-00
					(ATTACHING PARTS)		
-111	210-3033-00			6	. EYELET,METALLIC:0.59 X 0.156 L	07707	SE-25
					- - - * - - -		
-112	343-0496-03			1	CLIP,SW:REAR	80009	343-0496-00
					(ATTACHING PARTS)		
-113	210-3033-00			6	. EYELET,METALLIC:0.59 X 0.156 L	07707	SE-25
					- - - * - - -		
-114	131-0608-00			38	. TERM PIN:0.365 X 0.025 PH BRZ GOLD	22526	48283-036
-115	214-0579-00			13	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	162-0416-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(RED)	80009	162-0416-00
	162-0418-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(YELLOW)	80009	162-0418-00
	162-0419-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(GREEN)	80009	162-0419-00
	162-0420-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(BLUE)	80009	162-0420-00
	162-0417-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(ORANGE)	80009	162-0417-00
	162-0422-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(GRAY)	80009	162-0422-00
	162-0421-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(VIOLET)	80009	162-0421-00
-116	214-0259-00			1	. SPR,HLCPS:0.018 X 0.312 CLOSED	80009	214-0259-00
-117	210-0676-00			1	. EYELET,METALLIC:0.089 X 0.28 L	83385	ORD BY DESCR
-118	380-0103-00			1	. HSG,HELICAL SPR:BRS ALBALOY PL	80009	380-0103-00
-119	----- -----			1	SW,PB ASSY:(SEE A1S1251 REPL)		
-120	----- -----			1	SW,CAM ASSY:(SEE A1S1222 REPL)		
					(ATTACHING PARTS)		
-121	211-0147-00			6	. SCR,MACH:4-40 X 0.25 PNH,STL	83385	ORD BY DESCR
-122	210-0003-00			6	. WSHR,LOCK:0.123 X 0.245	78189	1104-00-00-0541C
-123	210-0406-00			11	. NUT,PL HEX:4-40 X 0.188 BRS	73743	12161-50
					- - - * - - -		
-124	----- -----			1	SW,CAM ACTR AS:(SEE A2S2126 REPL)		
					(ATTACHING PARTS)		
-125	211-0147-00			4	. SCR,MACH:4-40 X 0.25 PNH,STL	83385	ORD BY DESCR
-126	210-0003-00			4	. WSHR,LOCK:EXT,0.123 ID X 0.245 OD	TK0858	ORD BY DESCR

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
2 -127	210-0406-00			6	. NUT,PL HEX:4-40 X 0.188 BRS	73743	12161-50
-128	----- -----			1	CKT BD ASSY:VERTICAL AMP SLOW RAMP(SEE A2 REPL)		
					CKT BD ASSY INCLUDES:		
-129	131-0604-00			7	. CONTACT,ELEC:CKT BD SW	80009	131-0604-00
-130	214-0579-00			6	. TERM TEST POINT:BRS CD PL	80009	214-0579-00
	162-0414-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(BLACK)	80009	162-0414-00
	162-0416-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(RED)	80009	162-0416-00
	162-0418-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(YELLOW)	80009	162-0418-00
	162-0419-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(GREEN)	80009	162-0419-00
	162-0420-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(BLUE)	80009	162-0420-00
	162-0421-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(VIOLET)	80009	162-0421-00
-131	131-0608-00			28	.TERM PIN:0.365 X 0.025 PH BRZ GOLD	22526	48283-036
-132	361-0384-00			2	SPCR,PB SW 0.133 L	80009	361-0384-00
-133	----- -----			1	SW,PUSH (SEE A2S2254 REPL)		

