INSTRUCTION MANUAL

TEKTRONIX®

T921/T922/T922R
15 MHz
OSCILLOSCOPES
WITH OPTIONS

INSTRUCTION MANUAL

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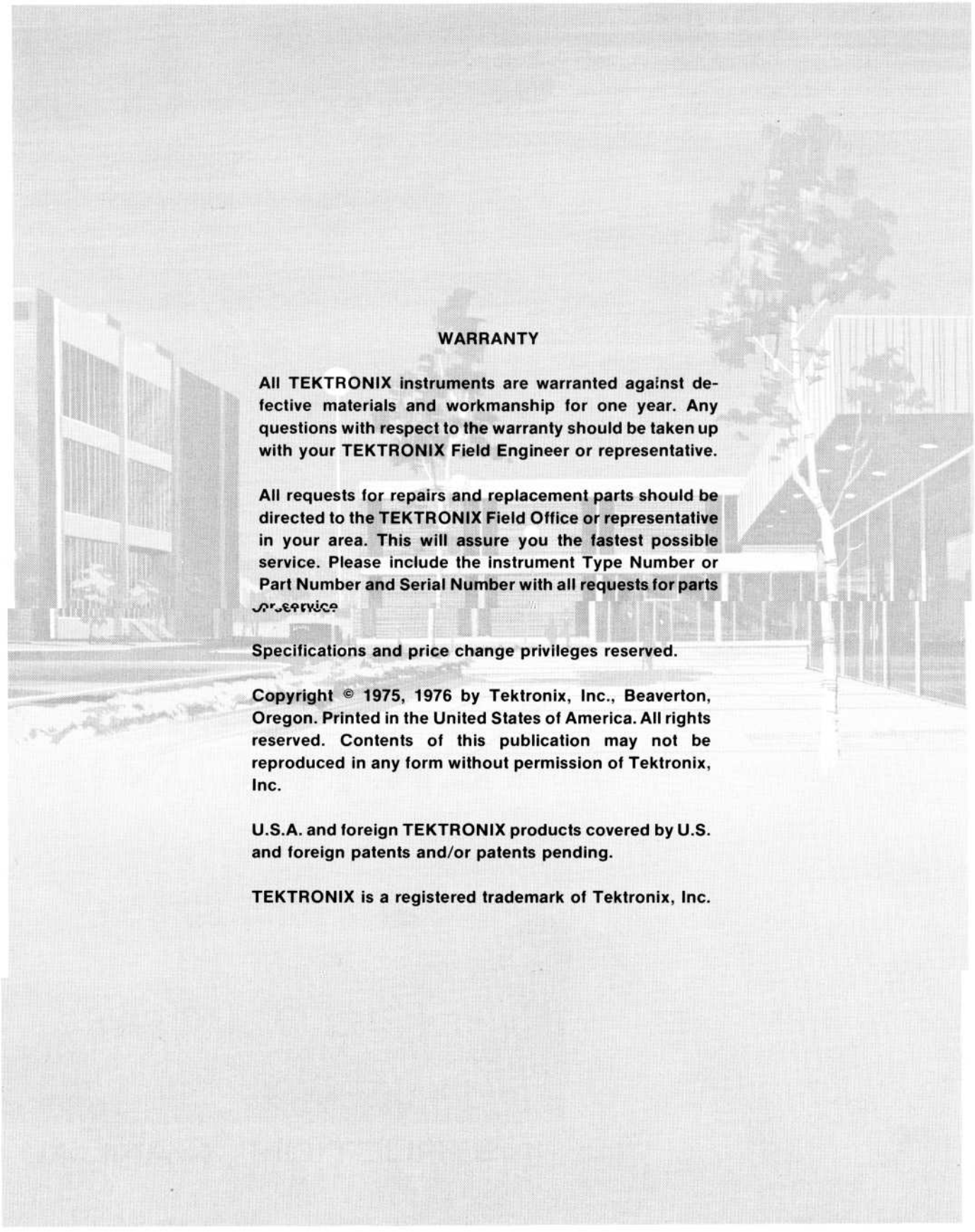

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

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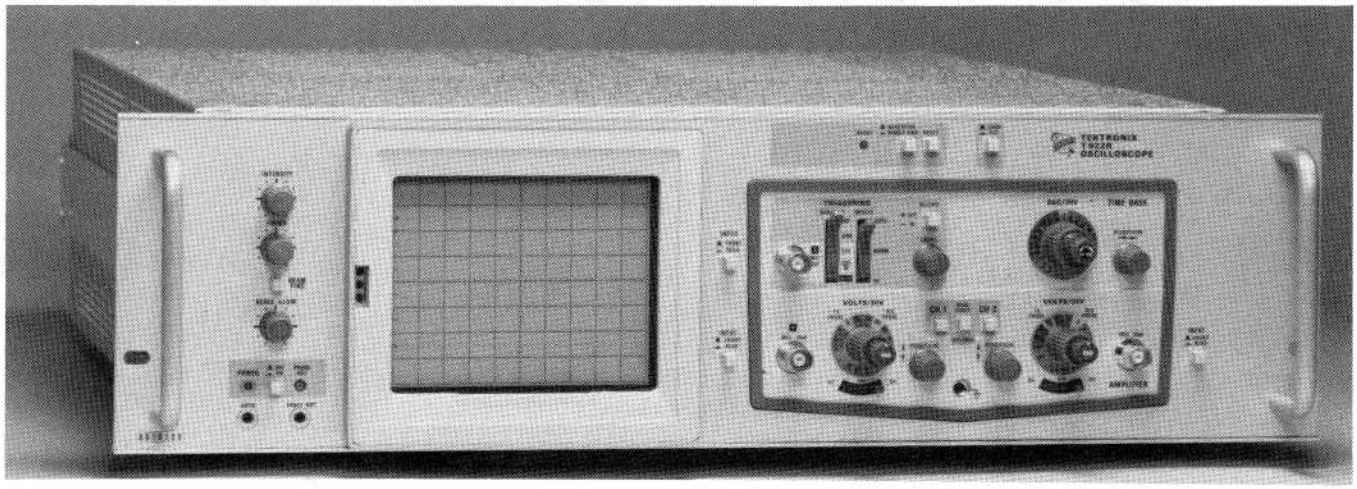
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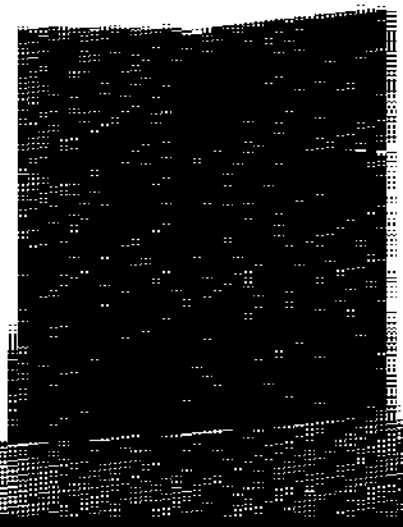


SPECIFICATIONS

This manual includes instructions for the T921, T922 and T922R portable oscilloscopes. The T922 is a 15 MHz, dual trace, oscilloscope and the T921 is a 15 MHz, single trace oscilloscope. The Vertical Amplifier, either single trace or dual trace, provides calibrated deflection factors from 2 mV to 10 V/div. The Time Base provides stable triggering over the full bandwidth of the Vertical Amplifier(s) and provides calibrated sweep rates from 0.5 s/div to 0.2 μs/div. A variable X1 to X10 magnifier extends the maximum sweep rate to 20 ns/div.

The T992R is a rackmount verison of the T922 oscilloscope which takes 5-1/4 inches of rack space. Features added to the rackmount version include: single sweep; rear panel outputs for Sweep Gate, Sweep Ramp, and Vertical Signal; internally selectable Z Axis polarity; user selection of the CHOP or ALT dual trace modes; and switch-selectable front-panel or rear-panel inputs for CH 1, CH 2, and EXT TRIG signals.

The following instrument specifications apply over an ambient temperature range of 0°C to +45°C unless otherwise specified. The Adjustment Procedure in Section 4, when performed completely, allows the T921/T922/T922R to meet the electrical specifications listed in Table 1-1.

TABLE 1-1

Electrical

Characteristic	Performance Requirement
A. DISPLAY	
Probe Adjust Output	
Voltage (0°C to +40°C)	Approximately 0.5 V.
Repetition Rate	Approximately 1 kHz.
Z-Axis Input	
Sensitivity	5 volt signal causes a noticeable decrease in intensity.
Signal Polarity	
T921 and T922	Positive going from ground.
T922R	Either polarity of signal can be applied, depending upon internal jumper connections.
Usable Frequency	Dc to 5 MHz.
Line Frequency	50 to 60 Hz.
Maximum Power Consumption	36 W, 0.35 A at 60 Hz, 120 V line.
CRT Display	
Display Area	8 x 10 cm.
Trace Rotation Range	Adequate to align trace with horizontal center line.
Standard Phosphor	P31.
Nominal Accelerating Potential	12,400 V.
B. VERTICAL AMPLIFIER	

TABLE 1-1 (cont)

Characteristic	Performance Requirement
B. VERTICAL AMPLIFIER (cont)	
Frequency Response	
Bandwidth	Dc to at least 15 MHz (5 division reference signal centered vertically from a 25 Ω source with VOLTS/DIV VAR control in calibrated detent).
Risetime	23 ns or less.
Chopped Mode Repetition Rate (T922)	Approximately 250 kHz.
Input Resistance	Approximately 1 MΩ.
Input Capacitance (T921 and T922)	Approximately 30 pF.
Input Capacitance (T922R)	
CH 1 and CH 2, (front only)	Approximately 40 pF.
Maximum Input Voltage	
DC Coupled	400 V (dc + peak ac). 800 V (p-p ac) at 1 kHz or less.
AC Coupled	400 V (dc + peak ac). 800 V (p-p ac) at 1 kHz or less.
Vertical Output (T922R)	
Amplitude	

Characteristic	Performance Requirement
C. TIME BASE	
Sweep Rate	
Calibrated Range	0.5 s/div to 0.2 μs/div; 20 steps in a 1-2-5 sequence. Variable X1 to X10 magnifier extends maximum sweep rate to 20 ns/div.
Accuracy	Accuracy specification applies over center 8 divisions. Exclude first 50 ns of sweep for both magnified and unmagnified sweep rates and anything beyond the 100th magnified division.
+20° C to +30° C	
Unmagnified	Within 3%.
Magnified	Within 5%.
0° C to +45° C	
Unmagnified	Within 4%.
Magnified	Within 6%.
Variable Magnifier	10:1.
X-Y Operation	
Deflection Factor	
Variable Magnifier	
X10	Approximately 100 mV/div.
X1	Approximately 1 V/div.
X-Axis Bandwidth	
T921 & T922	DC to at least 1 MHz with 10 div reference signal.
T922R	DC to least 1 MHz with 5 div reference signal.

TABLE 1-1 (cont)

Characteristic	Performance Requirement
C. TIME BASE (cont)	
Triggering	
Sensitivity	0.5 div internal or 100 mV external from 2 Hz to 1 MHz, increasing to 1.5 div internal or 150 mV external at 15 MHz.
TV Sync	Composite sync 1 div internal or 100 mV external (approximately 2.3 div or 230 mV of composite video).
External Trigger Input	
Maximum Input Voltage	400 V (dc + peak ac). 800 V (p-p ac) (1 kHz or less).
Input Resistance	Approximately 1 MΩ.
Input Capacitance (T921 and T922)	Approximately 30 pF.
Input Capacitance (T922R, front only)	Approximately 40 pF.
Level Range	
EXT	+0.5 V to −0.5 V.
$\frac{\text{EXT}}{10}$	+5 V to − 5 V.

TABLE 1-2

Environmental

Characteristic	Performance Requirement
Temperature	
Storage	−55°C to +75°C.
Operating	
T921 & T922	0°C to +45°C.
T922R	0°C to +50°C.

TABLE 1-2 (cont)

Characteristic	Performance Requirement
Altitude	
Storage	To 50,000 ft.
Operating	To 15,000 ft. Maximum operating temperature decreases 1°C/1,000 ft. above 5,000 ft.

TABLE 1-3

Physical

Characteristic	Performance Requirement
Weight	
T921 and T922	
With Panel Cover, Accessories and Accessory Pouch	15.5 lbs (7.0 kg).
Without Panel Cover, Accessories and Accessory Pouch	15.0 lbs. (6.8 kg).
T922R	
Without Accessories	19.0 lbs (8.6 kg).
Domestic Shipping Wt	33.0 lbs (15.0 kg).
Overall Dimensions (T921 and T922)	Refer to Fig. 1-3.
Overall Dimensions (T922R)	Refer to Fig. 1-2.

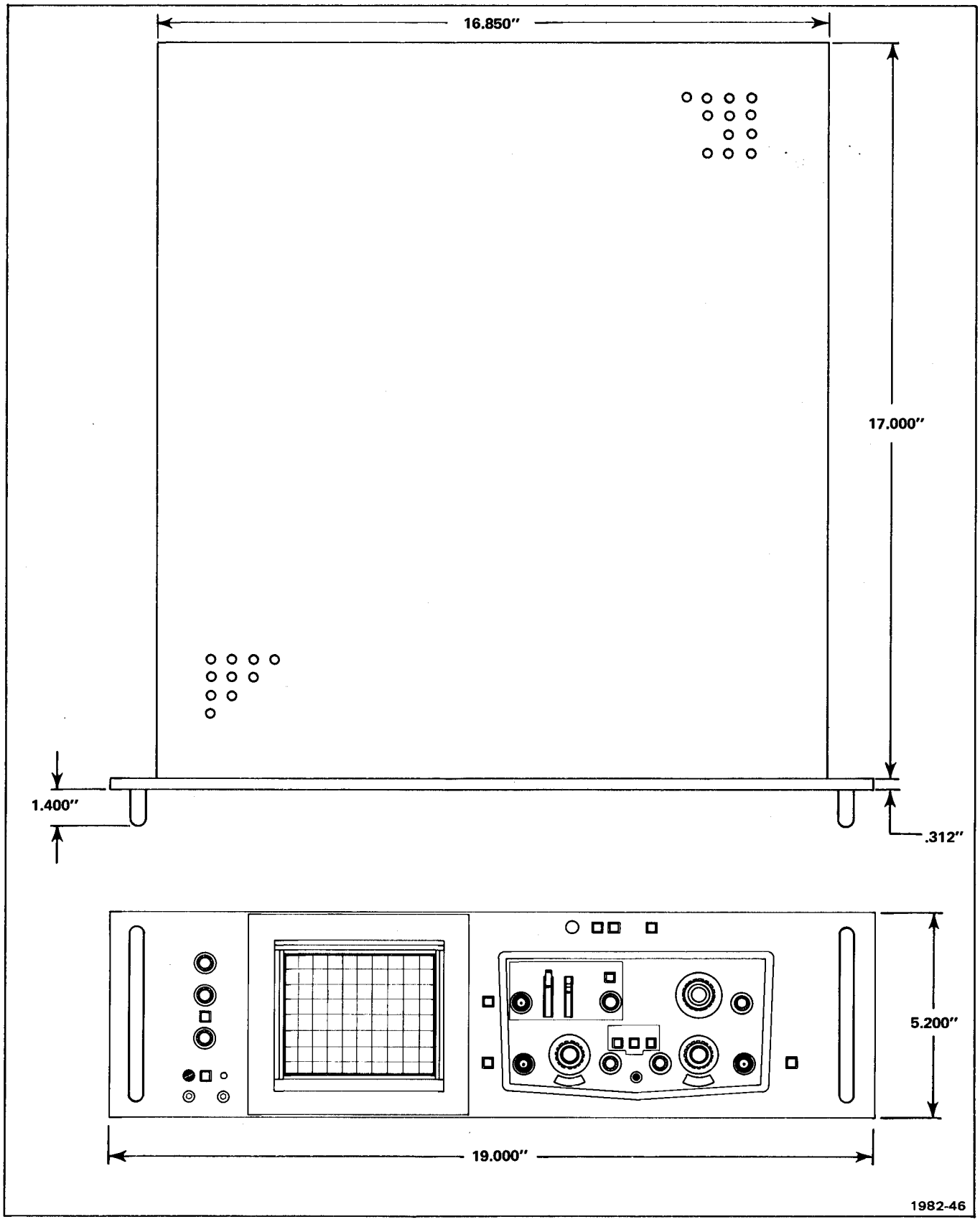


Fig. 1-2. T922R dimensional drawing.

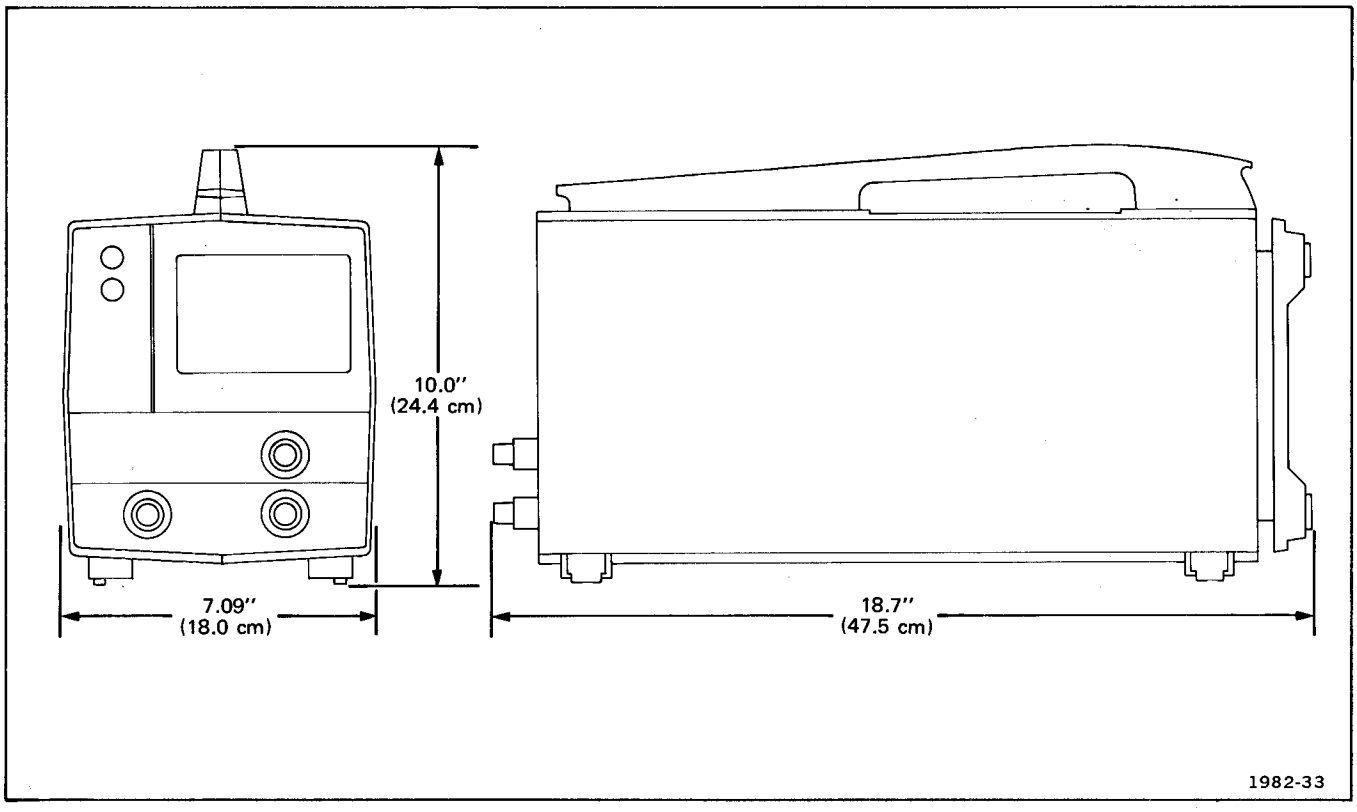


Fig. 1-3. T921/T922 dimensional drawing.

STANDARD ACCESSORIES

1	Instruction Manual	070-1982-01
1	Probe (T921)	010-0160-00
2	Probes (T922)	010-0160-00

RECOMMENDED ACCESSORIES

NOTE

The following accessories have been selected from our catalog specifically for your instrument. They are listed as a convenience to help you meet your measurement needs. For detailed information and prices, refer to a Tektronix Products Catalog or contact your local Tektronix Field Representative.

COVERS

FRONT COVER: Protects the instrument front panel during transport or storage and provides storage for small accessories (probes, cables, etc.) Made of blue plastic to match the instrument case.

Order 016-0340-00

PROTECTIVE WATERPROOF COVER: Blue vinyl cover provides protection for the entire oscilloscope during transport or storage.

Order 016-0361-00

STAND

PORTABLE STAND: The Portable Stand sits on the floor and holds the instrument at an angle to provide easy viewing and access. Also provides storage for small accessories (probe, cables, etc.).

Order 209

PROBES

P6101 GENERAL PURPOSE 1X VOLTAGE PROBE: Input capacitance 54 picofarads (plus oscilloscope input capacitance).

Order 010-6101-03

P6062A SWITCHABLE 1X-10X VOLTAGE PROBE: Provides full bandwidth capabilities of T900-series instruments. Can be compensated to match the vertical input capacitance.

Order 010-6062-13

P6009 GENERAL PURPOSE 100X VOLTAGE PROBE: Provides full bandwidth capabilities of T900-series instruments. Can be compensated to match the vertical input capacitance.

Order 010-0264-01

P6015 GENERAL PURPOSE 1000X VOLTAGE PROBE: Provides full bandwidth capabilities of T900-series instruments. Can be compensated to match the vertical input capacitance.

Order 010-0172-00

P6021 AC CURRENT PROBE: Provides a bandwidth from 120 Hz to the upper bandwidth of T900-series instruments. Spring-loaded slide opens (up to 0.150 inches) to allow measurement of current without breaking the circuit under test.