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
3					FRONT AND FRAME		
-1	337-2194-00			1	SHIELD ELEC:EMI,TOP	80009	337-2194-00
-2	342-0309-00	B010100	R118023	1	INSULATOR FILM:TOP,PLSTC	80009	342-0309-00
-3	337-2193-00	B010100	R118023	1	SHIELD ELEC:EMI,BOTTOM	80009	337-2193-00
	337-2193-02	R118024		1	SHIELD,ELEC:EMI,BOTTOM	80009	337-2193-02
-4	342-0310-00	B010100	R118023	1	INSULATOR FILM:BOTTOM,PLSTC	80009	342-0310-00
-5	426-1187-04	B010100	B102694	1	FRAME PNL,CAB:FRONT	80009	426-1187-04
	426-1187-01	B102695		1	SUBPANEL:FRONT	80009	426-1187-01
	614-0134-00			1	SUBPANEL,FRONT:W/SEALS	80009	614-0134-00
					(ATTACHING PARTS)		
-6	213-0718-00			1	. SCR,TPG,THD:6-20 X 0.625 OVH,STL	83385	ORD BY DESCR
-7	213-0227-00			5	. SCR,TPG,THD:6-32 X 0.50 FLH,STL	83486	ORD BY DESCR
					- - - * - - -		
-8	----- -----			1	CKT BD ASSY:OUTPUT AMPLIFIER (SEE A3 REPL)		
					(ATTACHING PARTS)		
-9	213-0088-00			4	. SCR,TPG THD CTG:4-24 X 0.25 PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
					CKT BD ASSY INCLUDES:		
-10	131-0608-00			22	. TERM PIN:0.365 L PH BRZ GOLD	22526	48283-036
-11	131-0589-00			5	. TERM PIN:0.46 L PH BRZ GOLD	22526	48283-029
-12	346-0127-00	B010100	B114407	1	STRAP,TIEDOWN:4.0L,PLSTC	59730	TY53A
	343-0775-00	B114408		1	CLIP,SPR,TNSN	52152	3484-1000
-13	214-1756-00			1	ACTR,SW:POWER	80009	214-1756-00
-14	260-0834-00			1	SW,TOGGLE:DPDT,5A	09353	U21-SHZQE
-15	210-0269-00	B010160		1	TERM LUG:0.257 MTG HOLE	78584	905020
-16	407-1590-00			1	BRKT,ANGLE:POWER SW,AL	80009	407-1590-00
					(ATTACHING PARTS)		
-17	211-0101-00			2	. SCR,MACH:4-40 X 0.25 FLH,STL	83385	ORD BY DESCR
					- - - * - - -		
-18	351-0436-00			1	GUIDE,PL-IN:UPPER RIGHT	80009	351-0436-00
					(ATTACHING PARTS)		
-19	213-0192-00			1	. SCR,TPG,THD:6-32 X 0.50 PNH,STL	93907	ORD BY DESCR
					- - - * - - -		
-20	----- -----			1	CKT BD ASSY:CHRT RCDR LOGIC (SEE A5 REPL)		
					(ATTACHING PARTS)		
-21	211-0008-00			4	. SCR,MACH:4-40 X 0.250 PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
					CKT BD ASSY INCLUDES:		
-22	131-0589-00			16	. TERM PIN:0.46 L PH BRZ GOLD	22526	48283-029
-23	136-0263-04			10	. SKT,PIN TERM:U/W 0.025 SQ PIN	22526	75377-001
-24	214-0579-00			7	. TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	162-0414-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(BLACK)	80009	162-0414-00
	162-0416-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(RED)	80009	162-0416-00
	162-0418-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(YELLOW)	80009	162-0418-00
	162-0419-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(GREEN)	80009	162-0419-00
	162-0420-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(BLUE)	80009	162-0420-00
	162-0417-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(ORANGE)	80009	162-0417-00
	162-0421-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(VIOLET)	80009	162-0421-00
-25	220-0729-00			1	NUT BLOCK:0.25 X 0.471 L	80009	220-0729-00