Order 015-0140-02

P6006 GENERAL PURPOSE 10X VOLTAGE PROBE: The P6006 is a 10X dc to 35 MHz voltage probe. The compensation range of the P6006 allows adjustment to match the front inputs of the T922R. The dc to 35 MHz bandwidth of the P6006 allows full use of the dc to 15 MHz bandwidth of the T922R.

Order 010-0160-00

CAMERAS

C-5A Option 3 Camera: Provides graticule illumination with xenon flash lamp powered by two AA penlight batteries. Recommended for, and molded to fit all bench version T900-series instruments. Fixed focus, fixed aperture f/16 lens with 0.67 or 0.85 user adjustable magnification. Mechanical shutter with speeds of 1/5 to 1/25 s, plus bulb and time.

Order . . . . . C-5A Option 3

C-5A Option 1 Camera: Recommeded for use with the T922R. Option 1 deletes the graticule flash unit from C5A. The T922R is equipped with scale illumination, so the graticule flash unit is not necessary.

The following cameras are also compatible with the T922R using the listed adapter.

CAMERA	ADAPTER
C12, Order	016-0299-00
C27, Order	016-0249-03
C30A, Order	016-0248-00
C59, Order	016-0249-03

RACKMOUNT HARDWARE KIT

Provides the slides and hardware needed to mount the T922R in a rack.

Order 016-0375-00

OPERATING INSTRUCTIONS

OPERATING VOLTAGE

The T921, T922, and T922R will operate from either a 120 V or 240 V ac, 50 to 60 Hz nominal power input source. To avoid equipment damage, the power input range selector switch (120 V or 240 V) and HI/LO switch on the bottom of the instrument (T921/T922 only) must be set to positions which include the value of the applied power input voltage. The POWER indicator lamp will blink when the applied power input voltage varies more than about 10% from the value for which the switches are set.

WARNING

To avoid electric shock and equipment damage, do not attempt to change the power input range selector switch, HI/LO switch, or internal fuse. This must be done by qualified service personnel only.

SAFETY INFORMATION

The T921, T922, and T922R operate from a single-phase power source with one of the current-carrying conductors (the neutral conductor) at ground (earth) potential. Operation from power sources where both current-carrying conductors are live with respect to ground (such as phase-to-phase on a 3-wire system) is not recommended, since only the line conductor has over-current (fuse) protection within the instrument.

The T921, T922, and T922R have a 3-wire cord with a 3-terminal polarized plug for connection to the power source and safety-earth. The ground terminal of the plug is directly connected to the metal parts of the instrument. For electric-shock protection, insert this plug in a mating outlet with a safety-earth contact.

FUNCTIONS OF CONTROLS, CONNECTORS, AND INDICATORS T921 AND T922

NOTE

(See text preceding FIRST TIME OPERATION for features found only in T922R or those which differ from the T921/T922.)

Before you turn the instrument on, read this portion of the manual to familiarize yourself with the controls, connectors, and indicators.

A. DISPLAY

Front Panel (Fig. 2-1)

(1) **INTENSITY**—Adjusts the brightness of the crt display. Set for the lowest visible display to prolong crt life.

(2) **FOCUS**—Adjusts for optimum spot size and definition.

(3) **BEAM FINDER**—Locates off-screen displays. Compresses the crt display to within the graticule area independently of the position control or applied signals.

To locate an off-screen display:

a. Set the vertical POSITION and INTENSITY controls to midrange and rotate the horizontal POSITION control clockwise.

b. If a display or dot still is not visible, press BEAM FINDER and hold in. A compressed display or dot should appear. If not, increase the INTENSITY until a display appears.

If a dot or vertical line appears, the sweep is not triggered. Set the trigger MODE switch to AUTO to obtain a display. Use the vertical and horizontal POSITION controls to move the display near the center of the graticule. Release the BEAM FINDER button and adjust the trigger level control for a stable display.

If a compressed display appears, adjust the VOLTS/DIV switch and the horizontal and vertical POSITION controls for a stable display.

(4) **PROBE ADJ**—Provides a square-wave output of approximately 0.5 V (negative-going with respect to ground) at approximately 1 kHz, for compensating voltage probes.

(5) **ON-OFF**—Push-push switch turns the instrument power on (button in) and off (button out). (In some versions this switch is labeled POWER.)

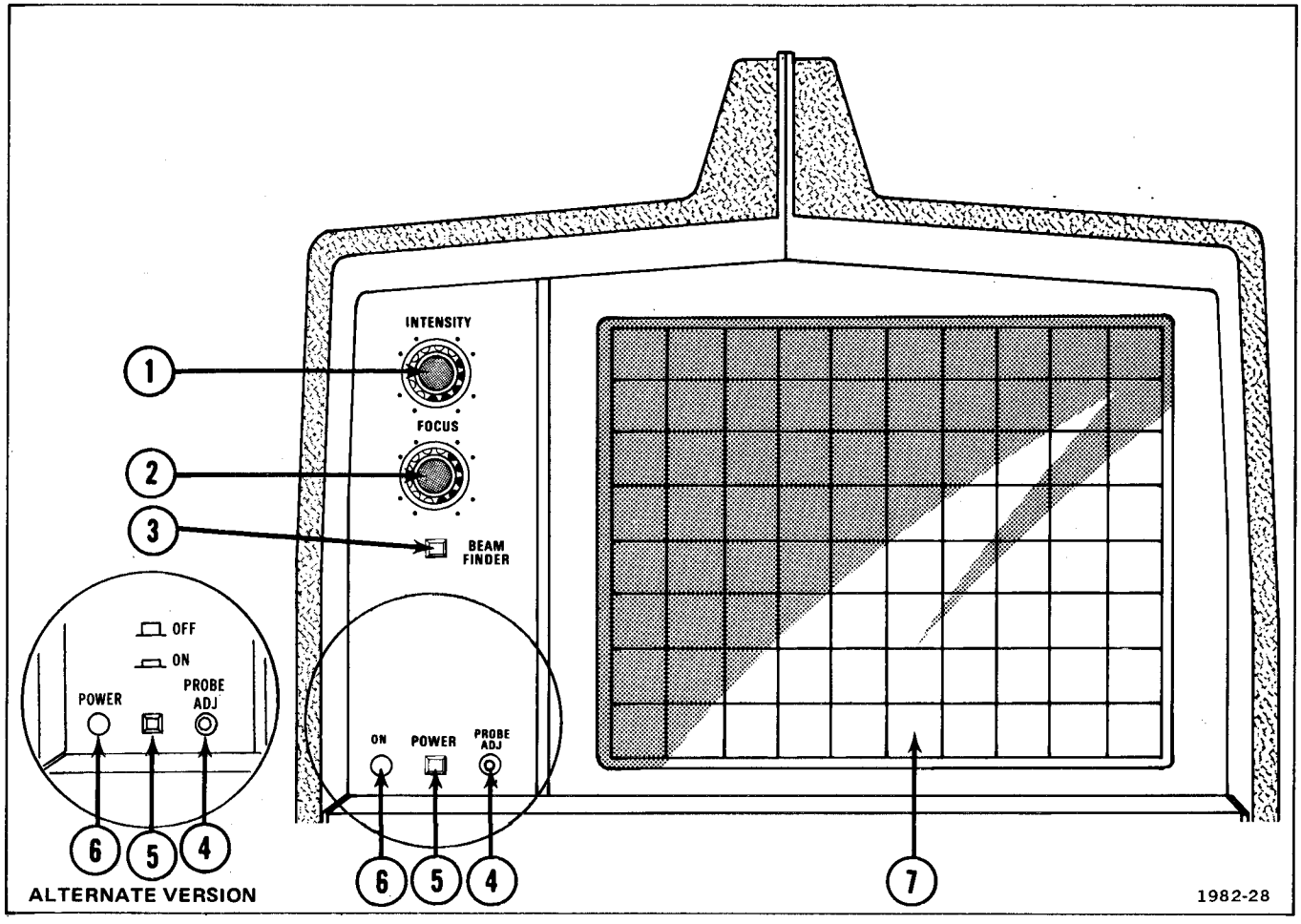


Fig. 2-1. Display front panel controls and connectors.

(6) **POWER**—Indicator lamp lights when ON-OFF button is depressed to ON (in) position and applied power input voltage does not vary more than about 10% from the value indicated by the 120 V/240 V and HI/LO voltage selector switch settings. When applied power input voltage varies more than about 10% (either high or low) from the selected value, the lamp will blink. (In some versions this lamp is labeled ON.)

(7) **Internal graticule**—Eliminates parallax. Risetime amplitude and measurement points are indicated at the left edge of the graticule.

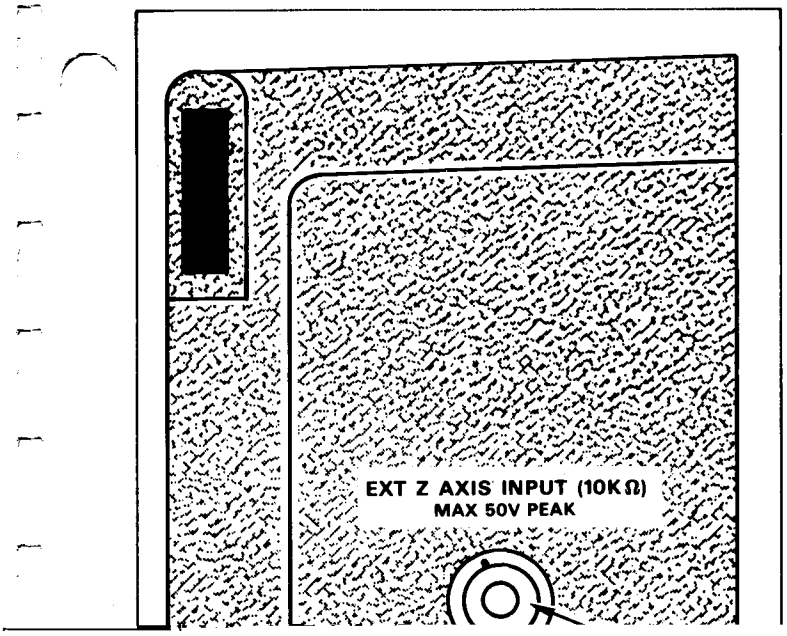
Rear Panel (Fig. 2-2)

(8) **EXT Z AXIS INPUT**—BNC connector for applying signals to intensity modulate the crt display. Signals must be time-related to the display for a stable display.

Left Side of Cabinet—T921/T922 only (See Fig. 2-3)

(9) **ASTIG**—Screwdriver adjustment used with FOCUS control to obtain a well-defined display. Requires little or no adjustment once set.

(10) **TR ROT**—Trace rotation screwdriver adjustment. Aligns trace with the horizontal graticule lines.



(13) **CH 1 DC BAL**—Screwdriver adjustment. When properly adjusted, prevents trace shift when switching between adjacent positions of the CH 1 VOLTS/DIV switch.

(14) **CH 2 DC BAL**—Screwdriver adjustment. When properly adjusted, prevents trace shift when switching between adjacent positions of the CH 2 VOLTS/DIV switch.

B. VERTICAL AMPLIFIER

Front Panel (Fig. 2-5)

(1) **VOLTS/DIV**—Selects the vertical deflection factor in a 1-2-5 sequence (VAR control must be in detent position to obtain the indicated deflection factors). Read the correct deflection factor for a 1X probe from the 1X position and a 10X probe from the 10X position.

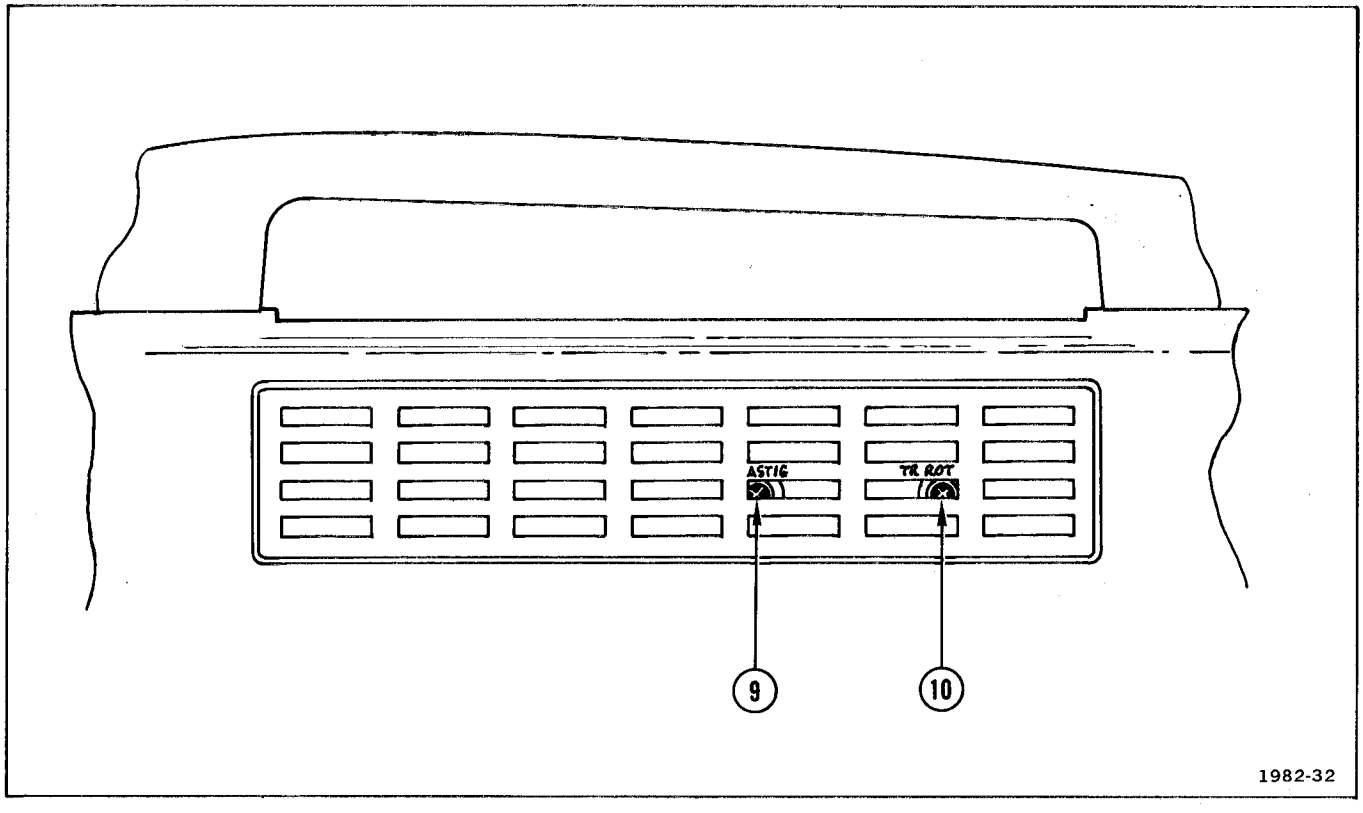


Fig. 2-3. Left side of cabinet.

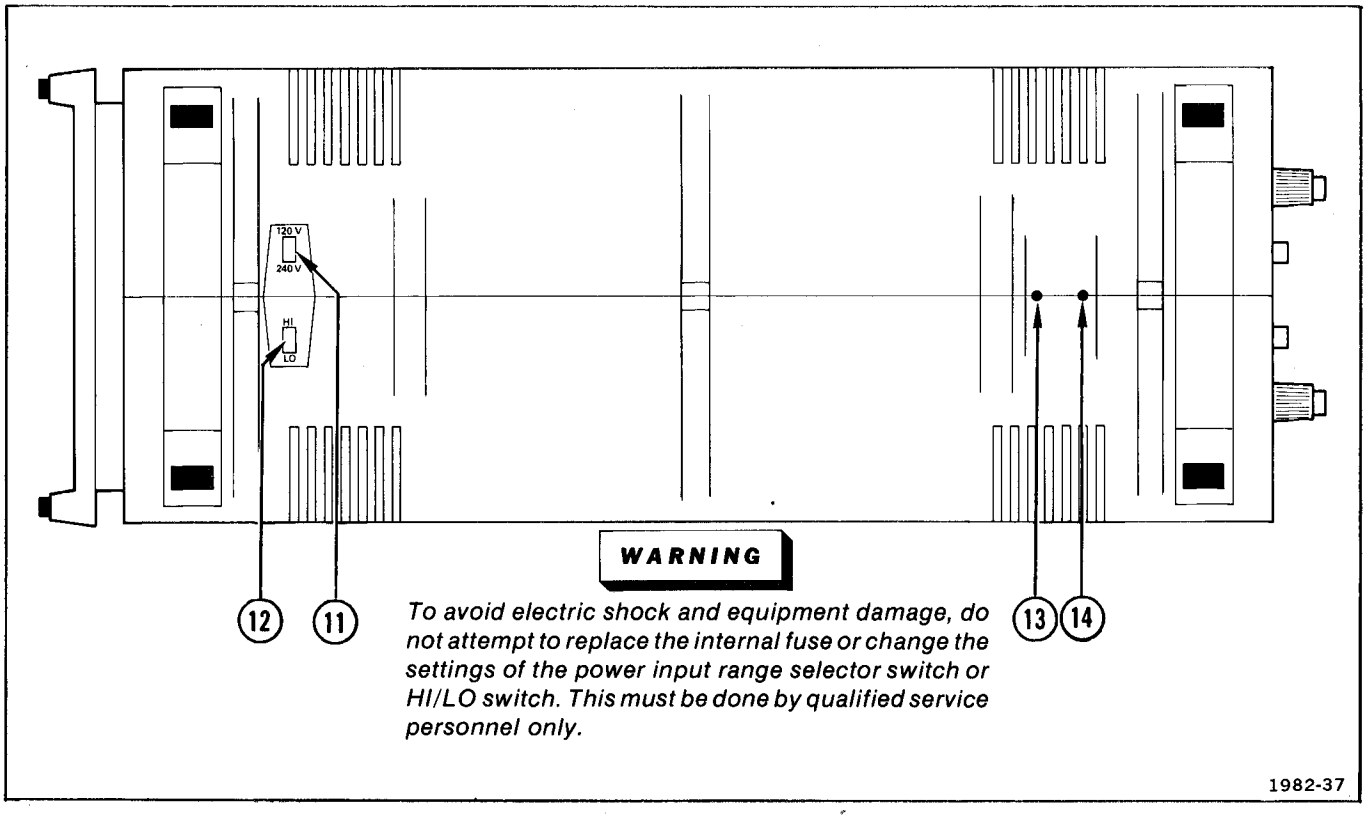


Fig. 2-4. Bottom of cabinet.

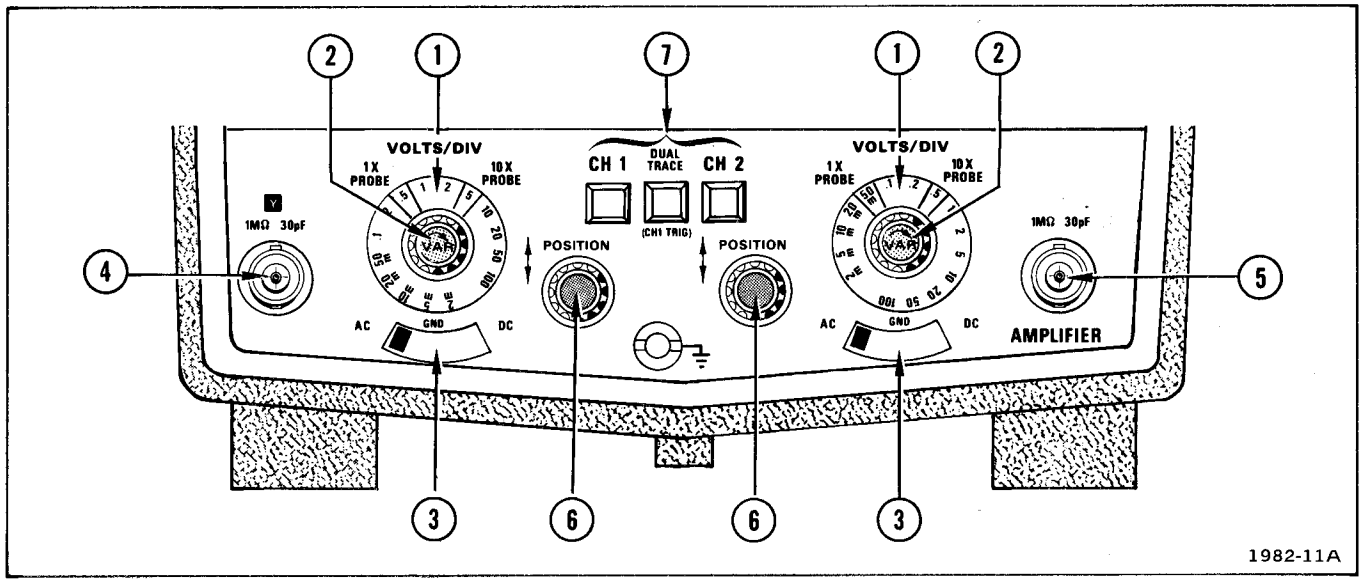


Fig. 2-5. Vertical amplifier front panel controls.

6 **POSITION**—Controls the vertical position of the crt display.