					(ATTACHING PARTS)		
-26	211-0101-00			1	. SCR,MACH:4-40 X 0.25,FLH STL	83385	ORD BY DESCR
					- - - * - - -		

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
3 -27	351-0435-00			1	GUIDE,PL-IN:LOWER LEFT	80009	352-0435-00
					(ATTACHING PARTS)		
-28	213-0192-00			1	. SCR,TPG,THF:6-32 X 0.50 PNH,STL	93907	ORD BY DESCR
					- - - * - - -		
-29	131-1165-00			1	CONN,RCPT:15 PIN FE FLOATING	71468	DAF-15S
					(ATTACHING PARTS)		
-30	211-0034-00			2	. SCR,MACH:2-56 X 0.50,PNH STL	83385	ORD BY DESCR
-31	361-0742-00			3	. SPACER SLEEVE:0.094 ID X 0.2 L	80009	361-0742-00
					- - - * - - -		
-32	134-0014-00			2	PLUG TIP:MALE	74970	023-0026-001
					(ATTACHING PARTS)		
-33	210-0457-00			2	. NUT,ASSEM WSHR:6-32 X 0.312 STL	78189	511-061800-00
-34	210-0202-00			2	. TERM LUG:0.146 ID,LCKG,BRZ	78189	2104-06-00-2520N
-35	210-0975-00			2	. WSHR,SHLDR:0.14 ID PLSTC	80009	210-0975-00
-36	210-0933-00			2	. WSHR:0.625 DIA,MICA	08530	ORD BY DESCR
					- - - * - - -		
-37	343-0089-00			1	CLAMP,CABLE:0.3 DIA,PLSTC	80009	343-0089-00
-38	343-0213-00			1	CLAMP,LOOP:0.2 ID,PLSTC	80009	343-0213-00
-39	348-0064-00			1	GROMMET,PLSTC:0.625 DIA,ROUND	80009	348-0064-00
-40	348-0417-00			1	GROMMET,PLSTC:0.75 DIA,OBLONG	80009	348-0417-00
-41	----- -----			1	CKT BD ASSY:POWER (SEE A6 REPL)		
					(ATTACHING PARTS)		
-42	211-0008-00			4	. SCR,MACH:4-40 X 0.250,PNH STL	83385	ORD BY DESCR
					- - - * - - -		
					CKT BD ASSY INCLUDES:		
-43	136-0352-00			8	. CONTACT,ELEC:U/W 0.02 DIA PIN	00779	50462-7
-44	131-0589-00			5	. TERM PIN:0.46 L PH BRZ GOLD	22526	48283-029
-45	131-0608-00			21	. TERM PIN:0.365 L PH BRZ GOLD	22526	48283-036
-46	131-0590-00			2	. TERM PIN:0.71 L PH BRZ GOLD	22526	47351
-47	214-0579-00			7	. TERM TEST POINT:BRS CD PL	80009	214-0579-00
	162-0414-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(BLACK)	80009	162-0414-00
	162-0416-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(RED)	80009	162-0414-00
	162-0418-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(YELLOW)	80009	162-0414-00
	162-0419-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(GREEN)	80009	162-0414-00
	162-0420-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(BLUE)	80009	162-0414-00
	162-0417-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(ORANGE)	80009	162-0414-00
	162-0421-00			AR	. . INSUL SLVG,ELEC:HT SHRINK(VIOLET)	80009	162-0414-00
-48	----- -----			1	CKT BD ASSY:SWEEP GENERATOR (SEE A4 REPL)		
					(ATTACHING PARTS)		
-49	211-0116-00			4	. SCR,ASSEM WSHR:4-40 X 0.312 PNH,BRS	78189	ORD BY DESCR
					- - - * - - -		
					CKT BD ASSY INCLUDES:		
-50	136-0252-04			6	. SKT,PIN TERM:U/W 0.16 DIA PINS	22526	75060-007
-51	131-0589-00			7	. TERM PIN:0.46 L,PH BRZ GOLD	22526	48283-029
-52	131-0608-00			5	. TERM PIN:0.365 L,PH BRZ GOLD	22526	48283-036
-53	214-0579-00			2	. TERM TEST POINT:BRS CD PL	80009	214-0579-00
-54	129-0541-00			1	POST,ELEC-MECH:1.53 L W/4-40 THD	80009	129-0541-00