C. TIME BASE

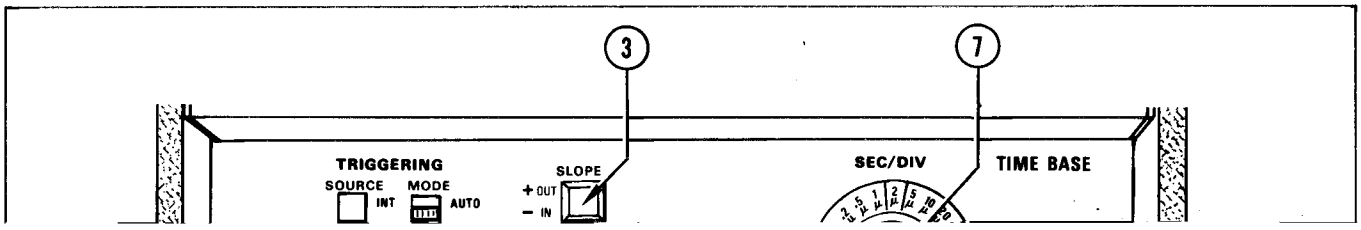
Front Panel (Fig. 2-6)

[redacted]

7 **Vertical Mode**—Selects the vertical amplifier

INT: Uses a sample of the signal displayed on the crt as a trigger signal in the CH 1 or CH 2

[redacted]


3
7
TRIGGERING
SOURCE
INT
MODE
AUTO
SLOPE
+ OUT
– IN
SEC/DIV
TIME BASE

FUNCTIONS OF CONTROLS, CONNECTORS, AND INDICATORS T922R

The following information shows the different mechanical layout of the T922R and discusses features found only on the rackmount version. The location and names af all T922R controls, connectors, and indicators are given here. For the discussion of those common to T921, T922 and T922R, see the Operating Instuctions section of the standard T921/T922 portion of this manual.

A. DISPLAY (FIG. 2-7)

(1) **INTENSITY**

(2) **FOCUS**

(3) **BEAM FIND**

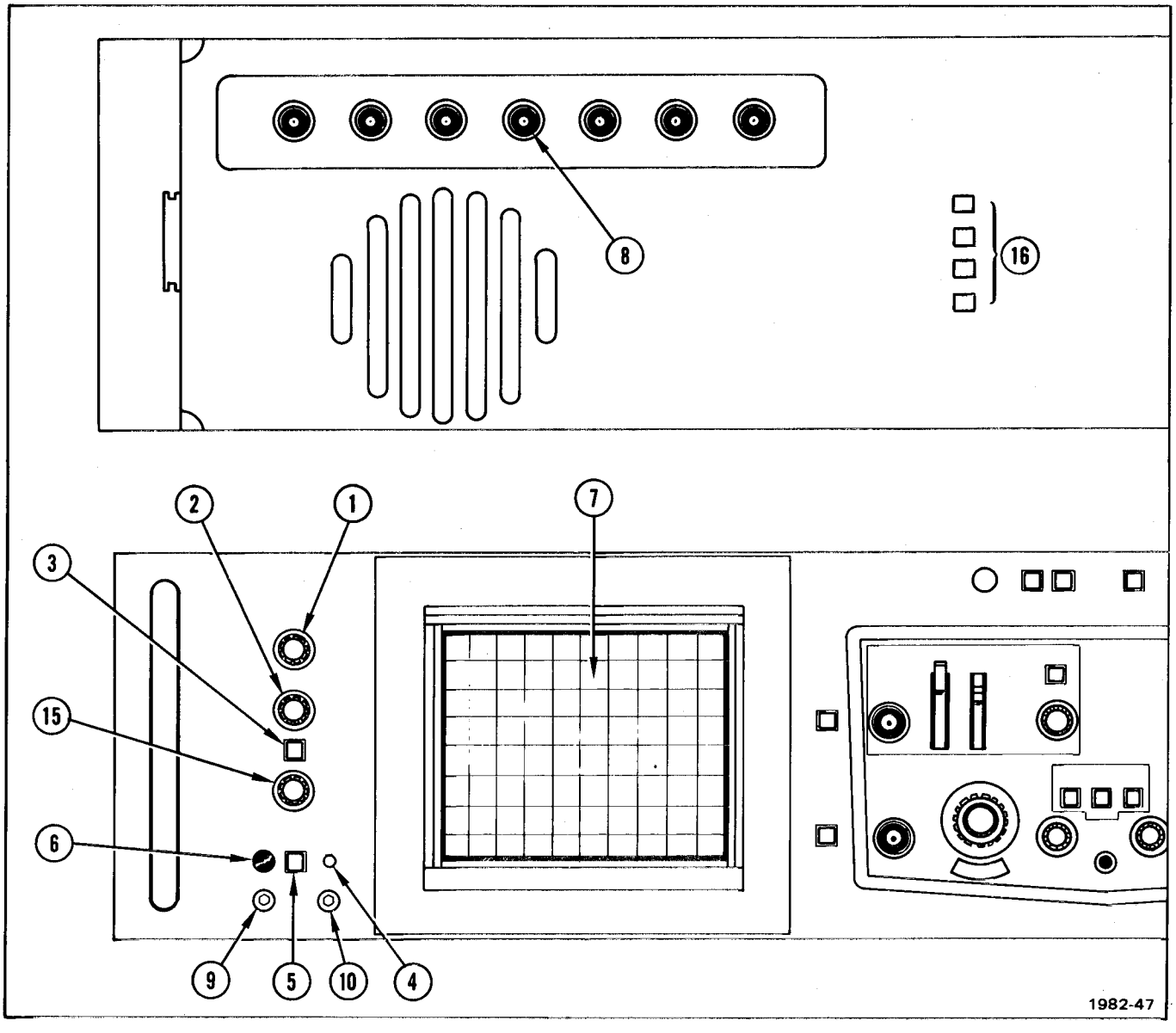


Fig. 2-7. T922R display controls, connectors, and indicators.

(4) **PROBE ADJ**

(5) **OFF—ON**

(6) **POWER Lamp**

(7) **Internal Graticule**

(8) **Z AXIS IN**

(9) **ASTIG**

(10) **TRACE ROT**

(11), (12), (13), **and** (14)—In the T922R these controls are internally accessible only.

WARNING

To avoid electric shock and equipment damage, do not attempt to change the power input range selector switch, HI/LO switch, or internal fuse. This must be done by qualified service personnel only.

(15) **SCALE ILLUM**

(16) **AC RMS RANGE**—Indicates the voltage from which the T922R is set to operate.

B. VERTICAL AMPLIFIER (FIG. 2-8)

(1) **VOLTS/DIV**

(2) **VAR**

(3) **Input Coupling**

(4) **Channel 1 or Y Inputs**—Two switch-selectable inputs for applying signals to Channel 1. One is mounted on the front panel and the other on the rear panel.

(5) **Channel 2 Inputs**—Two switch-selectable inputs for applying signals to Channel 2. One is mounted on the front panel and the other on the rear panel.

(6) **POSITION**

(7) **Vertical Mode**—When operating in the DUAL TRACE mode you must manually select either CHOP or ALT (see control 8).

(8) **CHOP-ALT**—Selects either CHOP or ALT dual trace modes. Use CHOP at lower sweep speeds and ALT at higher sweep speeds.

(9) **COMP VERT SIG OUT**—The signal available at this connector is a sample of the vertical signal being displayed plus a dc component proportional to the the vertical position of the display.

(10) **FRONT-REAR**—Two push-button switches, one for CH 1 and one for CH 2, which select either the front or the rear vertical inputs.

C. TIME BASE (FIG. 2-9)

(1) **SOURCE**

(2) **MODE**—To use the AUTO, NORM, or TV SYNC modes the SINGLE SWEEP/REPETITIVE button must be set to REPETITIVE (out).

(3) **SLOPE**

(4) **LEVEL**

(5) **EXT TRIG or X**—Two switch-selectable inputs for external trigger or X axis signals. One is mounted on the front panel and the other on the rear panel.

(6) **SEC/DIV**

(7) **X1-X10**

(8) **POSITION**

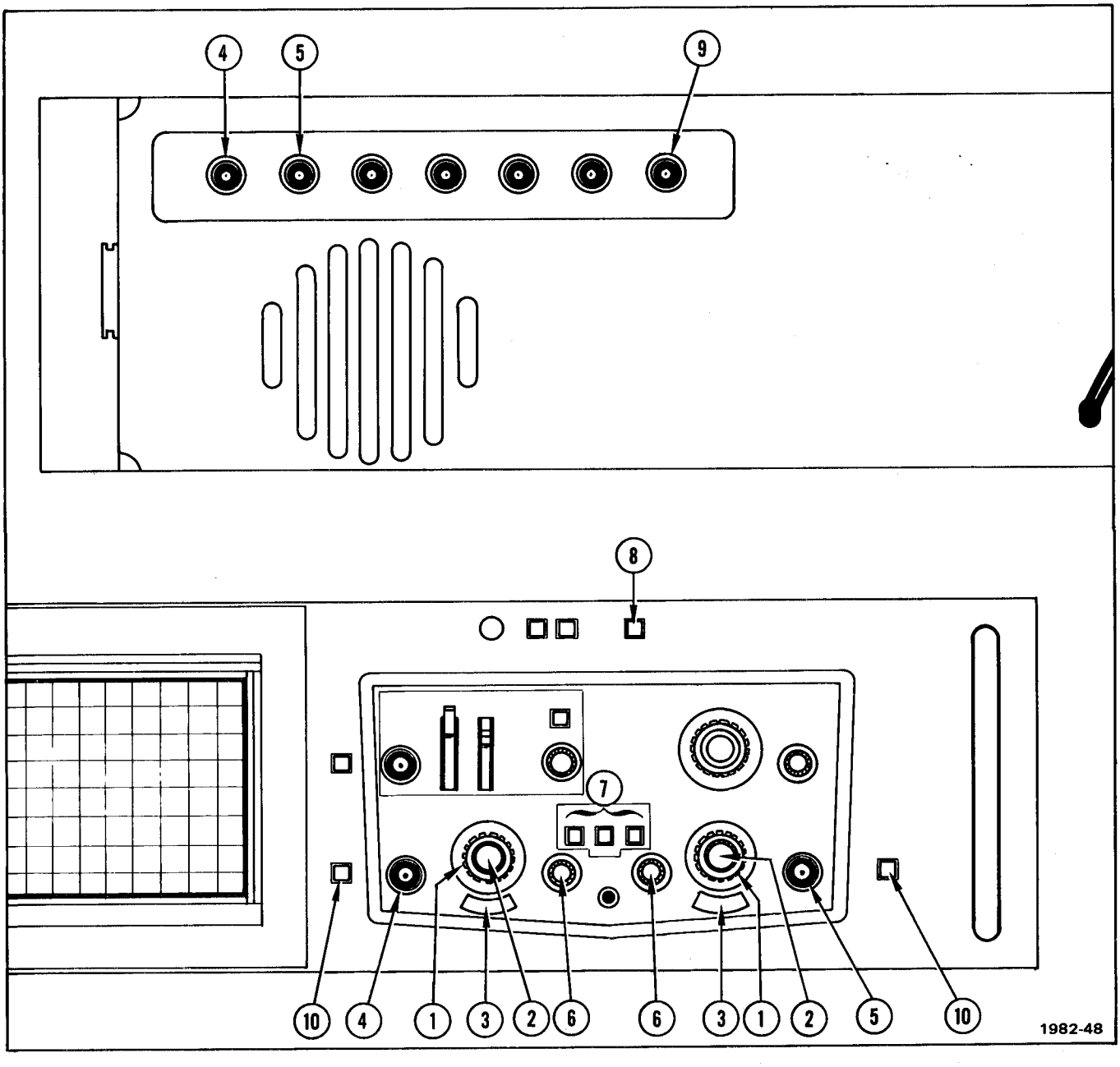


Fig. 2-8. T922R vertical amplifier controls, connectors, and indicators.

(9) **SWEEP RAMP OUT**—Provides a ramp output corresponding to the sweep waveform applied to the crt.

(10) **SWEEP GATE OUT**—Provides a logic level output which goes high while the crt trace is being swept and goes low during retrace and holdoff.

(11) **REPETITIVE/SINGLE SWEEP**—Set the SINGLE SWEEP pushbutton to the in position to operate in the single sweep mode. In the single sweep mode, when an adequate trigger signal becomes available, the sweep generator runs only once. Set RESET.

(12) **RESET**—When operating in the single sweep mode and after a single sweep display has been presented,

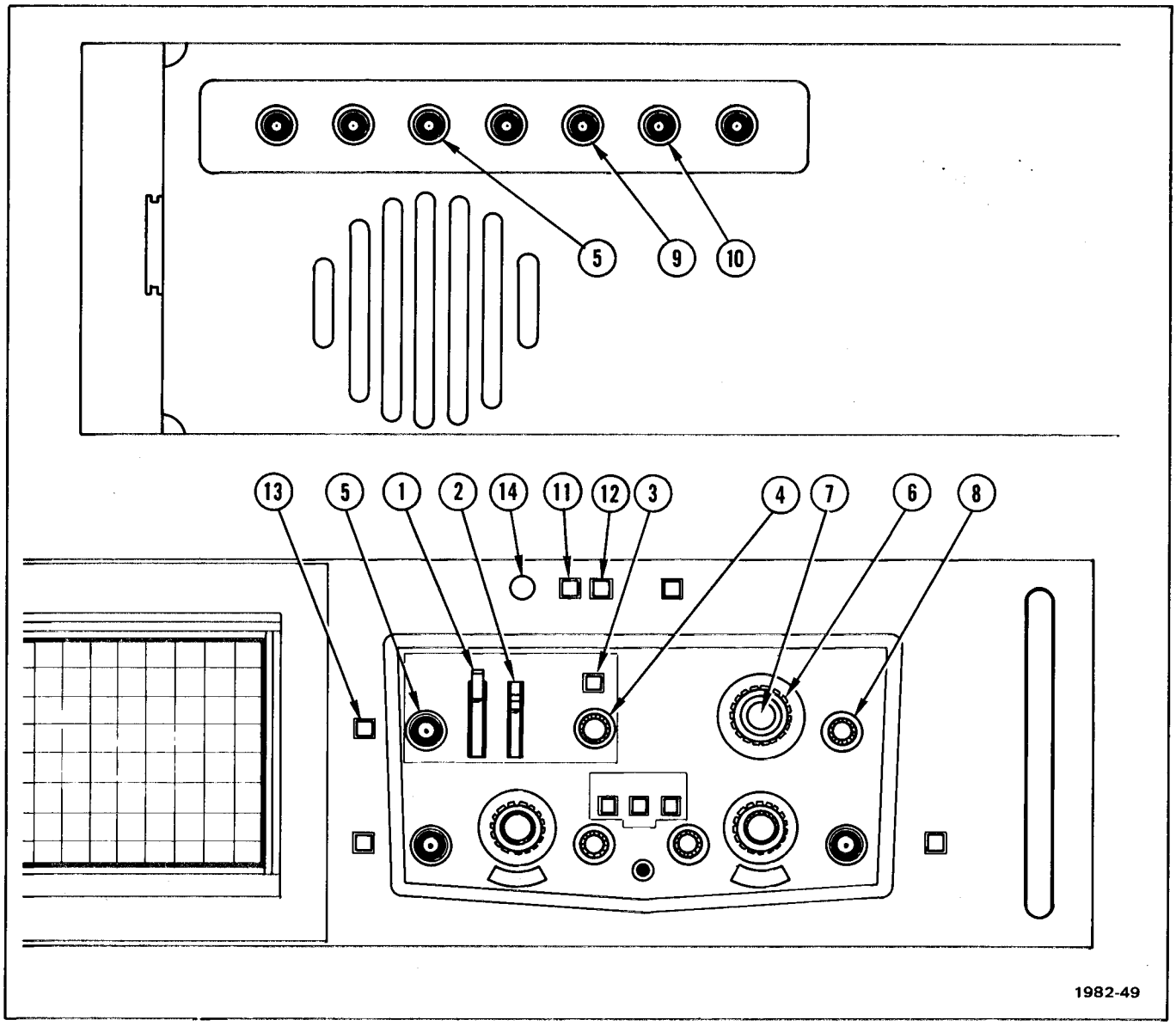


Fig. 2-9. T922R time base controls, connectors, and indicators.

another single sweep display cannot be presented until the RESET button is pushed.

(13) **FRONT-REAR**—Pushbutton switch which selects either the front or rear EXT TRIG or X input.

(14) **READY**—An indicator, that when lit indicates the RESET button has been pushed and that a single sweep will be presented when an adequate trigger signal is received.

FIRST TIME OPERATION

Use this procedure when you turn instrument on for the first time. It checks that most functions of the instrument are operational. The procedure requires a probe, and a 10X probe is supplied as a standard accessory with the T921 and T922. See the Accessories list in Section 1 for the recommended probe for the T922R. Read the descriptions of the controls and connectors to familiarize yourself with them before you turn your instrument on.

A complete performance check is given in Section 3.

Only the control settings that affect the check being performed are given. Do not move the control settings unless instructed to do so. Start at the beginning and follow the sequence of steps through to the end. If you skip a step or start in the middle of a check, you won't be able to tell whether a partiular function is operational. If you have a T921, use the control settings for Channel 1 only.

First, check that the Power Input Voltage Selector switch and the HI-LO Range Selector switch on the bottom of the cabinet (T921/T922 only) are set for your power input voltage. In the United States the Power Input Voltage Selector switch is normally set for 120 V and the HI-LO Range Selector switch is normally set for HI at the factory. In Europe the Power Input Voltage Selector switch is normally set for 240 V and the HI-LO Range Selector is normally set for LO.

CAUTION

Your instrument may be damaged if it is operated from a 240 V power input voltage source with the power input voltage selector switch set for 120 V. Only qualified service personnel should change the power input voltage selector switch to a different range.

WARNING

To avoid electric shock, refer T922R input voltage [illegible]

See the Service Information section of this manual for range change instructions.

You should get a trace on the crt screen. If you don't, push the BEAM FINDER button and hold it in while increasing the INTENSITY (clockwise). A trace, or one or two bright dots, indicates that the instrument is operating. You may also have to adjust the FOCUS and POSITION controls.

Vertical Positioning and Horizontal Operation

1. Set:	LEVEL	mid-range
	SEC/DIV	1 ms
	X1 - X10	X1 (fully ccw detent)
	vertical mode	CH 1

2. Check that the CH 1 POSITION control moves the trace off the top and bottom of the screen. Leave the trace between one and two divisions above the center line. If the trace does not extend across the screen, move the horizontal POSITION control until it does.

3. Set the vertical mode switch for CH 2. Check that the CH 2 POSITION control moves the trace off the top and bottom of the screen. Leave the trace between one and two divisions below the center line.

4. Set the vertical mode switch for DUAL TRACE. You should have two traces on the crt screen—one above the center line and one below.

In the following steps, if you use a 1X probe or coaxial cable, use the 1X PROBE window for VOLTS/DIV settings. If you use a 10X probe (as supplied with T921 and T922), use the 10X probe window.

The PROBE ADJ output is a square wave. An incorrectly compensated probe will distort the top and bottom of the signal but will not affect the checks.

If you want to compensate a probe, refer to the Probe Compensation information after this procedure.

1. Set:

CH 1 VOLTS/DIV	.2 V (10X window)
CH 1 VAR	detent (fully clockwise)
CH 1 AC-GND-DC	GND

2. Using the CH 1 POSITION control, align the trace with the center graticule line. If the trace is tilted, adjust the trace rotation (control marked TR ROT on the left-cabinet side of T921 and T922) for the best alignment of the trace with the center graticule line.

3. Connect the Probe to the CH 1 input and hold the probe tip against the PROBE ADJ connector. Set the CH 1 AC-GND-DC switch to DC. You should have approximately 2.5 divisions display. The square wave will be below the center line. This display may or may not be stable.

4. Set the CH 1 AC-GND-DC switch to AC. The display should be approximately equidistant above and below the center line.

5. Set:

Vertical Mode	CH 2
CH 2 VOLTS/DIV	.2 V
CH 2 VAR	detent (fully cw)
CH 2 AC-GND-DC	GND
CH 2 POSITION	To align trace with center graticule line

7. Connect the probe to the CH 2 input and hold the probe tip against the PROBE ADJ connector.

8. Set the CH 2 AC-GND-DC switch to DC. The square wave will be below the center line.

9. Set the CH 2 AC-GND-DC switch to AC. The square wave will be approximately equidistant above and below the center line.

10. Rotate the CH 2 VAR control through its range. The display amplitude will decrease. Leave the VAR control fully clockwise (in detent).

11. Return the vertical mode switch to CH 1.

X-Axis Operation

1. Connect the probe to the X input (if a 1X probe is available, use it, if a 10X probe is used, rotate the X1-X10 control fully clockwise) and hold the probe tip against the PROBE ADJ connector.

2. Set the SOURCE switch to X-Y, and reduce INTENSITY as necessary. Adjust the horizontal POSITION control as needed to locate the display. You should see 2 dots separated by a distance dependent on the X1-X10 control setting. Return X1-X10 to X1 (fully counterclockwise detent).

X-Y and Dual Trace Operation

3. Set the INTENSITY and FOCUS controls for the best defined display. If the display still appears out of focus, use a small screwdriver to adjust the ASTIG control (through left cabinet side of T921/T922) for the best defined display.

4. Rotate the INTENSITY control fully clockwise. The display will get brighter and defocus (get thicker). Return the INTENSITY control to the preferred brightness level.

Ext Z Axis Input Operation

For the T921 or T922 a positive-going signal will cause a [redacted] negative-going signal will increase the intensity level of a low-intensity trace. For the T922R, an internal plug allows a selection of either a positive-going or a negative-going signal to cause a decrease in intensity. See Service Information.

X1-X10 and Trigger Operation

[redacted] with several cycles of the PROBE

8. Set the SOURCE switch to LINE. If a trace doesn't appear, adjust the LEVEL control until a trace appears.

9. Set:

SOURCE	INT
MODE	AUTO
CH 1 AC-GND-DC	AC

The instrument is now ready to operate when signal is applied to the CH 1 input.

PROBE COMPENSATION

An incorrectly-compensated probe is one of the greatest sources of operator error. Most attenuator probes are equipped with adjustments to ensure optimum

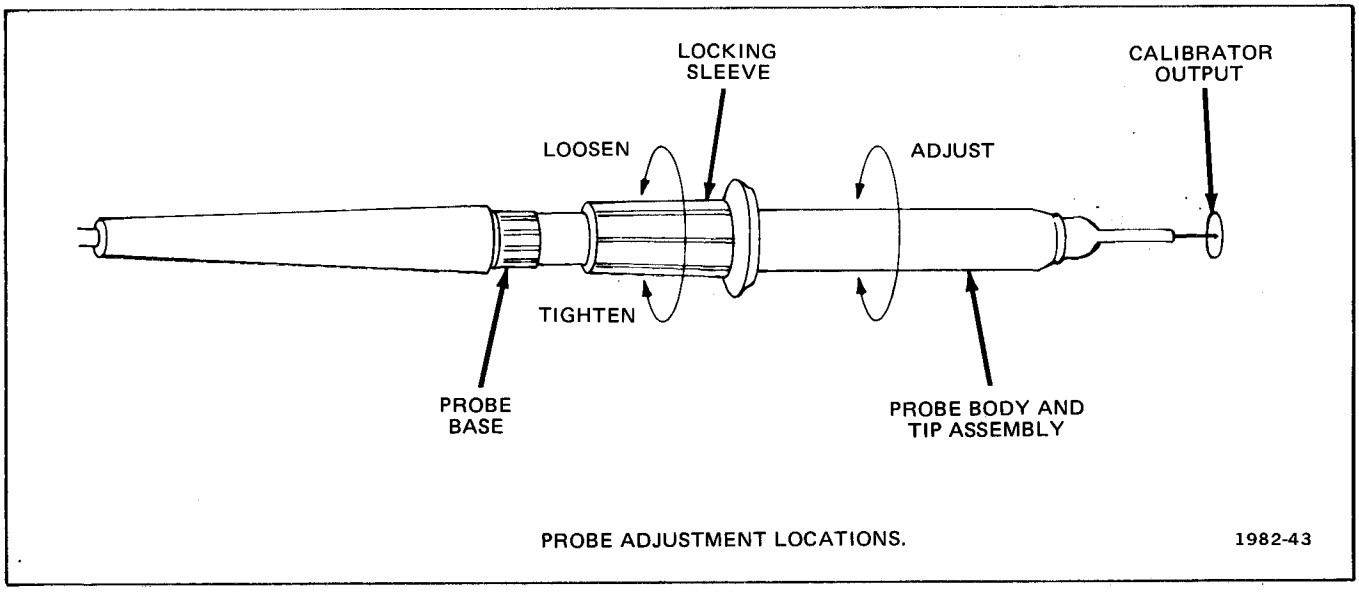


Fig. 2-10. Probe compensation.

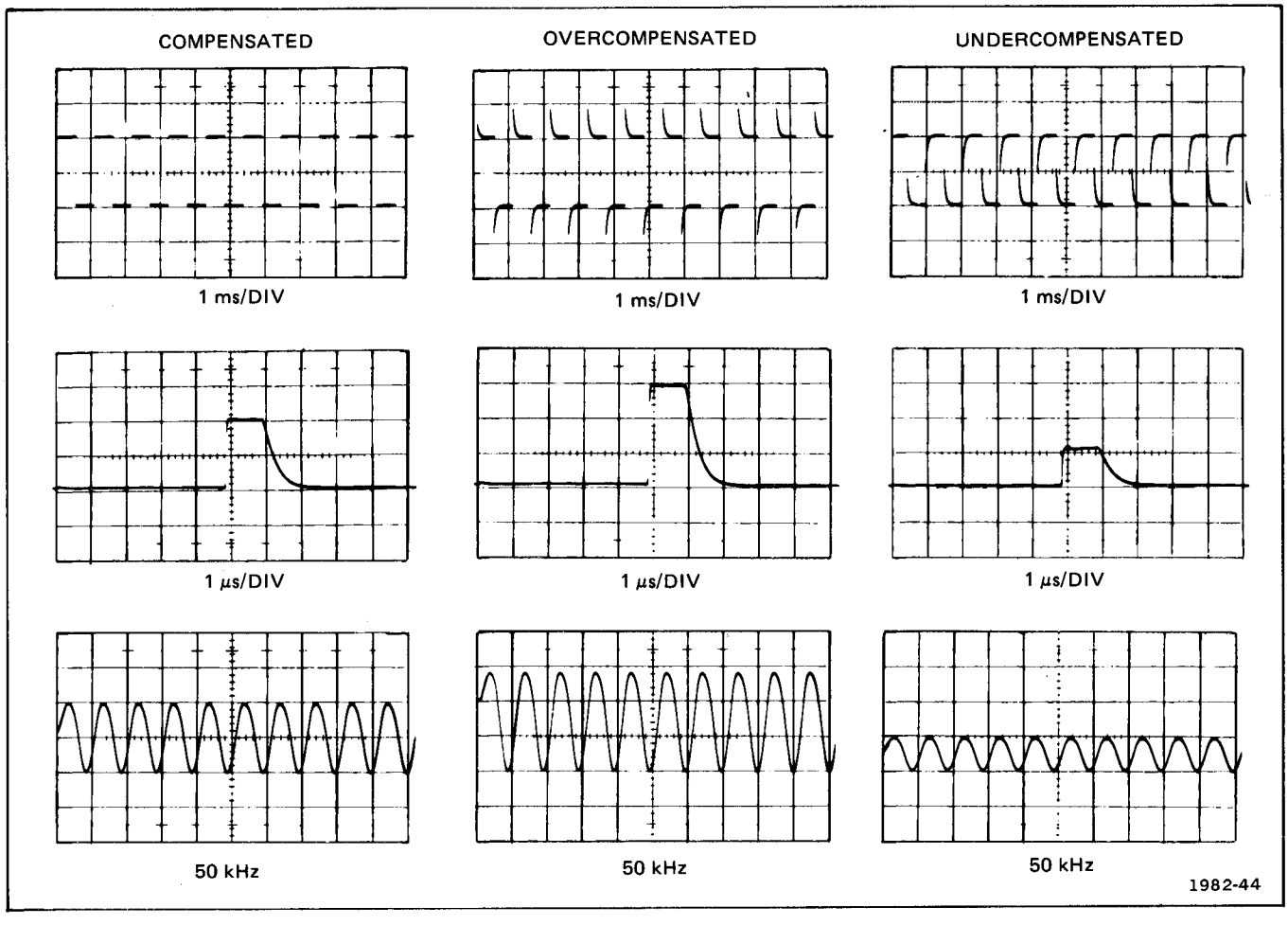
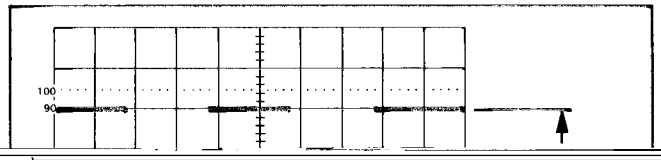


Fig. 2-11. Effects of probe compensation.



Substituting the given values:

$$\text{Instantaneous Voltage} = \text{5 divisions} \times \frac{\text{10 mV}}{\text{divisions}} = \text{50 mV}$$

6. Turn the variable (X1 - X10) SEC/DIV control until one cycle of the reference signal (Channel 1) occupies exactly eight divisions between the first and ninth graticule lines (see Fig. 2-14). Each division of the graticule represents 45° of the cycle (360° ÷ 8 divisions = 45°/ division).

7. Measure the horizontal difference between corresponding points on the waveforms.

8. Multiply the measured distance (in divisions) by 45°/ division (sweep rate) to obtain the exact amount of phase difference.

Example:

Assume a horizontal difference of 0.6 divisions with a sweep rate of 45° division as shown in Fig. 2-14.

Substituting the given values:

$$\text{Phase Difference} = 0.6 \text{ division} \times 45°/\text{division}$$

$$\text{Phase Difference} = 27°$$

Example:

The horizontal distance measured is 8.3 divisions (see Fig. 2-15).

The SEC/DIV switch is set to 2 ms.

Substituting the given values:

$$\text{Time Duration} = \text{Horizontal distance (divisions)} \times \text{SEC/DIV setting}$$

$$\text{Time Duration} = 8.3 \text{ divisions} \times 2 \text{ ms/division}$$

$$\text{Time Duration} = 16.6 \text{ m (milliseconds)}$$

and

$$\text{Frequency} = \frac{1}{\text{time duration}}$$

$$\text{Frequency} = \frac{1}{16.6 \text{ ms}^*} = 60 \text{ Hz}$$

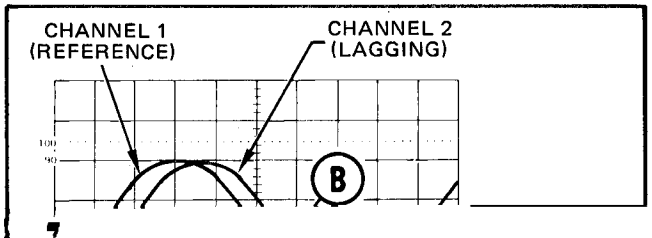
*16.6 ms = .0166 seconds

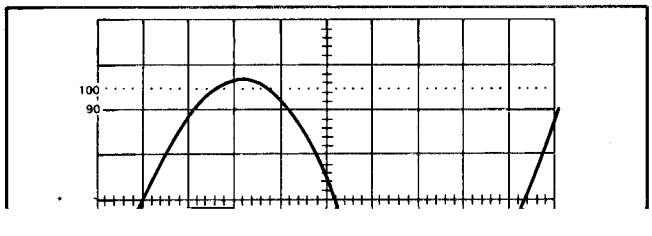
Time Duration and Frequency Measurements

To find the time duration between 2 points on a waveform, multiply the horizontal distance (in divisions) between the 2 points by the SEC/DIV switch setting. Frequency (in hertz) is the reciprocal of the time duration of one cycle (in seconds).

Risetime Measurements

Risetime measurements are made in the same manner as time duration measurements, except the measurements are made between the 10% and 90% points of the waveform's amplitude (see percentage markings on the left edge of the graticule).





Use the following procedure to measure risetime:

1. Adjust the VOLTS/DIV and VAR controls for a display amplitude of exactly 5 divisions.

2. Adjust the vertical POSITION control so that the display bottom just touches the 0% graticule line and the display top just touches the 100% graticule line (see Fig. 2-16).

3. Measure the horizontal distance (divisions) between the 10% and 90% points on the waveform (point A to point B, Fig. 2-16).

4. Use the following formula to find risetime:

$$\text{Risetime} = \begin{matrix}\text{horizontal} \\ \text{distance} \\ \text{(divisions)}\end{matrix} \times \begin{matrix}\text{SEC/DIV} \\ \text{setting}\end{matrix}$$

Examples:

The horizontal distance between the 10% and 90% point on the waveform is 5 divisions with a SEC/DIV switch setting of 1 μs.

Substituting the given values:

Risetime = 5 divisions x 1 μs/division

T922R RACKMOUNTING

Introduction

The Tektronix T922R Oscilloscope is designed to mount in a standard 19-inch rack. When mounted in accordance with the following mounting procedure, the instrument will meet all electrical and environmental characteristics given in Section 1 of this manual.

Instrument Dimensions

A dimensional drawing showing the major dimensions of the T922R is shown in Fig. 1-2 in Section 1 of this manual.

Rack Dimensions

Height. A least 5.25 inches of vertical space is required to mount this instrument in a rack.

Width. When used with the optional slide-out tracks, the minimum width of the opening between the left and right front rails of the rack must be 17 5/8 inches. This allows room on each side of the instrument for the slide-out tracks to operate freely, permitting the instrument to move smoothly in and out of the rack.

Depth. Total depth necessary to mount the T922R in a cabinet rack is 18 inches. This allows room for air circulation, power cord clearance and the necessary mounting hardware. (Additional room may be needed if

The hardware needed to mount the slide-out tracks is shown in the illustrations at the end of this section. Since the hardware supplied is intended to make the tracks compatible with a variety of cabinet racks and installation methods, not all of it will be needed for this installation. Use only the hardware that is required for the mounting method used.

Mounting Procedure

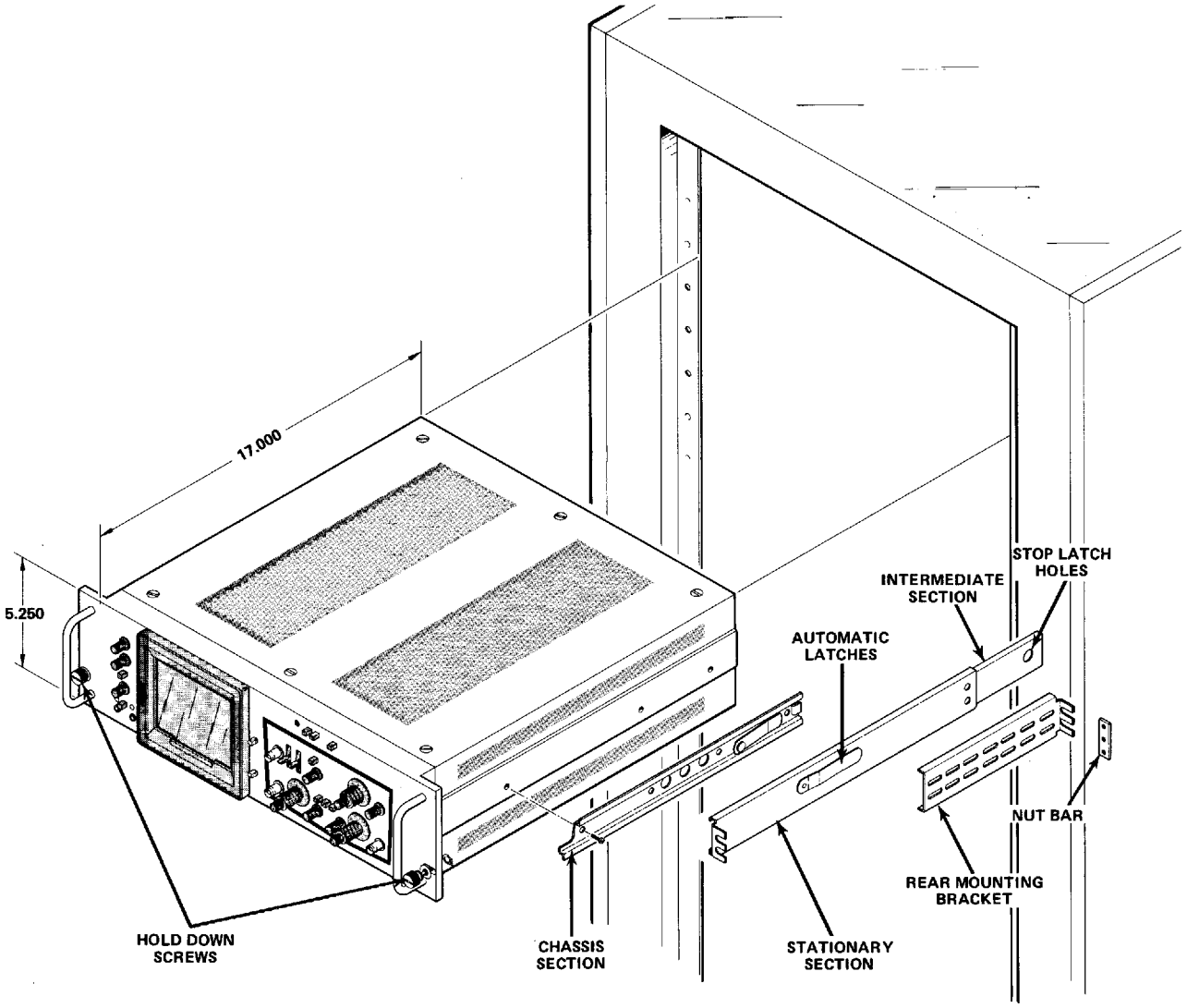
Refer to the illustrations at the end of this section for recommended mounting procedures.

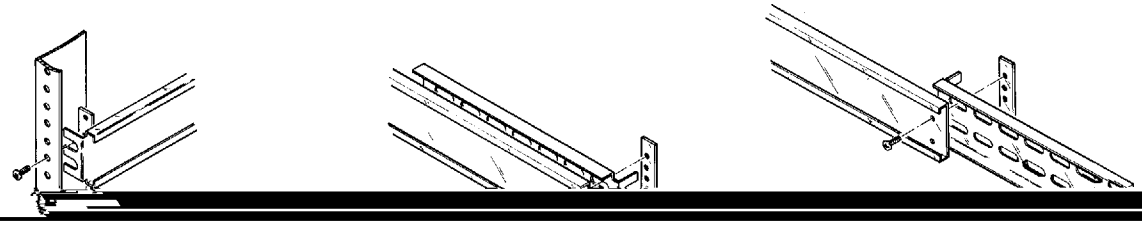
Removing or Installing the Instrument

After inital installation and adjustment of the slide-out tracks, the T922R can be removed or installed without further adjustments under normal conditions.

Slide-Out Track Lubrication

The slide-out tracks normally require no lubrication. The special finish on the sliding surfaces provides permanent lubrication. However, if the tracks do not slide smoothly even after proper adjustment, a thin coating of paraffin rubbed onto the sliding surfaces may improve operation.


17.000
5.250
HOLD DOWN SCREWS
CHASSIS SECTION
STATIONARY SECTION
AUTOMATIC LATCHES
INTERMEDIATE SECTION
STOP LATCH HOLES
NUT BAR
REAR MOUNTING BRACKET



PERFORMANCE CHECK

This procedure allows the basic performance specifications to be checked without removing the instrument covers. It is intended for use in incoming inspection to determine acceptability of newly purchased or recently calibrated instruments.

LIMITS AND TOLERANCES

TEST EQUIPMENT REQUIRED

Table 3-1 (cont)

Description	Minimum Specifications	Usage	Examples of Applicable Test Equipment
6. Dual Input Coupler	Connectors, BNC female to 2 BNC male.	Signal interconnection.	a. Tektronix Part 067-0525-00.
7. T Connector	Connectors, BNC.	Signal Interconnection.	a. Tektronix Part 103-0030-00.
8. Adapter	BNC female to BNC female.	Signal Interconnection.	a. Tektronix Part 103-0028-00.
9. TV Source	Composite Sync, output at least 100 mV (or Composite video, output at least 230 mV).	TV SYNC Trigger.	a. Any video source with the specified output, including a TV set.

PRELIMINARY PROCEDURE

Use the following steps to put your instrument into a basic operating mode before proceeding with the Performance Check. This procedure is the same for the T921, T922, and T922R except that the T921 has only one vertical channel.

NOTE

For the T921, use the channel 1 control settings and procedures.

1. Check that the Power Input Voltage Selector switch and the HI-LO Range Selector switch on the bottom of the cabinet (T921 and T922) are set for your power input voltage. In the United States, the Power Input Voltage Selector switch is normally set for 120 V and the HI-LO Range Selector switch is normally set for HI at the factory. In Europe, the Power Input Voltage Selector switch is normally set for 240 V and the HI-LO Range Selector is normally set for LO. Only qualified service personnel should change the Power Input Voltage Selector Switch to a different voltage range setting.

2. If the 120 V/240 V and HI/LO switches are properly set, connect the power cord plug to the power source and turn the instrument on, connect test equipment to an appropriate power source and turn it on. Set the trigger MODE to AUTO, and SOURCE to INT.

NOTE

3. Set the controls as follows:

Vertical Amplifier

Vertical Mode	CH 1
POSITION (both)	Midrange
VOLTS/DIV (both)[2]	2 mV
VAR (both)	Detent (cw)
CH 1 AC-GND-DC	DC
CH 2 AC-GND-DC	GND

Time Base

SEC/DIV	.5 ms
X1-X10 (variable)	X1 (unmagnified—fully ccw)
SOURCE	INT
MODE	AUTO
POSITION	Midrange
SLOPE	+OUT
LEVEL	Midrange

4. The POWER ON light should be on and a baseline trace should be visible on the graticule. Adjust INTENSITY, FOCUS, and ASTIG controls for a low intensity, well

Baseline should be parallel with horizontal graticule lines. If not, adjust R472, TR ROT, (trace rotation) in left side panel (T921 and T922) until trace aligns with horizontal graticule lines.

This ends the preliminary procedure.

PERFORMANCE CHECK PROCEDURE

1. CH 1 and CH 2 Deflection Accuracy

a. Connect test equipment as shown in Fig. 3-1 (use appropriate POSITION control as needed to center the display within the graticule area).

b. CHECK—Deflection accuracy for CH 1 according to Table 3-2 within 3% (+20°C to +30°C).