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
3 -55	----- -----			1	XFMR,PWR,STPDN:(SEE T0389 REPL)		
					(ATTACHING PARTS)		
-56	210-0457-00			1	. NUT,ASSEM WSHR:6-31 X 0.312,STL	78189	511-0618-00-00
-57	210-0202-00			1	. TERM LUG:0.146 ID,LCKG,	78189	ORD BY DESCR
-58	211-0529-00			1	. SCR,MACH:6-32 X 1.25,PNH STL	83385	ORD BY DESCR
-59	211-0628-00			3	. SCR,MACH:6-32 X 1.125,PNH STL	83385	ORD BY DESCR
-60	210-1133-00			4	. WSHR,FLAT:0.142 ID X 0.058 THK,FBR	80009	210-1133-00
					- - - * - - -		
-61	358-0329-00	B010100	R117916	10	BSHG,FEEDTHRU:FUSEHLDR TERM	80009	358-0329-00
	358-0699-00	R117917		10	BSHG,TERM & PIN:FEED THRU,DELRIN	80009	358-0699-00
-62	131-1360-00			1	CONN,RCPT,ELEC:CKT BD,10/20 CONTACT	05574	ORD BY DESCR
					(ATTACHING PARTS)		
-63	210-0406-00			2	. NUT,PL HEX:4-40 X 0.188 BRS	73743	ORD BY DESCR
-64	210-0201-00			2	. TERM LUG:0.12 ID LCKG,BRS TIN PL	73743	ORD BY DESCR
-65	211-0014-00			2	. SCR,MACH:4-40 X 0.50,PNH STL	83385	ORD BY DESCR
					- - - * - - -		
-66	220-0547-01			1	NUT BLOCK:0.38 X 0.26 (2) 4-40 THD	80009	220-0547-01
					(ATTACHING PARTS)		
-67	211-0101-00			1	. SCR,MACH:4-40 X 0.25,FLH STL	83385	ORD BY DESCR
					- - - * - - -		
	334-2501-00	B010100	B060749	1	MARKER,IDENT:MKD CAUTION	80009	334-2501-00
	334-2501-01	B060750		1	MRKR,IDENT:MKD CAUTION	80009	334-2501-01
-68	441-1262-00			1	CHASSIS,TDR UNIT:MAIN	80009	441-1262-00
					(ATTACHING PARTS)		
-69	211-0008-00			8	. SCR,MACH:4-40 X 0.250,PNH,STL	83385	ORD BY DESCR
					- - - * - - -		
-70	256-0570-00			1	DEHYDRATING AGT: SILICA GEL,2.75 DIA	53718	X-1009
					(ATTACHING PARTS)		
-71	211-0513-00			1	. SCR,MACH:6-32 X 0.625,PNH STL	93907	B80-00032-003
-72	210-0055-00			1	. WSHR,LOCK:#6 SPLIT,0.031 THK,STL	83385	ORD BY DESCR
-73	407-1694-00			1	. BRACKET RETAINER:AL	80009	407-1694-00
					- - - * - - -		
-74	129-0562-00			1	POST,RETAINER:0.892 L X 0.375 HEX	80009	129-0562-00
					(ATTACHING PARTS)		
-75	211-0033-00	B010210		1	. SCR,ASSEM WSHR:4-40 X 0.312,PNH STL	83385	ORD BY DESCR
					- - - * - - -		
-76	131-1084-01			1	CONN,RCPT:3 BLADE,6A,250V	80009	131-1084-01
					(ATTACHING PARTS)		
-77	210-0586-00			2	. NUT,ASSEM WSHR:4-40 X 0.25,STL	TK0435	ORD BY DESCR
-78	211-0012-00			2	. SCR,MACH:4-40 X 0.375,PNH STL	83385	ORD BY DESCR
-79	210-0994-00			2	. WSHR,FLT:0.125 ID X 0.25,STL	83385	ORD BY DESCR
-80	361-0764-00			2	. SPCR SLV:0.135 L X 0.132 ID,BRS	80009	361-0764-00
					- - - * - - -		
-81	220-0547-01			3	NUT BLOCK:0.38 X 0.26 (2) 4-40 THD	80009	220-0547-01
					(ATTACHING PARTS)		
-82	211-0101-00			3	. SCR,MACH:4-40 X 0.25,FLH STL	83385	ORD BY DESCR
-83	211-0507-00			1	. SCR,MACH:6-32 X 0.312,PNH STL	83385	ORD BY DESCR
-84	210-0407-00			1	. NUT,PL HEX:6-32 X 0.25,BRS	73743	3038-402
					- - - * - - -		
-85	210-0202-00			1	TERM LUG:0.146 ID,LCKG	78189	2104-06-00-2520N
-86	386-3154-00	B010100	B010209	1	PANEL,REAR:1502	80009	386-3154-00
	386-3154-01	B010210		1	PANEL:REAR	80009	386-3154-01
					(ATTACHING PARTS)		
-87	213-0192-00			1	SCR,TPG THD:6-32 X 0.50,PNH,STL	93907	ORD BY DESCR
					- - - * - - -		
-88	426-1184-00			1	FRAME SECT,TDR:LEFT	80009	426-1184-00
-89	426-1185-00			1	FRAME SECT,TDR:CENTER	80009	426-1185-00
-90	426-1186-00			1	FRAME SECT,TDR:RIGHT	80009	426-1186-00