TABLE 3-2

Deflection Accuracy

VOLTS/DIV (1X PROBE WINDOW)	Amplitude Calibrator Output	Vertical Deflection (divisions)	±3% Tolerance (divisions)
2 mV	10 mV	5	4.85 to 5.15
5 mV	20 mV	4	3.88 to 4.12
10 mV	50 mV	5	4.85 to 5.15
20 mV	.1 V	5	4.85 to 5.15
.2 V	1 V	5	4.85 to 5.15
2 V	10 V	5	4.85 to 5.15

c. Set:

CH 1 AC-GND-DC	GND
CH 2 AC-GND-DC	DC
Vertical Mode	CH 2
CH 2 POSITION	As needed

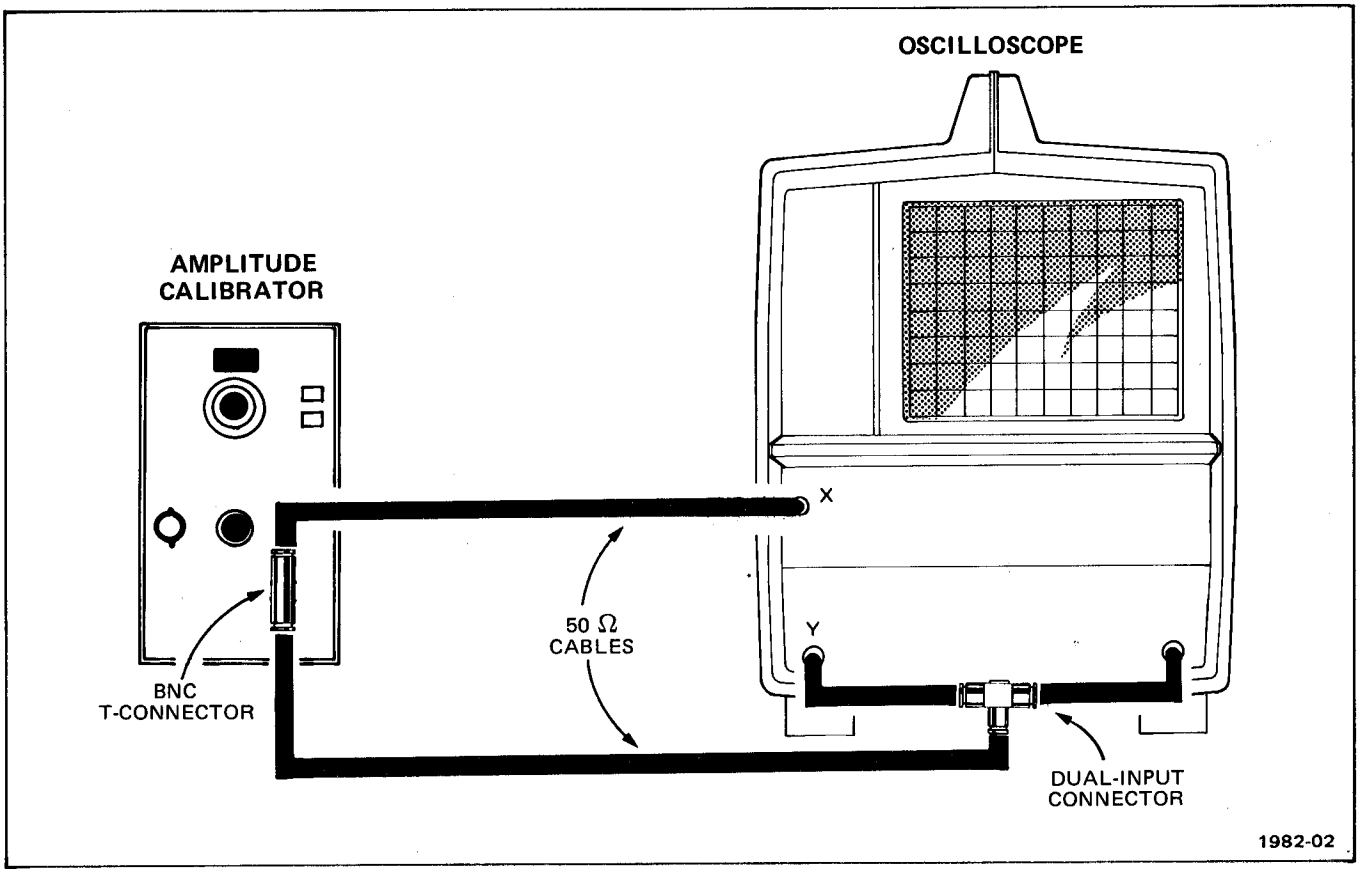


Fig. 3-1. Deflection accuracy and X gain check test setup.

d. CHECK—Deflection Accuracy for CH 2 according to Table 3-2 within 3% (+20°C to +30°C).

e. Set Amplitude Calibrator to 0.1 volt.

2. CH 1 and CH 2 VAR (Variable) Volts/Div Range

a. Set CH 1 and CH 2 VOLTS/DIV to 20 mV.

b. CHECK—Display amplitude reduces from 5 divisions to less than 2 divisions with CH 2 VAR control turned fully counterclockwise.

c. Set:

Vertical Mode	CH 1
CH 1 AC-GND-DC	DC
CH 2 AC-GND-DC	GND

d. CHECK—Display amplitude reduces from 5 divisions to less than 2 divisions with CH 1 VAR control turned fully counterclockwise.

e. Return both VAR controls to detent position.

NOTE

For bench versions of the T921 and T922, skip steps 3 and 4 and proceed with step 5.

3. Rear Vertical Inputs (T922R)

a. Set:

SEC/DIV	.2 m
VOLTS/DIV	.1
CH 1 and CH 2 FRONT-REAR	REAR
Vertical Mode	CH 1
Trigger Mode	AUTO

b. Connect test equipment as shown in Figure 3-2.

c. Set amplitude calibrator for a 0.5 volt standard amplitude output.

d. CHECK—Display amplitude is 4.85 to 5.15

f. CHECK—No vertical deflection.

g. Set Vertical Mode to CH 2.

h. CHECK—Display amplitude is 4.85 to 5.15 divisions.

i. Set CH 2 FRONT-REAR to FRONT.

j. CHECK—No vertical deflection.

4. Rear EXT TRIG or X Input (T922R)

a. Disconnect BNC cable from dual input coupler and connect it to rear-panel EXT TRIG or X input (see Fig. 3-2).

b. Set:

EXT TRIG or X FRONT-REAR	REAR
Trigger SOURCE	X-Y

c. Set Amplitude calibrator Amplitude to 5 volts.

d. CHECK—Display is two dots separated horizontally by about 5 divisions.

CAUTION

Do not allow a bright spot to remain stationary on the crt. This can burn the crt phosphor.

e. Set EXT TRIG or X FRONT-REAR to FRONT.

f. CHECK—No horizontal deflection.

g. Disconnect test equipment.

5. X Gain

a. Set:

CH 1 AC-GND-DC	GND
SOURCE	X-Y
INTENSITY	For a dim display

b. Connect test equipment as shown in Fig. 3-1 and set calibration generator output amplitude to 5 V.

c. CHECK—Horizontal deflection is between 3.5 and 6.5 divisions (set horizontal POSITION as needed to view start and end of display).

d. Disconnect test equipment.

e. Set SOURCE to INT.

6. CH 1 Bandwidth

a. Connect test equipment as shown in Fig. 3-3.

b. Set:

VOLTS/DIV (both)	2 mV
AC-GND-DC (both)	DC
LEVEL	Fully cw

c. Set generator frequency to 50 kHz (reference) and adjust output amplitude for 5 division display.

d. Set generator frequency to 15 MHz.

e. CHECK—Display amplitude is at least 3.5 divisions.

7. CH 2 Bandwidth (T922 and T922R Only)

a. Set: Vertical Mode CH 2

b. Move the sine-wave generator output (through 50 Ω cable and 50 Ω termination) from CH 1 input connector to CH 2 input connector.

c. Set generator frequency to 50 kHz (reference) and adjust output amplitude for 5 division display.

d. Set generator frequency to 15 MHz.

e. CHECK—Display amplitude is at least 3.5 divisions.

f. Disconnect generator from CH 2 input connector and reduce INTENSITY setting for a dim display.

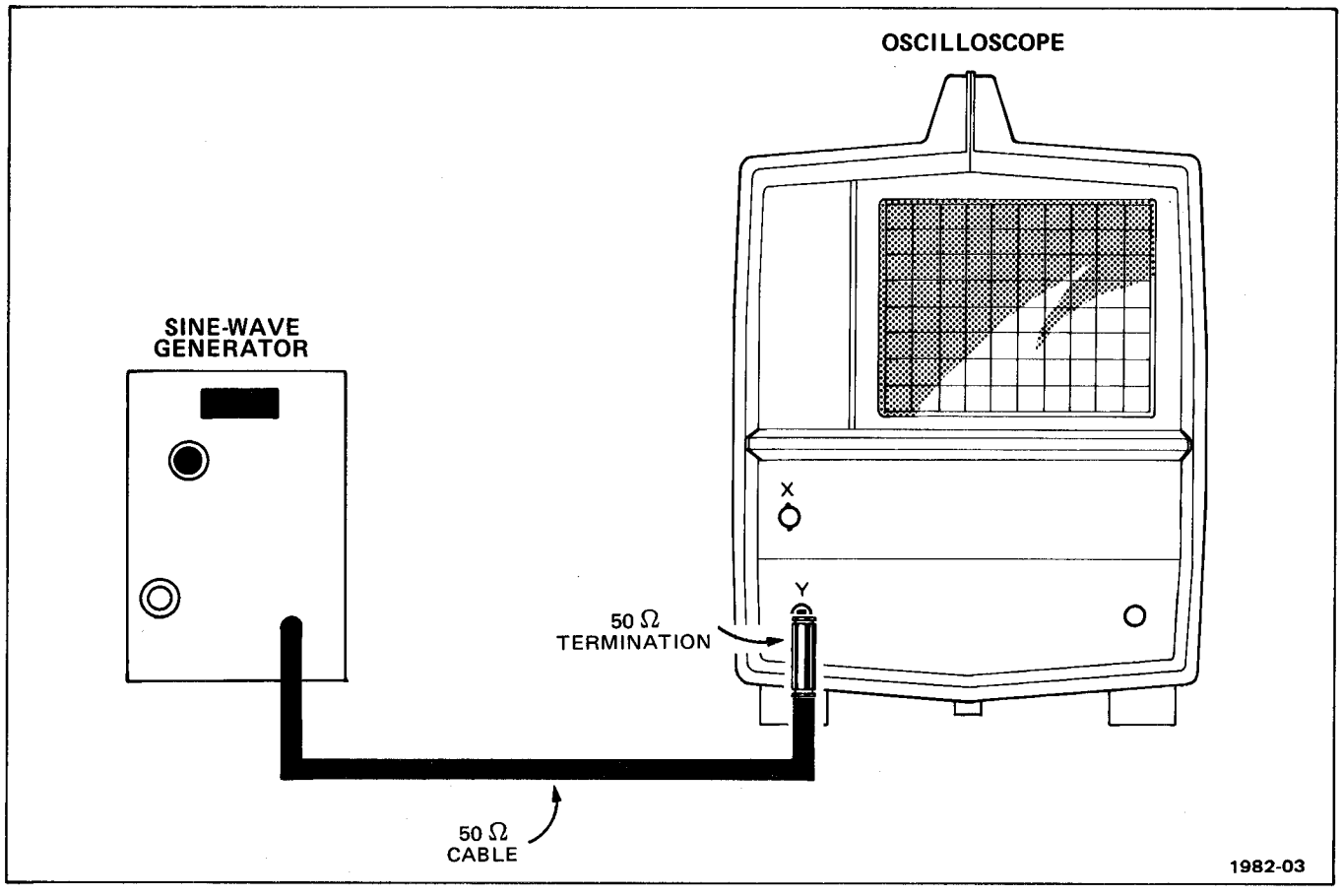


Fig. 3-3. Bandwidth check test setup.

8. X Bandwidth

a. SET:

SEC/DIV	1 ms
SOURCE	X-Y
INTENSITY	For visible display
X1-X10	X10

b. Connect sine-wave generator through 50 Ω cable and 50 Ω termination to X (EXT) input.

c. Set generator frequency to 50 kHz (reference) and adjust output amplitude for 10 divisions (about 1 volt) of horizontal deflection.

d. Set generator frequency to 1 MHz.

e. CHECK—Display amplitude is at least 7 divisions.

f. Disconnect test equipment.

g. Set SOURCE to INT.

NOTE

When making trigger checks, adjust the LEVEL control as needed for a stable display, unless instructed otherwise.

9. Low Frequency Triggering

a. Set:

SEC/DIV	10 ms
X1-X10 (variable)	X1 (fully ccw)
Vertical Mode	CH 1
MODE	NORM

b. Connect 10X probe to CH 1 input.

c. Lay probe near ac-line-voltage source and adjust CH 1 VOLTS/DIV switch and VAR control for 0.4 division display.

d. CHECK—Stable display can be obtained in both +OUT and −IN positions of SLOPE switch for AUTO and NORM modes in LINE and INT source positions.

e. Remove probe.

f. Return VAR to detent; MODE to NORM; and SOURCE to INT.

10. 1 MHz Internal Triggering

a. Connect test equipment as shown in Fig. 3-4.

b. Set: CH 1 VOLTS/DIV 1 V

SEC/DIV .5 μs

c. Set sine-wave generator frequency for 1 MHz and adjust output amplitude for 0.5 division display.

d. CHECK—Stable display can be obtained in both +OUT and −IN positions of SLOPE switch for both AUTO and NORM.

11. 1 MHz External Triggering

a. Set: CH 1 VOLTS/DIV .1 V

b. Adjust sine-wave generator output amplitude for 100 mV (one div on crt).

c. Set: SOURCE EXT

d. CHECK—Stable display can be obtained on both +OUT and −IN positions of SLOPE switch for both AUTO and NORM.

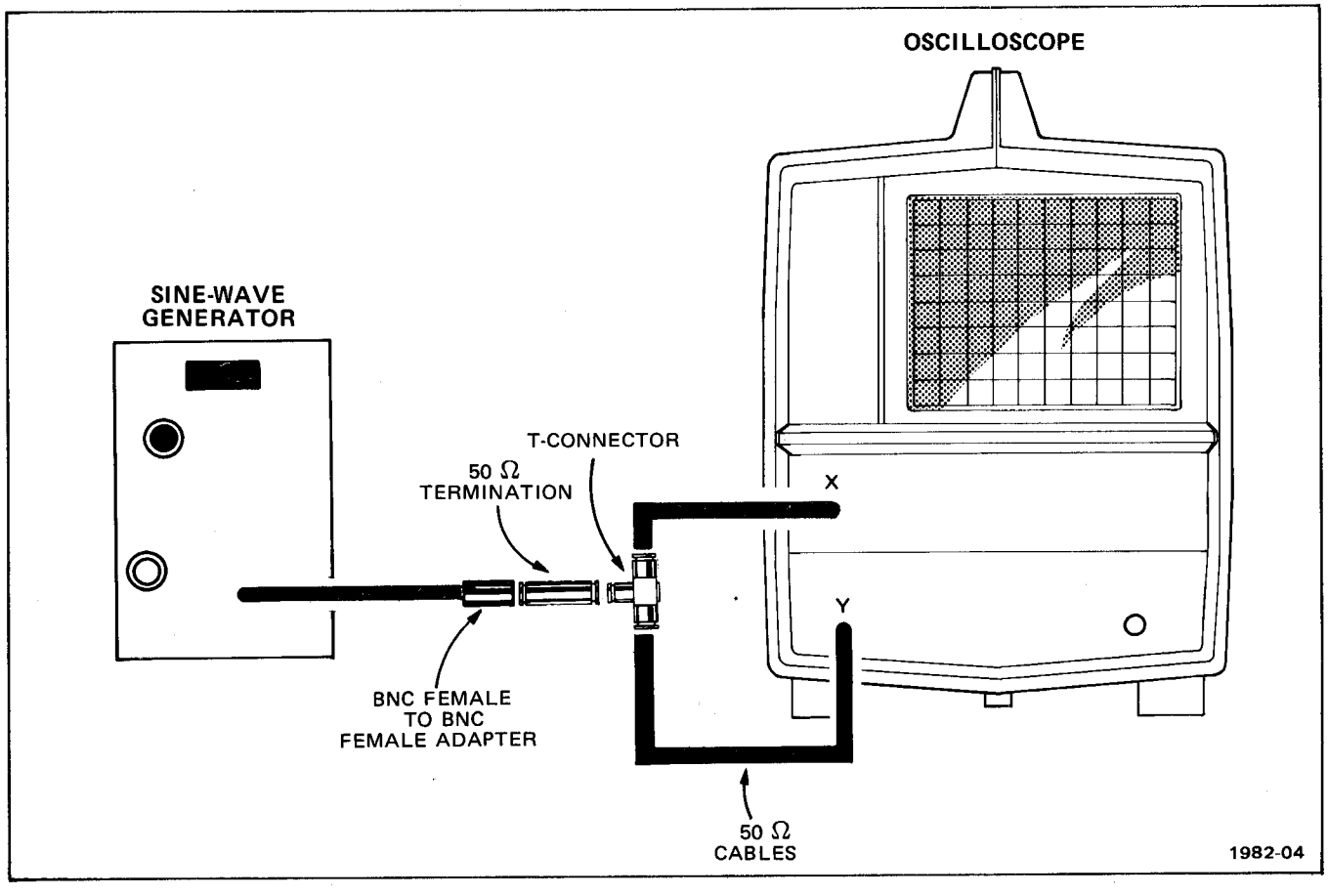


Fig. 3-4. Triggering and Z-axis input check test setup.

12. 15 MHz Internal Triggering

a. Set:

SOURCE	INT
CH 1 VOLTS/DIV	50 mV
SEC/DIV	.2 μs

b. Set sine-wave generator frequency to 15 MHz and output amplitude for a 3 division display; then set CH 1 VOLTS/DIV to .1 V.

c. CHECK—Stable display can be obtained in both +OUT and −IN positions of SLOPE switch for both AUTO and NORM modes.

13. 15 MHz External Triggering

a. Set: SOURCE EXT

b. CHECK—Stable display can be obtained in both +OUT and −IN positions of SLOPE switch for both AUTO and NORM.

14. Z-Axis Input

a. Set:

CH 1 VOLTS/DIV	1 V
SEC/DIV	.1 ms
SOURCE	INT
MODE	AUTO

b. Set sine-wave generator frequency to 50 kHz and adjust output amplitude for 5 division display.

c. Disconnect 50 Ω cable from X or EXT (external trigger) input and connect it to EXT Z AXIS connector at rear of instrument.

d. CHECK—Trace modulation is noticeable at normal intensity. (Adjust LEVEL control as required to obtain stable display.)

e. Disconnect test setup.

15. Sweep Rate Accuracy

a. Connect test setup as shown in Fig. 3-5.

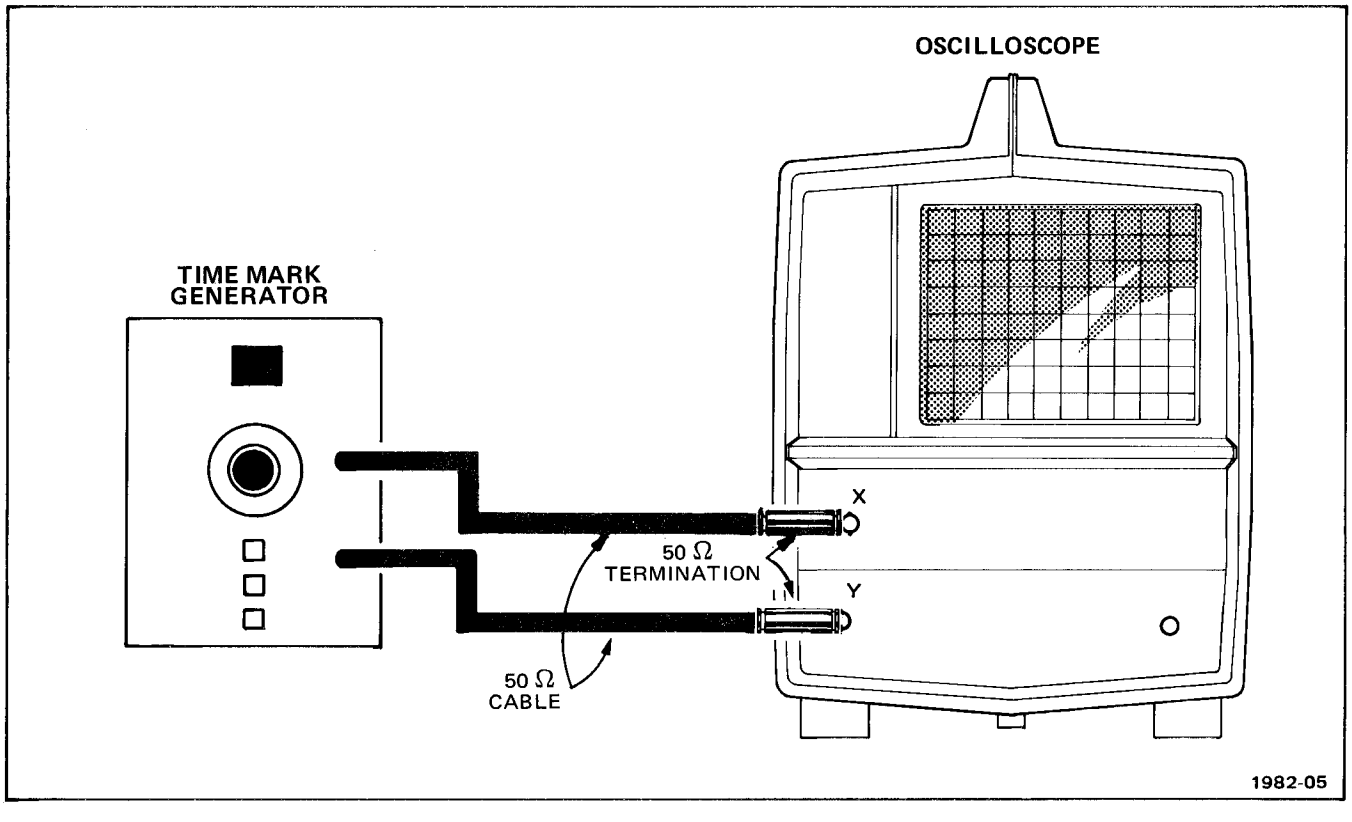


Fig. 3-5. Timing accuracy check test setup.

b. Set:

CH 1 VOLTS/DIV	.2 V
SOURCE	INT
MODE	NORM

c. CHECK—SEC/DIV accuracy according to Table 3-3: One or two time marks, as indicated, within 3% (0.24 div) over center 8 divisions. Accuracy specifications apply for a temperature range of +20° C to +30° C.

TABLE 3-3

Normal Sweep Timing Accuracy

SEC/DIV switch setting	Time-mark generator output	crt display (marker/division)
.2 μs	0.1 microsecond	2
.5 μs	0.5 microsecond	1
1 μs	1 microsecond	1
2 μs	1 microsecond	2
5 μs	5 microsecond	1
10 μs	10 microsecond	1
20 μs	10 microsecond	2
50 μs	50 microsecond	1
.1 ms	0.1 millisecond	1
.2 ms	0.1 millisecond	2
.5 ms	0.5 millisecond	1
1 ms	1 millisecond	1
2 ms	1 millisecond	2

c. CHECK—Magnified sweep accuracy according to Table 3-4: One or two time marks, as indicated, within 5% (0.4 div) over center 8 divisions. Exclude the first 50 ns after the start of the sweep; 2.5 divisions for the 0.2 μs setting (one division for 0.5 μs and 1 μs settings) and anything beyond the 100th magnified divisions. Accuracy specifications apply for a temperature range of +20° C to +30° C.

d. Return X1-X10 to X1 and SOURCE to INT.

e. Disconnect test equipment.

TABLE 3-4

Magnified Sweep Timing Accuracy

SEC/DIV switch setting	Time-mark generator output	crt display (markers/division)
.2 μs	10 nanosecond	2
.5 μs	50 nanosecond	1
1 μs	.1 microsecond	1
.5 ms	50 microsecond	1

17. Rear Panel Outputs (T922R)

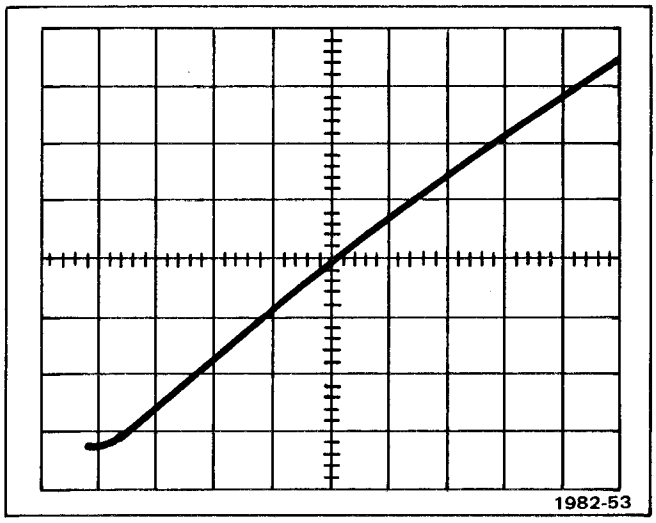


Fig. 3-6. SWEEP RAMP OUT display.

c. Set generator for 0.1 second time marks.

d. Adjust LEVEL for a stable display.

e. Set: SINGLE SWEEP SINGLE SWEEP (in)

Input Coupling GND

f. CHECK—No visible display.

g. Push RESET and release.

h. CHECK—READY lamp lights.

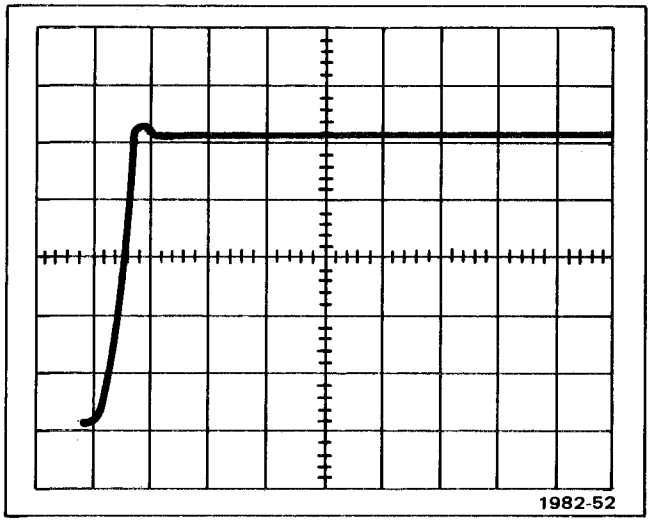


Fig. 3-7. SWEEP GATE OUT display.

j. CHECK—Crt is swept only once and READY lamp extinguishes.

k. Disconnect test equipment.

18. Single Sweep (T922R)

19. TV Trigger

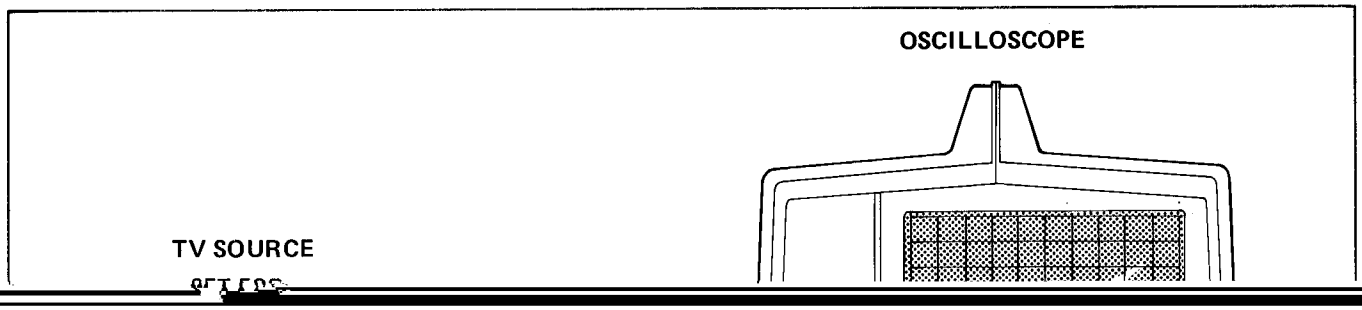
NOTE

We recommend that you only check the TV trigger if you are going to be using it. Any TV signal source will do for the check—such as a TV set.

NOTE

The amplitude settings given in this procedure are to check both the INT and EXT trigger requirements. You can check just the INT trigger by using the VOLTS/DIV setting to attenuate the signal to 1 div of composite sync or 2.3 div of composite video.

a. Connect test setup as shown in Fig. 3-8.


OSCILLOSCOPE
TV SOURCE

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

ADJUSTMENTS

WARNING

SERVICING INFORMATION IN THE FOLLOWING SECTIONS IS INTENDED FOR USE BY QUALIFIED SERVICE PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT REMOVE INSTRUMENT COVERS OR PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

IMPORTANT—PLEASE READ BEFORE USING THIS PROCEDURE

When done properly, this procedure allows you to adjust the instrument to its original performance specifications. The Adjustment Procedure is not intended as a troubleshooting guide. Any trouble you find during the procedure should be corrected before continuing. Refer to the Service Information section for further information.

LIMITS AND TOLERANCES

of the −8 V supply unless you intend to re-adjust the entire

Limits and tolerances are instrument specifications only if they are called out as performance requirements in the Specification section. Tolerances given are for the oscilloscope under test and do not include test equipment error.

ADJUSTMENT INTERACTION

Some adjustments interact with others. These are identified with an INTERACTION step.

PARTIAL PROCEDURES

You can perform part of the adjustment procedure after replacing components or just to touch up the performance between major re-adjustments. Do not change the setting

To adjust only part of the instrument, set the controls according to the nearest preceding Control Settings and use the test setup given in the step you intend to perform or the setup in a preceding step. To prevent unnecessary re-adjustment of other parts of the instrument, reset an adjustment only if the tolerance given for that step is not met. If it is necessary to reset an adjustment, also check any steps listed in the INTERACTION— part of the step.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1, or equivalent is required for complete calibration of the oscilloscope. Specifications given for the equipment are the minimum necessary for accurate calibration.

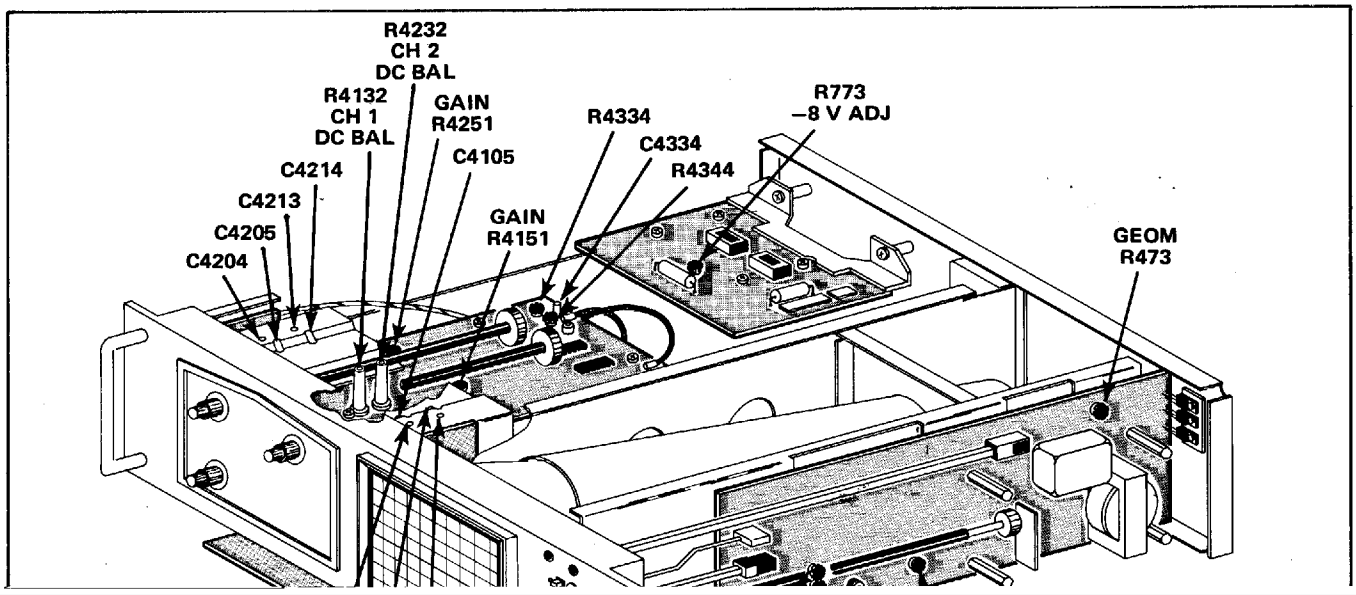
TABLE 4-1

Test Equipment

Description	Minimum Specifications	Usage	Examples of Applicable Test Equipment
1. Digital Voltmeter	Range, 0 to 9 V dc; accuracy within 0.3%.	Power supply adjustment.	a. Tektronix DM 501 Digital Multimeter.[1]
2. Time-Mark Generator	Markers, 0.5 μs to 0.5 s; accuracy, within 0.3%.	Y-axis alignment, geometry adjustment, sweep and timing adjustments.	a. Tektronix TG 501 Time-Mark Generator.[1]

TABLE 4-1 (cont)

Description	Minimum Specifications	Usage	Examples of Applicable Test Equipment


R4232
CH 2
DC BAL
R4132
CH 1
DC BAL
GAIN
R4251
C4105
R4334
C4334
R4344
R773
–8 V ADJ
C4214
C4213
C4205
C4204
GAIN
R4151
GEOM
R473

A. DISPLAY AND POWER SUPPLY

Equipment Required

1. Digital Voltmeter
2. Time-Mark Generator
3. 50 Ω BNC Cable
4. 50 Ω Termination
5. Screwdriver
6. Low-Capacitance Screwdriver

1. Set the Front Panel Controls as Follows:

NOTE

Do not preset internal controls.

NOTE

For adjustment of the T921, use the channel 1 control settings and procedures.

INTENSITY midrange

[redacted]

Vertical Mode	CH 1
CH 1 VOLTS/DIV[2]	1 V
VOLTS/DIV VAR (both)	detent
AC-GND-DC (both)	GND
SEC/DIV	.1 ms
X1-X10	X1 (fully ccw)
SOURCE	INT
MODE	AUTO

front panel), and ASTIG control (left side of cabinet) as needed to maintain a well-defined display.

2. −8 V Power Supply

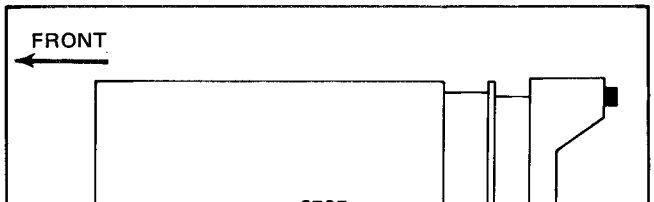
NOTE

Do not change the setting of the −8 V adjustment unless you intend to re-adjust the entire instrument.

a. Connect digital voltmeter between the −8 V side of R775 and ground (see Fig. 4-2). If meter does not read between −7.96 V and −8.04 V, proceed to part b.

b. ADJUST—R773, −8 V Adj (see Fig. 4-2) for −8.00 V dc.

c. Disconnect digital voltmeter.



3. Trace Rotation

a. Position trace vertically to center horizontal graticule line.

b. ADJUST—TRACE ROT, R472, to align trace with

e. ADJUST—Y-Axis, R474, (see Fig. 4-3) to align center marker with center vertical graticule line.

f. INTERACTION—Position display baseline to center horizontal graticule line and check that baseline aligns

B. VERTICAL AMPLIFIER

NOTE
Use Channel 1 control settings and procedures for the T921.

Equipment Required

1. Digital Voltmeter
2. Amplitude Calibrator
3. Square-Wave Generator
4. 50 Ω BNC Termination
5. 50 Ω BNC Cable
6. Alignment Tool
7. Screwdriver
8. Low-Capacitance Screwdriver
9. 10X Probe
10. 10 X Attenuator
11. Probe-tip-to-BNC Adapter

PRELIMINARY CONTROL SETTINGS

Preset front panel controls as follows:

INTENSITY	midrange
FOCUS	midrange
Vertical Mode	CH 1
VOLTS/DIV (both)[3]	2 mV
AC-GND-DC (both)	GND
VAR (both)	detent
SEC/DIV	.5 ms
X1-X10	X1 (fully cw)
SOURCE	INT
MODE	AUTO
SLOPE	+OUT
LEVEL	midrange
POSITION (all)	midrange

Set all other controls as desired.

[3]**Unless otherwise stated, use the 1X probe window for VOLTS/DIV settings throughout this procedure.**

The oscilloscope should produce a baseline trace with the controls set as above. Adjust INTENSITY and FOCUS controls as needed to maintain a well-defined display while making adjustments.

1. Vertical Preamplifier Balance

a. ADJUST—CH 1 DC BAL, R4132 (see Fig. 4-4) for no trace shift while switching CH 1 VOLTS/DIV control between 2 mV and 10 mV.

b. SET: Vertical Mode CH 2.

c. ADJUST—CH 2 DC BAL, R4232 (see Fig. 4-4) for no trace shift while switching CH 2 VOLTS/DIV control between 2 mV and 10 mV.

2. Vertical Output Amplifier Gain

NOTE

You should not have to re-adjust the vertical output gain unless you have replaced the crt or other components.

a. Set VOLTS/DIV (both) to 5 mV/div and Vertical Mode to CH 1.

b. Set Gain, R126 (see Fig. 4-3) to physical midrange.

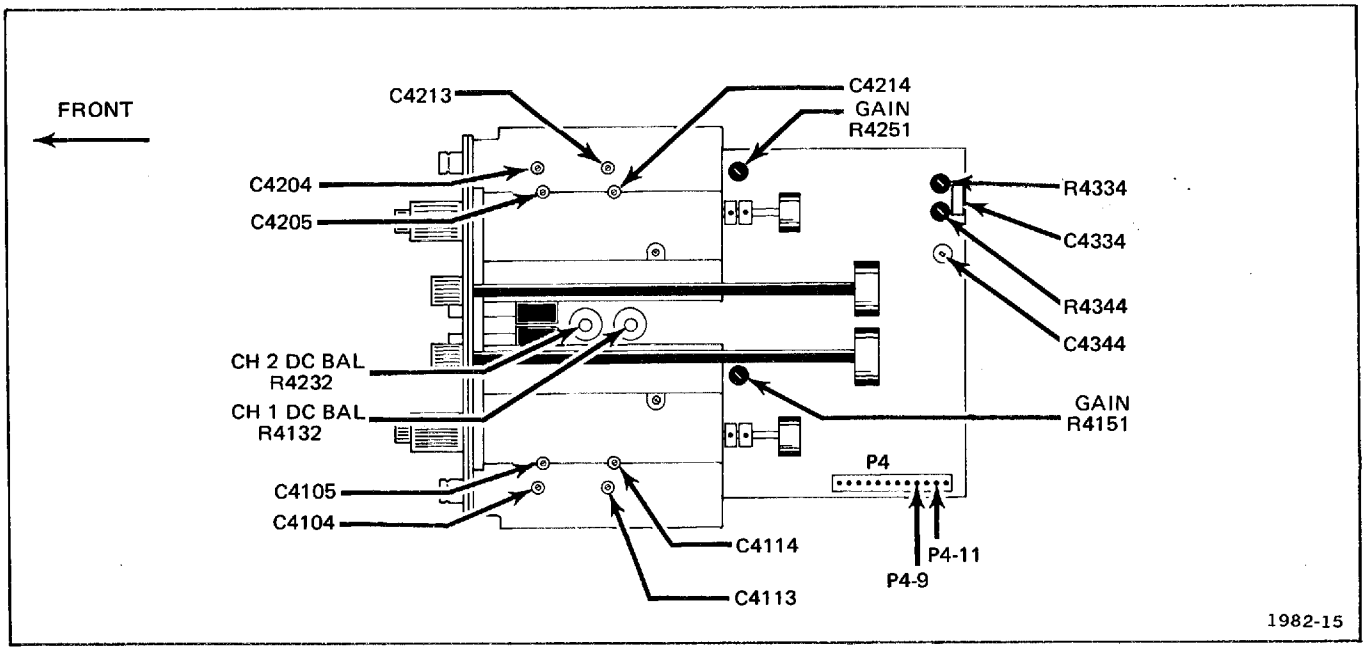


Fig. 4-4. Vertical amplifier adjustment locations (bottom view of T921 and T922).

c. Connect digital voltmeter between P4-9 and P4-11 (see Fig. 4-4). Select range on meter for at least 500 mV reading.

d. Set vertical POSITION control so trace is aligned with center horizontal graticule line. Note meter reading.

e. Rotate vertical POSITION control until meter reading has increased 150 mV from reading in part d (trace moved toward top of screen).

f. Adjust Gain, R126 (see Fig. 4-3), so trace aligns with third graticule line above center horizontal graticule line.

g. Disconnect digital voltmeter.

d. Move 20 mV amplitude calibrator signal to CH 2 input and set Vertical Mode to CH 2.

e. ADJUST—Gain, R4251 (see Fig. 4-4), for 4 division display.

f. INTERACTION—If you cannot adjust CH 1 and CH 2 Preamplifier Gain for 4 division display, repeat steps 2 and 3.

g. Disconnect test equipment.

4. High-Frequency Compensation

a. Set:	CH 1 VOLTS/DIV	5 mV
	Vertical Mode	CH 1

[redacted]

a. Set:	VOLTS/DIV (both)	5 mV
	AC-GND-DC (both)	DC
	Vertical Mode	CH 1
	CH 2 AC-GND-DC	GND
	SEC/DIV	.1 ms

b. Connect a 1 kHz, 20 mV amplitude calibrator (standard output) signal to CH 1 input via a 50 Ω unterminated cable.

b. Connect square-wave generator (fast-rise, + transition) to CH 1 input connector via 50 Ω cable, 10X attenuator, and 50 Ω termination.

d. Set POSTION controls to position the leading edge of the signal on screen.

e. ADJUST—R4334, C4334, R4344, C4344 (see Fig. 4-4), C114, R114, C118 (see Fig. 4-3), for best front corner of waveform using low capacitance screwdriver.

f. Disconnect test equipment.

5. CH 1 Attenuator Compensation

a. Set:	CH 1 VOLTS/DIV[1]	20 mV
	CH 1 AC-GND-DC	DC
	Vertical Mode	CH 1
	SEC/DIV	1 ms
	X1-X10	X10 (fully ccw)

b. Connect a 50 Ω cable from the high-amplitude output of the square-wave generator, through a 10X attenuator and a 50 Ω termination to the CH 1 input connector. Set

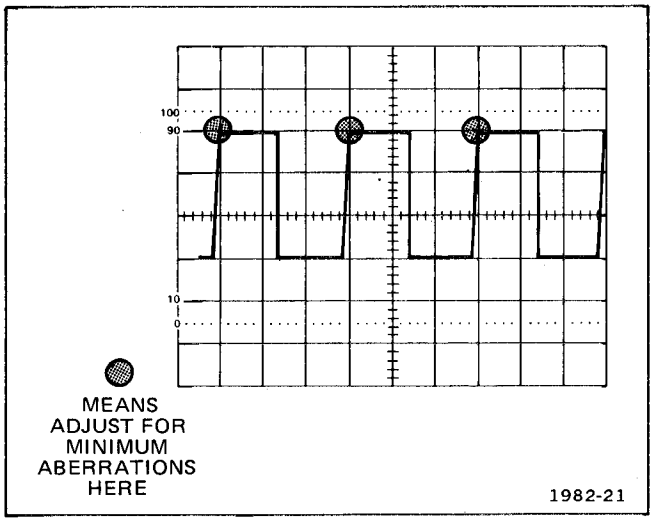


Fig. 4-5. Display of correct (idealized) attenuator compensation.

j. ADJUST—C4113 for flat top on square wave.

[redacted]

e. ADJUST—C4205 (see Fig. 4-4) for best square front corner (see Fig. 4-5 for example). Disconnect test equipment.

f. Set CH 2 VOLTS/DIV to 10 mV and X1-X10 to X1 (fully ccw).

g. Connect a 10X probe to the CH 2 input. Connect the probe tip to a probe tip-to-BNC adapter, the adapter to a 50 Ω BNC termination, and the termination to a 50 Ω BNC 10X attenuator attached to the square-wave generator high-amplitude output connector. Set generator for a 5-division, 1 kHz display.

h. Compensate probe for best front corner of waveform.

i. Set CH 2 VOLTS/DIV to 20 mV and set generator for a 5-division display (remove 10X attenuator if necessary).

j. ADJUST—C4213 for flat top on square wave.

k. Set CH 2 VOLTS/DIV to .2 V, and square-wave generator output for a 5-division display (remove 10X attenuator, and also 50 Ω termination if necessary).

l. ADJUST—C4204 for a flat top on square wave.

m. Disconnect test equipment.