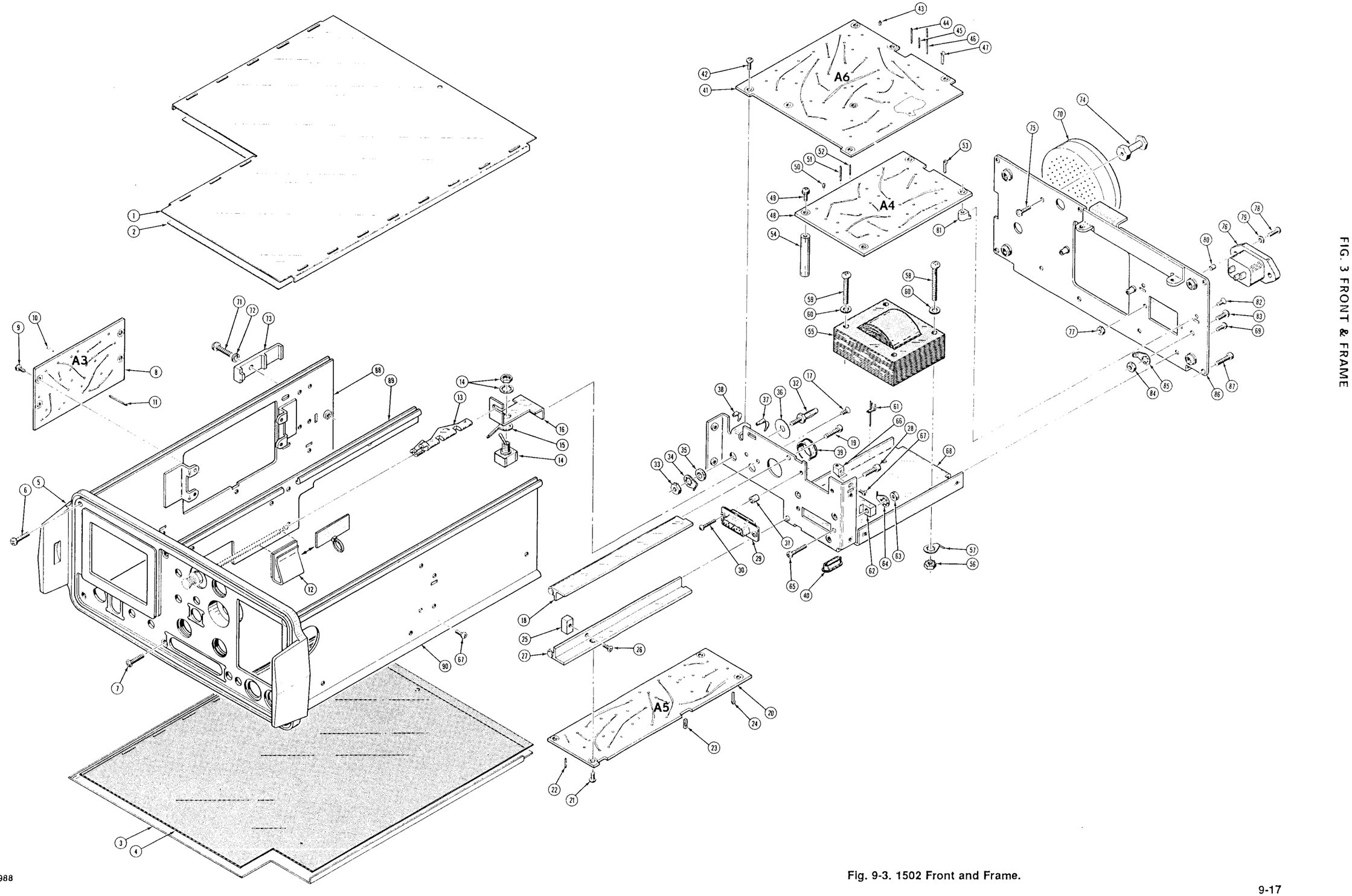
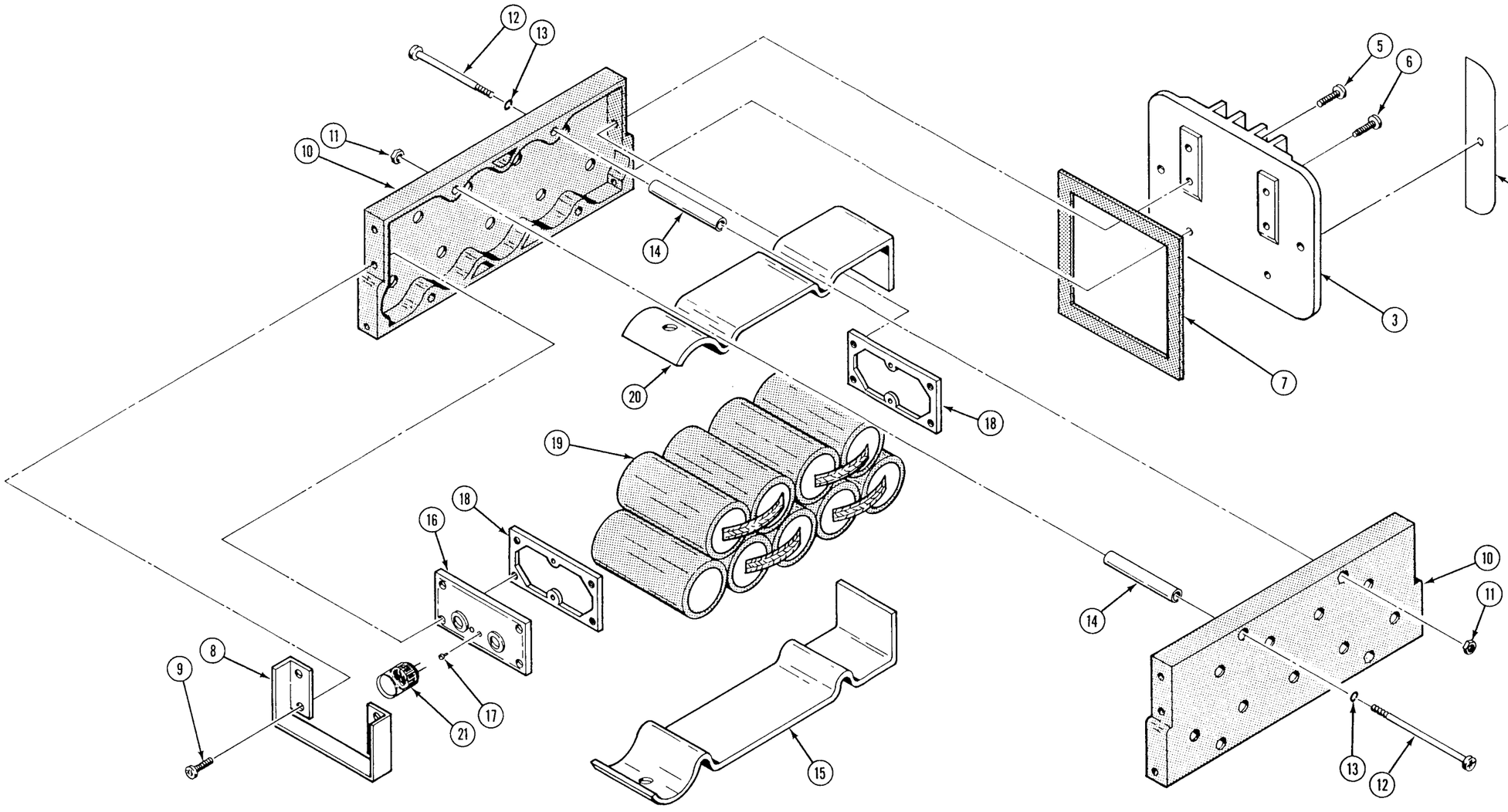