C. TIME BASE

Equipment Required

1. Time-Mark Generator
2. 50 Ω Termination
3. 50 Ω BNC Cable
4. Low-Capacitance Screwdriver

PRELIMINARY CONTROL SETTINGS

Preset front panel controls as follows:

INTENSITY	midrange
FOCUS	midrange
Vertical Mode	CH 1
CH 1 VOLTS/DIV[5]	.5 V
CH 1 VAR	detent
CH 1 AC-GND-DC	DC
CH 2 AC-GND-DC	GND
SEC/DIV	.5 ms
X1-X10	X1 (fully ccw)
SOURCE	INT
MODE	AUTO
SLOPE	+ OUT
LEVEL	midrange
POSITION (all)	midrange

Set all other controls as desired.

[5]**Unless otherwise stated, use the 1X probe window for VOLTS/DIV settings throughout this procedure.**

The oscilloscope should produce a baseline trace with the controls set as above, Adjust INTENSITY and FOCUS controls as needed to maintain a well-defined display while making adjustments.

1. Horizontal Gain

a. Connect time-mark generator to channel 1 input via 50 Ω BNC cable and 50 Ω termination. Set generator for .5 ms markers.

b. ADJUST—Horiz Cal R2332 (see Fig. 4-6 or Fig. 4-1B) and horizontal POSITION control for 1 time marker per division over center 8 divisions.

2. Sweep Timing

a. Set SEC/DIV to .5 μs and time-mark generator for .5 μs markers.

b. ADJUST—C2235 (see Fig. 4-6 or Fig. 4-1B) and horizontal POSITION control for 1 marker per division over center 8 divisions.

c. Disconnect the test setup.

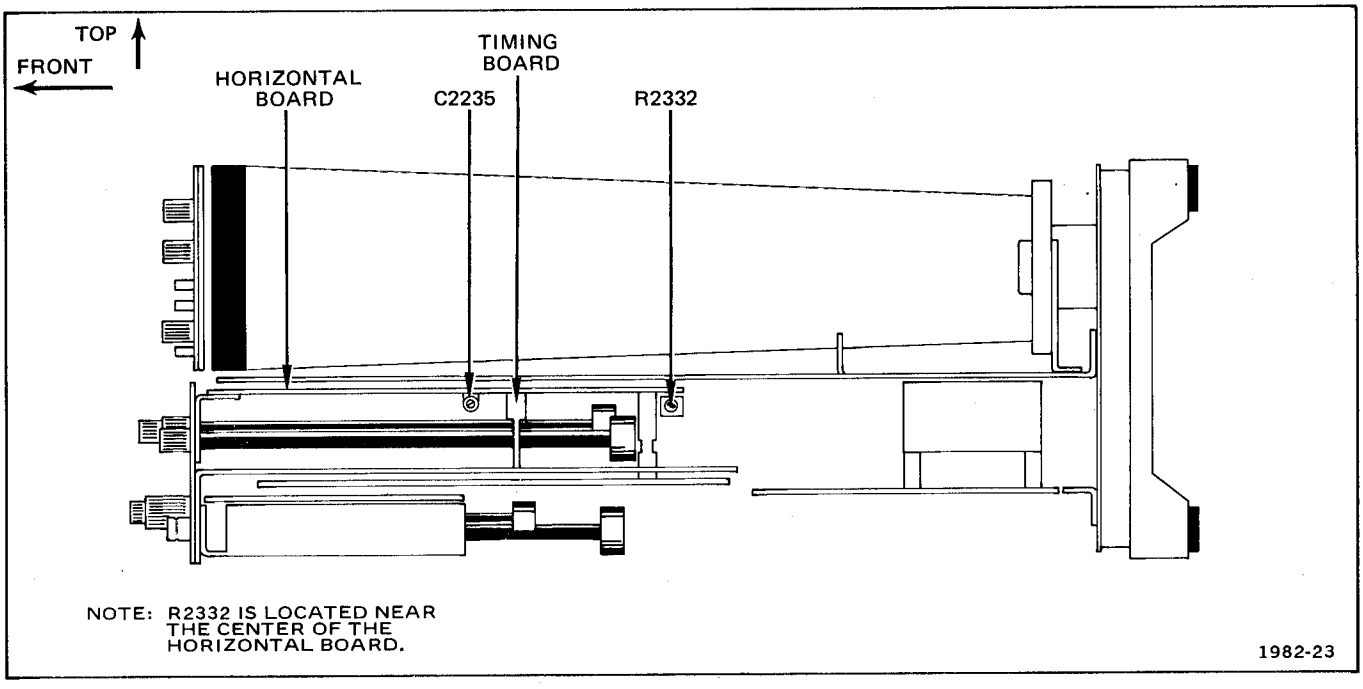


Fig. 4-6. Time base adjustment locations.

SERVICE INFORMATION

The following information is provided to help you keep your T921/T922/T922R in good operating condition. We [redacted]

Tektronix Service Center for re-adjustment and repair. Contact your local Tektronix representative for information about the Service Centers in your area.

CABINET REMOVAL

WARNING

Dangerous potentials exist at several points throughout the T921, T922, and T922R. When operating the instrument with the covers off, avoid touching connections and components. Some transistors have elevated cases. Disconnect the power before cleaning the instrument or replacing parts.

T921 AND T922

The cabinet provides protection from dust and dirt and should be in place during normal operation of the instrument.

CAUTION

Avoid the use of chemical cleaning agents containing benzene, toluene, xylene, acetone or similar solvents. These chemicals may damage the plastics used in this instrument. Recommended cleaning agents are isopropyl alcohol or Kelite (1 part Kelite, 20 parts water).

solution of one part Kelite to 20 parts water. If these are not available, petroleum ether, white kerosene, or a solution of 1% Joy detergent and 99% water may be used.

Recommended circuit coolants are dry ice and isopropyl alcohol.

The cam switch contacts are designed to operate

Troubleshooting Aids

Troubleshooting Chart. Use the troubleshooting chart (Fig. 5-1) to locate problem areas.

Diagrams. Complete circuit diagrams are located on the foldout pages in the Circuit Description and Diagrams section. The component number and electrical value of each component in the instrument are shown on the

Purpose: To test semiconductors.

Example: Tektronix 576 Curve Tracer or Tektronix 577 (D1 or D2) Curve Tracer with 177 Test Fixture.

2. Test Oscilloscope

Description: Frequency response, dc to at least 15 MHz. A 10X, 10 MΩ voltage probe should be used to reduce circuit loading for voltage measurements.

Purpose: To check operating waveforms.

3. Multimeter

Description: Non-loading digital multimeter. Voltmeter, 10 MΩ input impedance and 0 to 150 V range; dc voltage accuracy, within 0.15%; display, 4 1/2 digits. Ohmmeter, 0 to 20 MΩ.

Purpose: To check voltages and for general troubleshooting.

4. Variable Autotransformer

Description: Output variable from 0 to 140 V, 1.2A minimum rating. Must have a three-wire power cord, plug and receptacle.

Purpose: To vary the input line voltage when troubleshooting in the power supply.

Example: General Radio W8MT3VM or W10MT3W Metered Variac Autotransformer.

5. Vertical Amplifier Extender Troubleshooting Fixture

Description: 18 inch ribbon cable with an interface connector at each end (Tektronix part 067-0773-00).

Purpose: To operate the Vertical Amplifier outside the instrument. Useful for troubleshooting the Time Base which is inaccessible with the Vertical Amplifier installed.

Troubleshooting Techniques

NOTE

The troubleshooting techniques for the T922R are similar to those for the standard T922. However, the Vertical Amplifier extender troubleshooting fixture

1. Check the Control Settings. See the Operating Instructions for the correct control settings.

2. Check Associated Equipment and Connectors. Check to see that the signal source is properly connected and that the interconnecting cables are not defective. Also check the power cord and plug and the power source for defects.

3. Check the Performance of the instrument. If the instrument does not meet specifications, the trouble may be corrected by readjusting the instrument. See the Adjustment Procedure, Section 4, for instructions.

4. Visual Check. A visual check may reveal broken connections, damaged components, semiconductors not firmly mounted, damaged circuit boards, etc.

5. Isolate the Trouble to a Circuit. To isolate trouble to a particular circuit, note the trouble symptom. The symptom often identifies the circuit where the trouble is located. For example, poor focus indicates that the crt circuit (including the high-voltage supply) is probably at fault. When trouble symptoms appear in more than one circuit, check affected circuits by taking voltage and waveform readings.

Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltage of the individual supplies. However, a defective component elsewhere in the instrument can appear as a power supply trouble and may also affect the operation of other circuits. Table 5-1 lists the tolerances of the power supplies. Voltages are measured between the power supply test points and ground. If a power supply voltage is within the listed tolerance, assume the supply is working correctly.

TABLE 5-1

Power Supply Tolerance

Supply	Tolerance
−8 V	Set within 0.5%

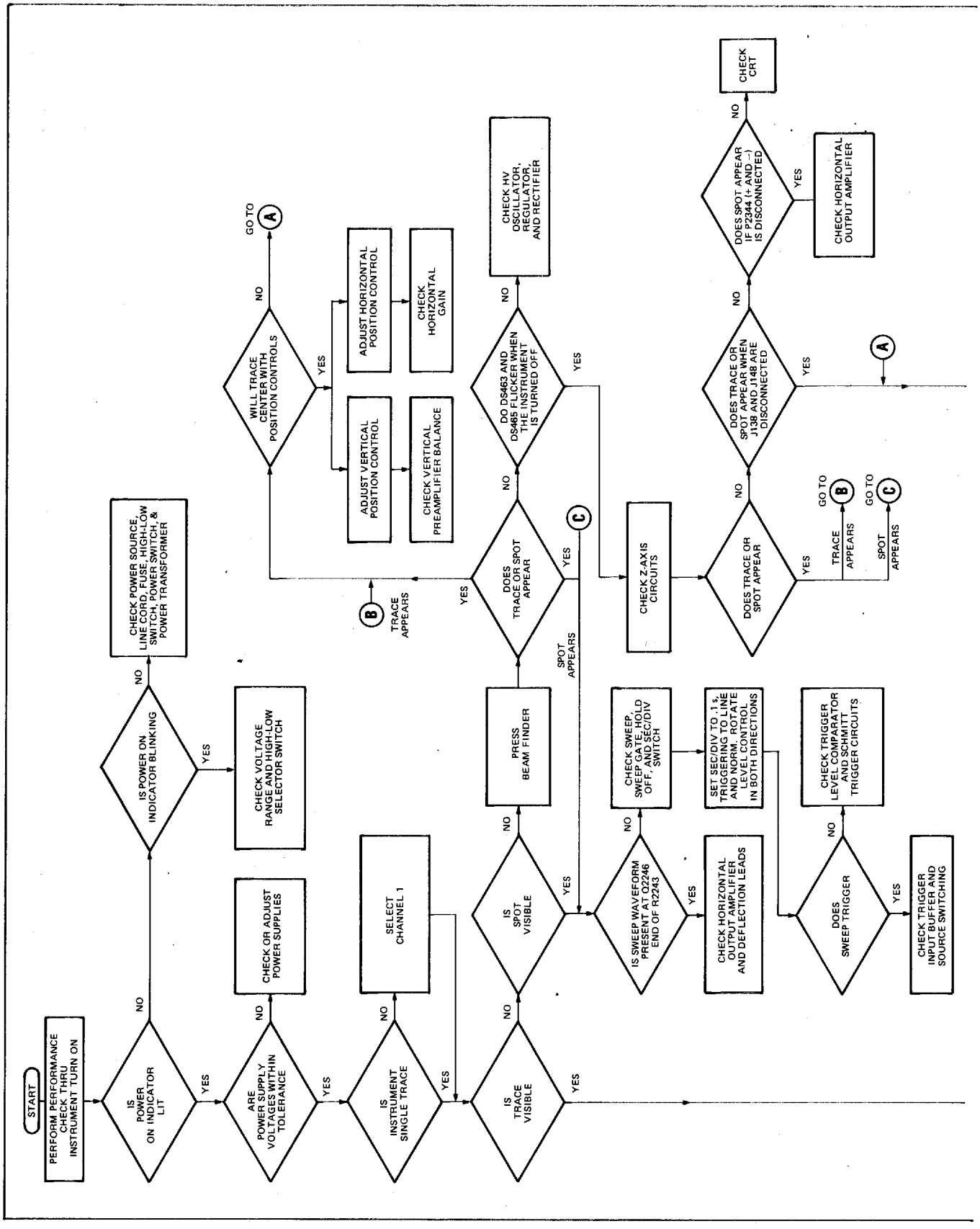


Fig. 5-1. Troubleshooting chart.

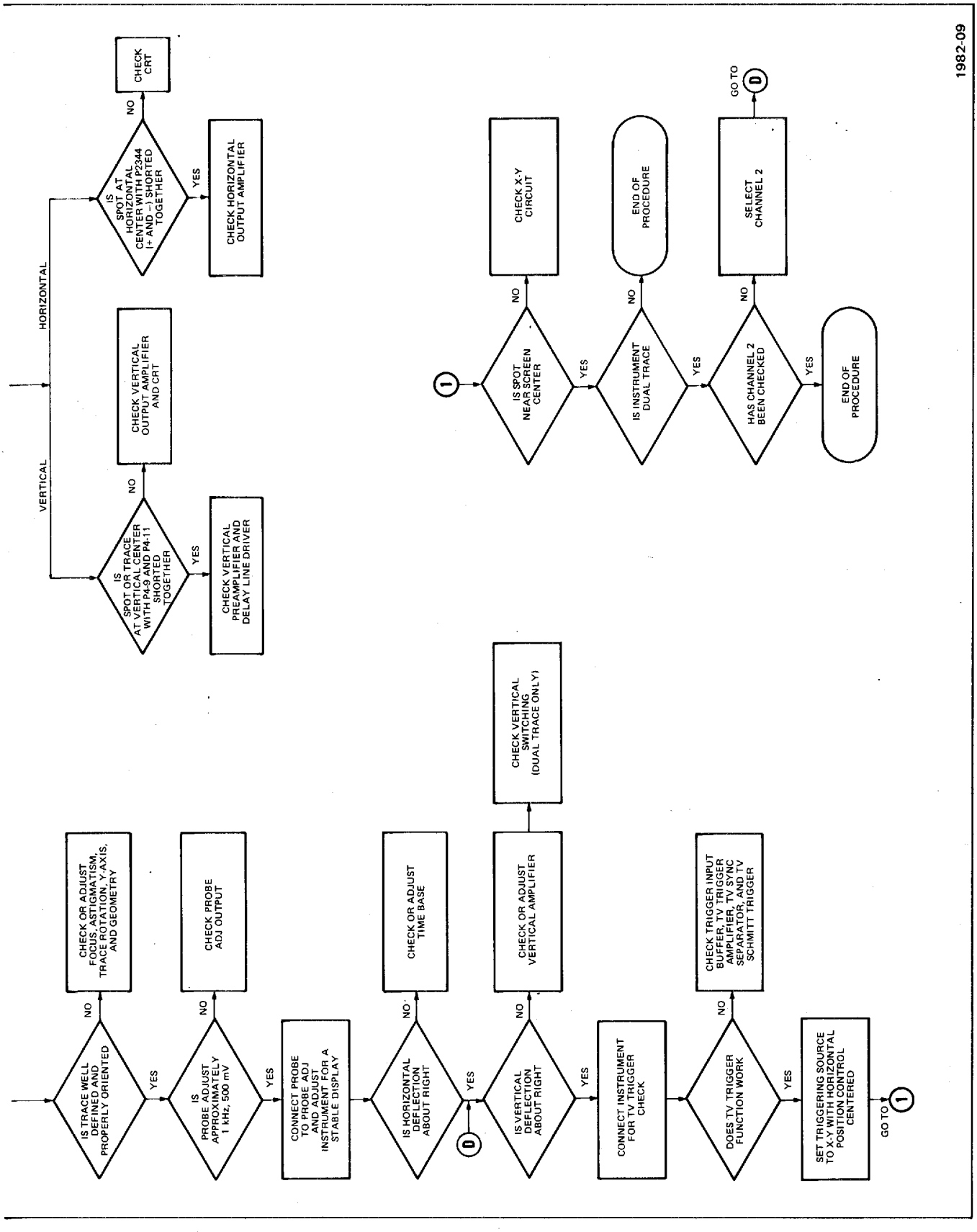
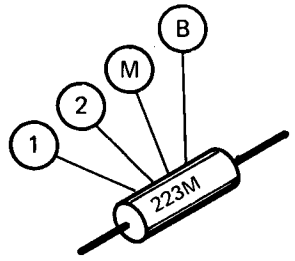
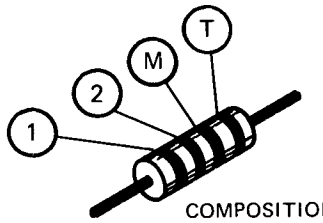


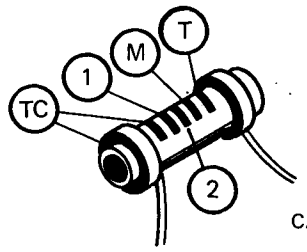
Fig. 5-1. Troubleshooting chart (cont).



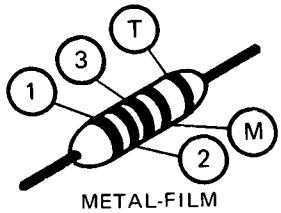
SMALL TUBULAR CAPACITORS



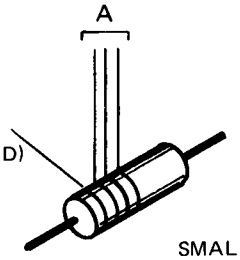
COMPOSITION RESISTORS



CERAMIC CAPACITORS



METAL-FILM RESISTORS



SMALL SIGNAL DIODES

(A) COLORS IDENTIFY SIGNIFICANT DIGITS IN TEKTRONIX PART NUMBER (E.G. BROWN, GRAY, GREEN STRIPES INDICATE PART NUMBER 152-0185-00)

(1) (2) and (3) 1ST, 2ND, AND 3RD SIGNIFICANT FIGS.

(M) MULTIPLIER (T) TOLERANCE;

(B) TOLERANCE; F=±1%, J=5%, K=10%, M=20%

(T) AND/OR (TC) COLOR CODE MAY NOT BE PRESENT ON SOME CAPACITORS;

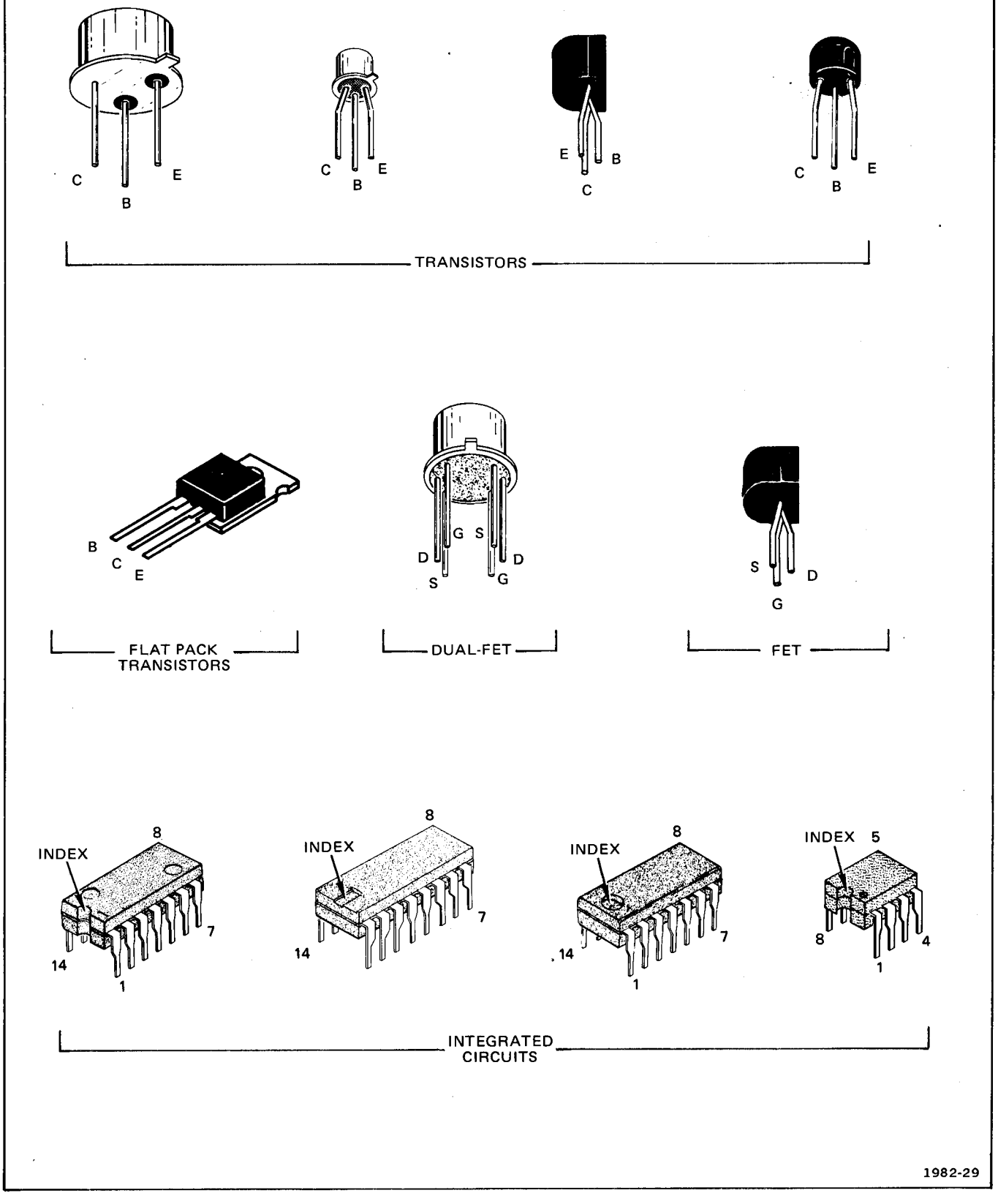


Fig. 5-3. Lead configuration for semiconductor devices.