Fig. 9-3. 1502 Front and Frame.

FIG. 3 FRONT & FRAME

FIG. 4 BATTERY PACK



REV MAY 1988

Fig. 9-4. 1502 Battery Pack.

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
	016-0595-00	B010100	B109999	1	BATTERY SET:	80009	016-0595-00
	016-0595-01	B110000	R118364	1	BATTERY SET:	80009	146-0595-01
	016-0813-00	R118365		1	BATTERY SET:	80009	146-0813-00
					(ATTACHING PARTS)		
4-1	214-1573-00			2	THUMBSCREW:6-32 X 0.656,SST	06540	6130-SS-0632
-2	210-1160-00			2	WASHER,FLAT:0.129 ID X 0.031 THK	86928	5612-32-31
					- - - * - - -		
					BATTERY PACK ASSY INCLUDES:		
-3	333-1990-00			1	.PANEL,FRONT	80009	333-1990-00
					(ATTACHING PARTS)		
-4	334-6867-00			1	.LABEL:BATTERY STORAGE TEMP	80009	334-6867-00
-5	211-0198-00			4	SCR,MACH:4-40 X 0.438,PH STL	77250	ORD BY DESCR
-6	213-0267-00			2	SCR,MACH:4-24 X 0.375,PNH STL	83385	ORD BY DESCR
					- - - * - - -		
-7	348-0432-00			1	GASKET:FRONT PANEL	80009	348-0432-00
-8	337-2762-00			1	SHIELD,FUSE:AL	80009	337-2762-00
					(ATTACHING PARTS)		
-9	211-0008-00			4	SCR,MACH:4-40 X 0.250,PNH STL	83385	ORD BY DESCR
					- - - * - - -		
-10	343-0349-01			2	CLAMP,BTRY RTNG:W/HOLES	80009	343-0349-01
					(ATTACHING PARTS)		
-11	210-0406-00			4	NUT,PL HEX:4-40 X 0.188 BRS	73743	12161-50
-12	211-0194-00			4	SCR MACH:4-40 X 47.5MM,PNH STL	80009	211-0194-00
					- - - * - - -		
-13	210-0054-00			4	WSHR,FLAT:#4 SPLIT,0.025 THK	77252	ORD BY DESCR
-14	361-0776-00			4	SPACER,SLEEVE:1.248 L X 0.118,NYLON	80009	361-0776-00
-15	214-2344-00			1	HEAT SINK,ELEC:BTRY SUPPLY,LOWER,AL	80009	214-2344-00
-16	----- -----			1	CKT BD ASSY:POWER FUSE JACK (SEE A9 REPL)		
-17	136-0352-00			4	.CONTACT,ELEC:U/W 0.02 DIA PIN	00779	50462-7
-18	386-2435-00			2	PLATE,METALLIC:W/TAPS	80009	386-2435-00
-19	146-0018-01	B010100	R118364	1	BATTERY SET:10.8V,1.5AH,9 C CELLS	19209	41B002K33G1
	146-0065-00	R118365		1	BTRY SET:1.2V,200mA D CELL	80009	146-0065-00
-20	214-2343-00			1	HEAT SINK,ELEC:BTRY SUPPLY,UPPER,AL	80009	214-2343-00

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
					X-Y PLUG-IN MODULE		
5-1	131-1726-00			3	JACK TIP:BLACK W/HARDWARE	83330	256-103
-2	131-1726-01			3	JACK TIP:RED W/HARDWARE	83330	21293-RED
-3	366-1368-00	B010100	R117091	1	KNOB:AL,0.125 X 0.375	80009	366-1368-00
	366-0650-00	R117092		1	KNOB:THUMBSCREW,CLEAR,0.12 X 0.37	80009	366-0650-00
	213-0076-00	B010100	R117091	1	. SETSCREW:2-56 X 0.125,STL BK OXD	70276	ORD BY DESCR
	213-0048-00	R117092		1	. SETSCREW:4-40 X 0.125,STL,BLK,OXD	70276	ORD BY DESCR
-4	384-1349-00			2	PIN STR,THD:0.125 X 6.417 L	80009	384-1349-00
					(ATTACHING PARTS)		
-5	354-0163-00			2	. RING,RETAINING:TRUARC,CD PL	79136	5133-12ZD
-6	210-1011-00			2	. WASHER:0.13 X 0.375,PLSTC	83309	ORD BY DESCR
-7	354-0538-00			2	. PACKING,PREFMD:0.119 X 0.125 NPRN	07322	
-8	210-0803-00			2	. WSHR,FLAT:0.15 X 0.032 THK,STL	12327	ORD BY DESCR
					- - - * - - -		
-9	333-2021-00			1	PANEL,FRONT:	80009	333-2021-00
-10	386-3229-01	B010100	B050909	1	SUBPANEL,FRONT	80009	38603229-01
	386-3229-03	B050910		1	SUBPANEL,FRONT	80009	386-3229-03
					(ATTACHING PARTS)		
-11	211-0101-00			4	. SCR,MACH:4-40 X 0.25,FLH STL	83385	ORD BY DESCR
					- - - * - - -		
-12	----- -----			1	CKT BD ASSY:X-Y PL-IN (SEE A7 REPL)		
					(ATTACHING PARTS)		
-13	211-0116-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH BRS	83385	ORD BY DESCR
-14	210-0201-00			1	TERM LUG:0.12 ID,LOCKING	73743	ORD BY DESCR
					- - - * - - -		
					CKT BD ASSY INCLUDES:		
-15	131-0608-00			3	.TERM PIN:0.365 L,PH BRZ GOLD	22526	48283-036
-16	131-0993-00			1	..BUS COND:SHUNT ASSY:2WIRE BLACK	22526	65474-005
-17	407-1633-00			1	BRKT,FRONT SECTION:AL	80009	407-1633-00
					(ATTACHING PARTS)		
-18	211-101-00			2	SCR,MACH:4-40 X 0.25 FLH,STL	83385	ORD BY DESCR
					- - - * - - -		
-19	220-0547-01			4	NUT BLOCK:0.38 X 0.26 (2)4-40	80009	220-0547-01
					(ATTACHING PARTS)		
-20	211-0101-00	B010100	B095639	4	SCR,MACH:4-40 X 0.25 FLH,STL,POZ	83385	ORD BY DESCR
	211-0105-00	B095640		4	SCR,MACH:4-40 X 0.188 FLH,STL	TK0435	ORD BY DESCR
					- - - * - - -		
-21	426-1204-00			2	FRAME SECTION:LEFT AND RIGHT	80009	426-1204-00

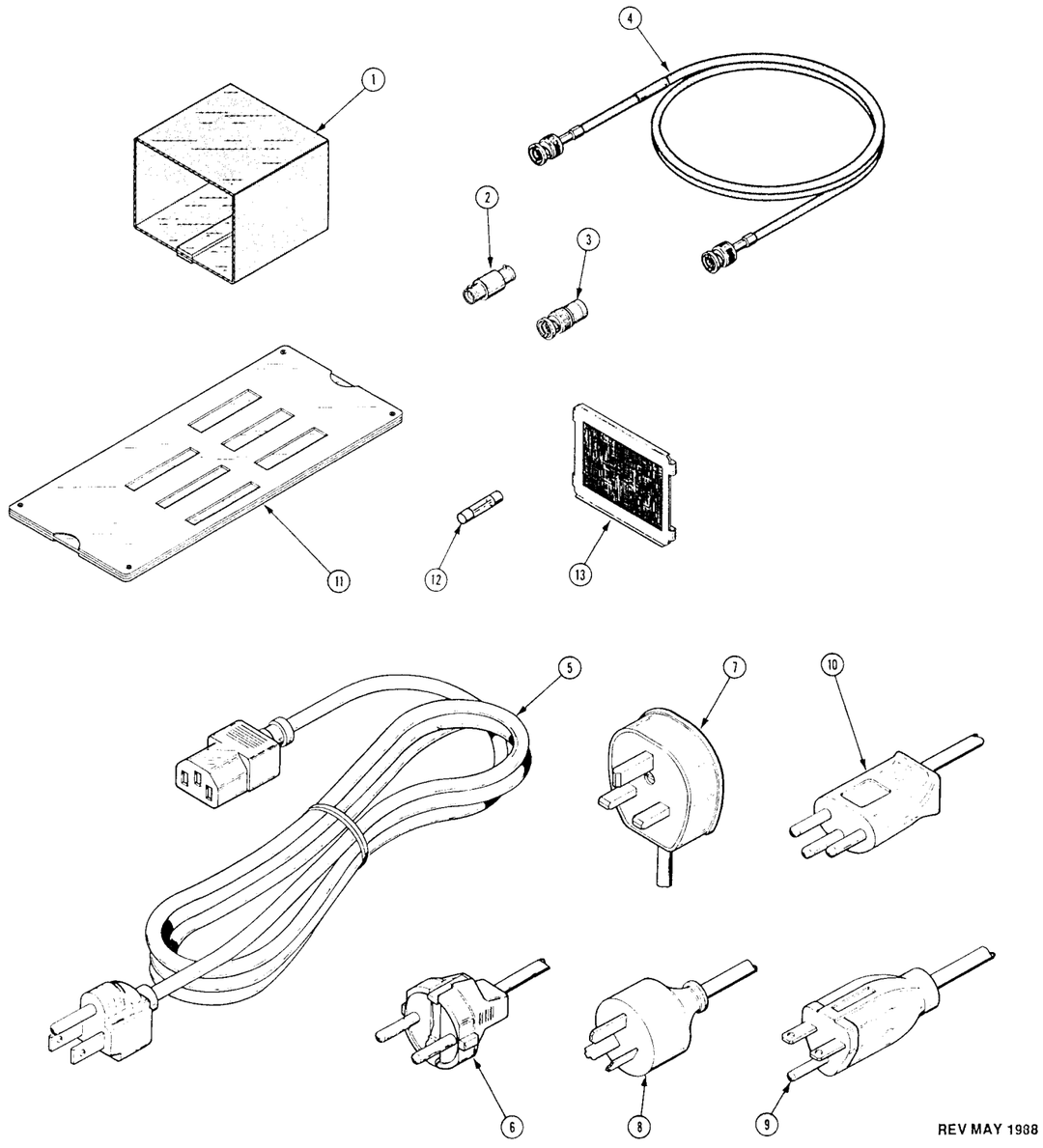


Fig. 9-6. 1502 Accessories.

Fig.& Index No.	Tektronix Part No.	Serial/Model No. Eff.	Dscont.	Qty.	Name & Description	Mfr. Code	Mfr.Part Number
6-1	016-0297-00	B010100	R118452	1	VISOR,CRT (SEE OPTIONAL ACCESSORIES,SECTION 10)	80009	016-0297-00
-2	103-0028-00			1	ADPTR,CONN:BNC FE TO FE	91737	UG914/UDURAPLATE
-3	011-0123-00			1	CONN,PLUG:50 OHM,BNC	18203	T1906
-4	012-0482-00			1	CA ASSY,RF:50 OHM,36 L	80009	012-0482-00
-5	161-0066-00			1	CA ASSY,PWR:3,18 AWG,115V,98.0 L (STANDARD INSTRUMENT ONLY)	TK1372	ORD BY DESCR
-6	161-0066-09	XB102860		1	CA ASSY,PWR:3,0.75MM SQ,220V,99.0 L (OPTION A1 EUROPEAN ONLY)	S3109	86511000
-7	161-0066-10	XB102860		1	CA ASSY,PWR:3,0.75MM SQ,240V,96.0 L (OPTION A2 UNITED KINGDOM ONLY)	TK1368	ORD BY DESCR
-8	161-0066-11	XB102860	R117780	1	CA ASSY,PWR:3,0.75MM,240V,96.0L	S3109	ORD BY DESCR
	161-0227-00	R117781		1	CA ASSY,PWR:250v,2.2 METERS L (OPTION A3 AUSTRALIA ONLY)	80009	161-0227-00
-9	161-0066-12	XB102860		1	CA ASSY,PWR:3,18 AWG,250V,99.0 L (OPTION A4 NORTH AMERICA ONLY)	TK1105	13E68,25-1E
-10	161-0154-00			1	CA ASSY,PWR:3,0.75MM,SQ,240V,6A,2.5M L (OPTION A5 SWITZERLAND ONLY)	S3109	86515000
-11	003-0700-00			1	SLIDE RULE:TDR	80009	003-0700-00
	062-8344-00			1	BOOK:TDR SLIDE RULE INSTR	80009	062-8344-00
-12	159-0029-00	B010100	B059999	1	FUSE CARTRIDGE:3AG,0.3A,250V	71400	MDL3/10
	159-0032-00	B060000	R117575	1	FUSE CARTRIDGE:3AG,0.5A,250V,SLOW BLOW	71400	MDL1/2
	159-0282-00	R117576	R118372	1	FUSE CARTRIDGE:0.5A,5 X 20MM	80009	159-0282-00
	159-0182-00	R118373		1	FUST CARTRIDGE:0.5A	80009	159-0182-00
	159-0054-00	B010100	B059999	1	FUSE CARTRIDGE:3AG,0.15A.250V	71400	15/100
	159-0029-01	B060000	R117575	1	FUSE CARTRIDGE:3AG,0.3A,250V	71400	MDL3/10
	159-0281-00	R117576		1	FUSE CARTRIDGE:0.25A,5 X 20MM	80009	159-0281-00
-13	378-0055-00			1	FILTER,MESH:CRT	80009	378-0055-00
	013-0130-00	XB060960		1	ADAPTOR,CONN:BNC TO PROBE	80009	013-0130-00
	070-1790-00			1	MANUAL,TECH:OPERATOR	80009	070-1790-00

ACCESSORIES

Standard Accessories
(included with instrument)

Accessory	Tektronix Part Number
2 Replacement Fuses (AC for front panel)	159-0032-00 (for 115 VAC) or 159-0029-00 (for 230 VAC)
1 Power Cord	161-0066-00
1 Viewing Hood	016-0297-00
1 50 Ω BNC Terminator	011-0123-00
1 X-Y Output Module	016-0606-00
1 Mesh Filter (CRT)	378-0055-00
1 Operator Manual	070-1790-00
1 Adapter: BNC to probe	013-0130-00
1 Precision 50 Ω Cable	012-0482-00
1 Calculator Slide Rule	003-0700-00
1 Slide Rule Applications Note	062-0344-00
1 BNC Connector, Female-to-Female	103-0028-00

OPTIONAL ACCESSORIES

Accessory	Tek Part No.	Accessory	Tek Part No.
Service Manual	070-1792-01	Adapter, 50/75 Ω	017-0091-00
Terminator, 75 Ω BNC	011-0102-00	Adapter, 50/92 Ω	017-0092-00
Connector, BNC, Female-to-Clip Leads	013-0076-00	Connector, BNC, Female-to-UHF	103-0015-00
Adapter, Camera (Extension)	016-0327-01	Connector, BNC, Female-to-Dual Banana Plug	103-0090-00
Chart Recorder	016-0506-06	Connector, BNC, Male-to-Male	103-0029-00
Chart paper	006-1658-00 or 01	Connector, BNC, Male-to-UHF Female	103-0032-00
Connector, BNC, Female-to-GR	017-0063-00	Connector, BNC, Male-to-Dual Binding Post	103-0035-00
Connector, BNC, Male-to-GR	017-0064-00	Connector, BNC, Male-to-Type N Female	103-0058-00
Adapter, 50/125 Ω	017-0090-00	Connector, BNC, Female-to-Dual Banana Plug	103-0090-00
Suppressor, Static	011-0132-00		

MANUAL CHANGE INFORMATION

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

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

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