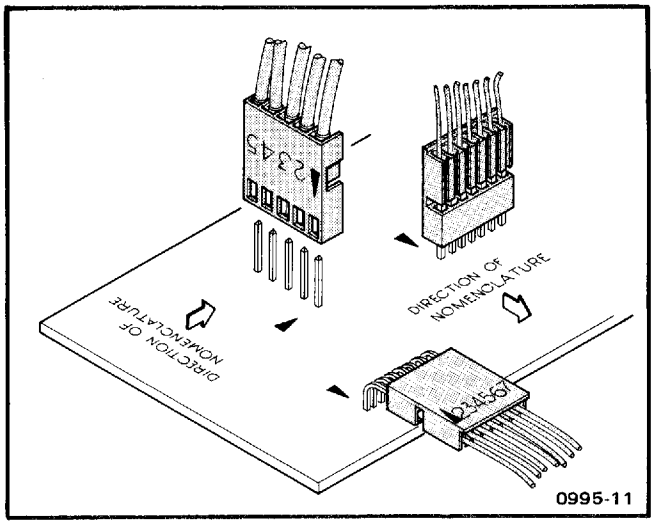


Fig. 5-4. Multi-connector holder orientation.

6. Check Voltages and Waveforms. Often a defective component can be located by checking for the correct voltages and waveforms in a circuit.

NOTE

Voltages and waveforms given on the diagrams are not absolute and therefore may vary slightly between instruments. To obtain operating conditions similar to those used to take these readings, see the voltage and waveform setup procedures in the Diagrams section. Individual deviations should be noted on the schematics for future reference.

7. Check the individual components. Remember that the best check of semiconductors—transistors, diodes, IC's—and thick film resistors is actual operation in a circuit. If you suspect that a semiconductor is bad, substitute a new one for it. Before you start checking IC's, read the part of the Circuit Description that covers the circuit.

WARNING

The power switch must be turned off before removing or replacing components to prevent electrical shock or circuit damage.

To check other components, resistors, capacitors and inductors, clip one lead and lift it. You may have to add a piece of wire when you resolder the connection.

one end from the circuit. Check the Electrical Parts List for the tolerance of the resistors used in this instrument. Resistors normally do not need to be replaced unless the measured value varies widely from the specified value.

Inductors: Check for open inductors by checking continuity with an ohmmeter. (It may be helpful to disconnect one end of the inductor when checking continuity.) Shorted or parially shorted inductors can also be found by checking the waveform response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response (increases roll-off).

Capacitors: A leaky or shorted capacitor can be detected by checking resistance with an ohmmeter, on the highest scale, after disconnecting one end from the circuit. Do not exceed the voltage rating of the capacitor (some ohmmeters use 30 volts as source voltage). The resistance reading should be high after initial charge of the capacitor. An open capacitor can also be detected with a capacitance meter or by checking whether the capacitor passes ac signals.

Switches: The most common cause of switch failure is dust between the contact and the pad. Check the suspected contact for continuity with an ohmmeter. If open and not obviously damaged, try cleaning (see Cam Switch Repair and Replacement).

Another frequent cause of switch failure is solder smoke residue. This can occur when replacing a component near the switch. This problem is usually indicated by reduced high-frequency response. Flushing the contact with isopropyl alcohol usually fixes this problem.

If the contact is physically damaged, replace the contact strip. Bending the contact is only a temporary repair. See Cam Switch Repair and Replacement.

8. After repairing a circuit or replacing components, check the performance of the instrument. If the Performance Check is within specifications, it is not necessary to re-adjust the instrument. If the instrument does not meet the specifications, perform the Adjustment Procedure in Section 4.

a. Does beam appear on screen? If not, rotate INTENSITY control clockwise while holding BEAM FINDER button in until beam appears or control is fully clockwise. If beam does not appear, the trouble may be in the power supplies (see Power Supply schematic).

b. Check all low voltage power supplies, starting with −8 V (−8 V is reference supply), the +8 V, and +100 V at appropriate test points.

(1) If no voltage is present, check F700.

(2) If −8V is low (or zero), check Q772, Q774, Q776, or U742.

(3) If −8 V is correct but +8 V is low (or zero), check Q752, Q754, Q756, and U742 (U742 is used for both −8 and +8 V supplies).

c. Check high-voltage supplies (see CRT and Vertical Amplifier schematic).

(1) Check for −2 kV at pin 1, P465, or pin 2, crt base socket. Use DVM for all voltage checks in this circuit to prevent circuit loading.

(2) If no −2 kV, check for 50 kHz sine wave (approximately 200 V, peak-to-peak) at pin 5 of T460 (high-voltage transformer primary).

(3) If neither −2 kV or 50 kHz sine wave is present, check Q454, Q458, and Q446.

CAUTION

Do not unload the secondary of the high-voltage transformer, T460; the transformer may be damaged.

Z Axis. SYMPTOM—No intensity or no control over intensity (BEAM FINDER button pushed).

a. Does beam come on screen? If not, and low and high-voltage supplies are correct, trouble may be in Z-Axis circuit (see CRT and Vertical Amplifier schematic).

(1) Check for approximately 60 V swing between crt-socket pins 2 and 3. If no voltage swing, trouble may be in unblanking.

(2) Check for positive-going pulse at Q416 emitter. This pulse amplitude should vary from 20 to 80 mV with change (fully cw to fully ccw) in INTENSITY control position.

(3) Check for 0-40 V, peak-to-peak unblanking pulse (varies with INTENSITY control position) at Q426 collector.

(4) If no unblanking pulse, check Q426, Q424, Q416, or Q434.

Vertical: SYMPTOM 1.—No trace on crt with BEAM FINDER button pushed, or vertical POSITION control does not center display (see Vert Input, Vert switching, and Crt & Vert Ampl schematics).

a. If trace is on screen, but about 2 cm above graticule center, it indicates trouble in vertical amplifier.

b. Short P4-9 to P4-11 (A8, Vertical board). If trace does not center, trouble is in output circuits. Check Q112, Q122, Q134, Q144, Q136, and Q146.

c. If trace centers with pins 9 and 11 short-circuited, trouble is ahead of P4.

d. Short-circuit Q4322 collector to Q4324 collector. If trace centers, trouble is ahead of delay-line drivers, Q4336-Q4346.

e. Check voltage at Q4302 and Q4303 emitters. Each should read approximately +5 V above ground. If emitter voltage is okay, trouble is either in Q4302 or Q4303, or in switching circuit (short-circuited CR4314, CR4303, or open CR4304).

SYMPTOM 2.—With 50 mV input and VOLTS/DIV set to 10 mV, crt display is low and does not position above graticule center.

a. Press BEAM FINDER button. If trace does not appear on screen, rotate vertical POSITION control.

b. If trace appears, but decreases in amplitude at graticule center, suspect vertical output circuit.

c. Short-circuit Q136 collector to Q146 collector. If trace centers, short-circuit Q112 collector to Q122 collector. Trace should center. If not, suspect Q112, Q134, or Q136.

Triggering: SYMPTOM 1.—Trace free runs, does not trigger in AUTO or NORM (see Trigger schematic).

a. Set TRIGGERING MODE to AUTO. Turn LEVEL control cw and ccw to both limits. Does the trace flicker? If not, triggering signal is not reaching sweep circuit.

b. Check voltage at junction of R2147, R2152, and R2143. Does voltage vary from −2 to +3 V while turning LEVEL control throughout its range? If yes, check U2156B output. Does U2156 output level change while turning LEVEL control as above?

c. Connect a signal to CH 1. Check for trigger pulse at U2156B output. If no signal, suspect U2156A or B, or related circuits.

SYMPTOM 2.—Does not trigger in AUTO.

a. Check for trigger pulse at pin 6 of U2212B. If none, check for HI at U2212B, pin 4, while varying the LEVEL control. If pin 4 does not go HI, check for defective U2212B, U2224B, or CR2227.

SWEEP: SYMPTOM 1.—No sweep on crt (see Sweep & Horizontal Amplifier schematic).

a. Push BEAM FINDER button. If trace or dot is right of center, check at R2243 (end of resistor toward board center) for a 12 V (approximately) ramp.

b. If ramp is not present, check for approximately 0.7 V at Q2274 base.

c. If voltage at Q2274 base is high (approximately 8.0 volts) check Q2274, Q2242, Q2244, or Q2246.

SYMPTOM 2.—No trace on crt.

a. Repeat sweep symptom 1, parts a and b.

b. Check for a HI at U2234C, pin 8. If not HI, check U2234C.

NOTE

When troubleshooting the sweep or horizontal circuits, the Vertical Amplifier may be removed from the instrument.

Sweep may lock up while troubleshooting. If in doubt, switch instrument power off and back on. If there are no problems, trace should free run.

HORIZONTAL: SYMPTOM 1.—No trace on screen (see Sweep and Horizontal schematic).

a. Check output (Q2334-Q2344 collectors) for approximately 40 V ramp. If okay, check for possibly defective crt leads.

SYMPTOM 2.—Trace is on screen but short.

a. Check horizontal output (Q2334-Q2344 collectors) for approximately 40 V ramp.

b. If no ramp at output, check for 12 V ramp at junction of R2243-R2244-R2245.

c. If ramp is present, check Q2314, Q2326, Q2332, Q2334, or Q2344.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of repair and parts replacement. This section contains general information, troubleshooting information, and component replacement information.

NOTE

Be sure you are familiar with soldering techniques and parts replacement procedures before replacing any components.

Soldering Techniques

WARNING

To prevent electrical shock, or damage to the instrument, always disconnect the instrument from the power source before soldering.

The T900 Series uses some single-sided circuit boards, i.e., wiring is plated on only one side. The components are located on the front of the circuit boards. The circuit designations have been silk-screened onto the component side of the circuit board next to the components. The circuit boards are mounted with the component side out to allow access to the components. If it is necessary to replace a component, the leads may be clipped and the new part soldered to the leads of the previous one. However, be careful not to loosen the connection with the etched circuit wiring on the back of the circuit board.

For soldering, use ordinary 60/40 solder and a 15-watt soldering iron. Excessive heat can cause the etched circuit wiring to separate from the board base material. Use caution if using a higher wattage-rated soldering iron on the circuit boards.

NOTE

If the instrument does not work after replacing components by soldering to the leads of the previous one, the connection with the etched circuit wiring may be broken. To check the connections, it is necessary to remove the circuit board from the instrument. Refer to the circuit board replacement information.

Replacement Parts

All parts for the T921/T922/T922R can be ordered from your local Tektronix Field Office, but many of the components are standard items that may be more readily available locally. Check the Parts Lists for value, tolerance, ratings, and description before you replace any components.

When ordering parts from Tektronix, include the following information:

(1) Instrument type.

(2) Instrument serial number.

(3) A description of part (if electrical, include the circuit number).

(4) Tektronix part number.

COMPONENT REPLACEMENT (T921 and T922)

NOTE

Refer to the end of this section for component replacement information for the T922R.

WARNING

Disconnect the power cord plug from the power input source before replacing components.

Since the components are located on one side of the circuit boards, it may be necessary to remove the circuit

Semiconductors

Replacement of semiconductors may affect the adjustment of this instrument. After replacing semiconductors, especially if using parts other than those listed in the parts list, check the performance of the instrument to be sure that the performance has not been degraded.

WARNING

Handle silicone grease with care. Avoid getting silicone grease in the eyes. Wash hands thoroughly after use.

Replacement semiconductors should be of the original type or a direct replacement. Lead configuration of the semiconductors used in this instrument are shown at the beginning of the corrective maintenance section. Some plastic case transistors have lead configurations which do not agree with those shown there. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. Most transistors are soldered directly onto the circuit boards. Transistors having heat radiators or those mounted on the chassis use silicone grease to increase heat transfer. Replace the silicone grease when replacing these transistors. Those transistors mounted on the chassis are held in place by a metal clip.

NOTE

After replacing a power transistor, check that the collector is not shorted to ground before applying power.

Power Cord Conductor Identification

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

Fuse Replacement

The line-voltage fuse, F700, is located next to the POWER ON switch, S700, on the Interface board. The high voltage fuse, F722, is located on the Power Supply board. Refer to the Electrical Parts List for correct fuse values.

Thick Film Resistor Replacement

To remove the thick film resistors, first remove the solder from the pins and then remove the resistors.

To replace the thick film resistor, R118, match the

Interconnecting Cable and Pin Connector Replacement

The interconnecting cable assemblies are factory assembled. They consist of machine installed pin connectors mounted in plastic holders. The plastic holders are easily replaced as individual items, but if the connectors are faulty, the entire cable should be replaced.

It is possible for the pin connectors to become dislodged from the plastic holders. If this happens, the connector can be re-installed as follows (see Fig. 5-5):

1. Bend grooved portion of holder away from cable as shown.

2. Re-insert connector into its hole in plug-in portion of holder.

NOTE

Holder positions are numbered (number one is identified with a triangle).

3. Bend grooved part of holder so that connector is inserted into groove.

When plugging connector holders onto board pins, be sure to match triangle mark on holder with triangle mark on circuit board.

Shaft-Knob Removal

1. Grip knob end with one hand and shaft end with other hand.

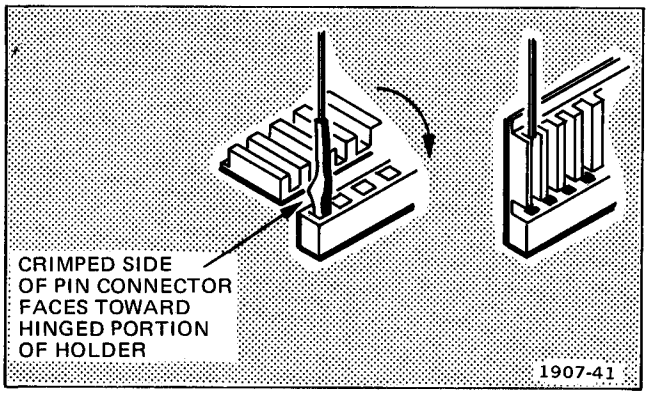


Fig. 5-5. Pin connector replacement.

2. Pull on knob, while pushing on shaft, to free recessed portion of shaft from retainer bushing (see Fig. 5-6). Some shaft-knobs may require considerable force to remove.

CAUTION

The bushing and shaft may separate abruptly. To avoid damage to the potentiometer and circuit board, or personal injury, grip both pieces firmly during shaft-knob removal. It may be helpful to grip the shaft with the tip of long-nose pliers and use a gentle rocking motion to separate the shaft from the bushing.

Vertical Amplifier Replacement

To remove the Vertical Amplifier from the instrument:

1. Support the Vertical Amplifier, while removing the retaining screws. One is between the attenuators and the other two are in the lower corners.

2. Disconnect P4 (see Fig. 5-7) from the Interface board by lifting the entire Vertical Amplifier. Be careful not to bend the pins.

To replace the Vertical Amplifier, reverse the above procedure.

NOTE

The front panel, switches, delay line, and attenuators are attached to the Vertical board.

Attenuator Replacement

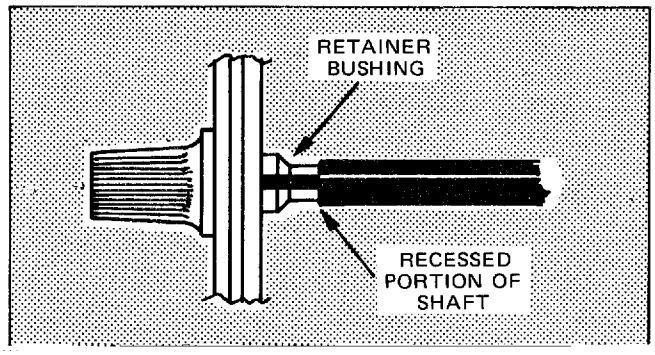
To remove the attenuator from the instrument:

1. Remove the POSITION switch knob and shaft.

2. Remove the VOLTS/DIV VAR knob and shaft. To remove the shaft, loosen the set screws holding the shaft to the potentiometer and pull the shaft out.

3. Pull the VOLTS/DIV knob and shaft out of the front panel.

4. Remove the three retaining screws from the attenuator shield and the hex nut behind the front panel below the BNC connector.



5. Pull the attenuator assembly off the Vertical Amplifier board. Be careful not to bend the connector pins.

6. To remove the attenuator shield, first unsolder the leads to the BNC connector. Take care not to touch the body of the capacitor with a hot soldering iron. Then remove the retaining screws. Be careful not to remove the screws holding the cam switch against the attenuator board. Lift the shield off the attenuator.

NOTE

The VOLTS/DIV shaft end is molded to form a key that fits into the cam. Attempting to force the shaft into the cam when it is not properly lined up, will damage the cam switch.

5. Line the VOLTS/DIV knob and shaft up with the cam and slide into place. When the shaft and cam are lined up, the shaft slides into the cam easily.

6. Replace the VOLTS/DIV VAR knob and shaft and tighten the set screws.

Cam Switch Repair and Replacement

A cam switch is actually an assembly consisting of a cam rotated by a front panel control and a set of contacts on an adjacent circuit board.

CAUTION

Repair of cam switches should be undertaken only by experienced repair personnel. Switch alignment and spring tension of the contacts must be carefully maintained for proper operation of the switch. For assistance in repair of the cam switches, contact your local Tektronix Field Office or representative.

Cleaning. If the contact is not obviously damaged, try cleaning it before replacing. Follow the cleaning procedure in the order given. Do not bend the contacts. This may temporarily fix the problem. However, bending the contact damages its self-cleaning action and causes problems in the future.

Use the following procedures to clean the contacts:

1. Operate the switch several times. The wiping action may clean the contacts.

2. Blow low pressure air in the area of the contact while operating the switch.

3. Flush the contact with isopropyl alcohol and blow dry with low-pressure air. Isopropyl alochol is flammable; avoid its use near open flame or other potential sources of ignition.

If the above procedures don't work, replace the contact strip. If cleaning the switch restores continuity, check to ensure that the contact wipes across the pad. If the contact does not wipe, replace the contact strip.

Contact Replacement. Cam Switch contacts in this instrument are part of a contact strip assembly. Refer to the mechanical parts list for ordering information.

If you do not have a replacement contact strip assembly, bend the contact for a temporary repair. If you

2. Support the Time Base while removing the retaining screw in the upper right corner (near the POSITION control), the post by the LEVEL potentiometer, and the post in the lower right corner.

3. Carefully remove the leads from P2344 (a white-red crt lead to the − side of P2344 and a white-green crt lead to the + side of P2344).

4. Remove J2 (see Fig. 5-7) from the Interface board by pulling the entire Time Base toward the right side of the instrument. Be careful not to bend the pins.

To replace the Time Base, reverse the above procedure.

To remove the Trigger board, unplug it from the Time

Power Supply Board Replacement

To remove the Low Voltage Power Supply from the instrument:

1. Remove the two retaining screws holding the heat sink to the rear subpanel.

2. Remove the top right and bottom left screws (the ones holding the Power Supply board to the crt shield). The other two screws hold the transformer to the Power Supply board.

3. Disconnect P7 from the Interface board by lifting the Power Supply board and transformer out. (see Fig. 5-7).

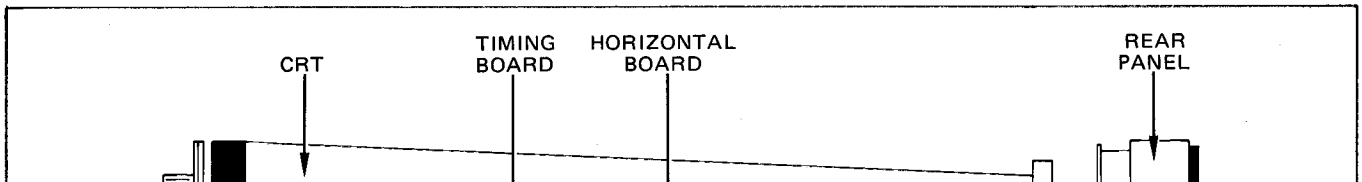
To replace the Power Supply board, reverse the above procedure

To remove the Timing board, first remove the SEC/DIV knob and the POSITION control shaft. Then unplug the Timing board from the Time base and pull the SEC/DIV shaft back out of the front panel. To reinstall the timing board, reverse the foregoing procedure.

Interface Board Replacement

To remove the Interface board from the instrument:

1. Remove the Vertical Amplifier and Time Base.



2. Use a small screwdriver to remove the clip holding Q458 to the rear subpanel.

3. Remove the front panel knobs and shafts.

4. Remove the high-voltage shield and the two posts underneath the shield.

5. Disconnect J138 (white-blue wire), J148 (white-brown wire), J470 (a brown two-lead connector and a black two-lead connector), J475, J465, J466, and the Cal Out lead (goes to PROBE ADJ on front panel). The J138 and J148 wires pass through the board to the crt.

NOTE

To disconnect J475, J466, and J465, lift the cable retainers with a screwdriver until [illegible]

cable. Also remove the high-voltage lead from U460 to the crt.

WARNING

The crt anode and the output terminal of high-voltage multiplier U460 may retain a 10,000 volt charge after the instrument is turned off. To avoid electrical shock, ground both the output terminal of U460 and the crt high-voltage anode lead to chassis ground.

To remove the crt from the instrument, disconnect the power cord plug from the power input source and remove the cabinet halves. Turn the front of the instrument toward you, and perform the following steps.

1. Remove the two screws holding the high-voltage shield over the Interface board, and remove the shield.

WARNING

The crt anode and the output terminal of high-voltage multiplier U460 may retain a 10,000 volt charge after the instrument is turned off. To avoid electrical shock, ground both the output terminal of U460 and the crt high-voltage anode lead to chassis ground.

2. Grip the insulated portion of the anode lead and disconnect it from the U460 output terminal, and ground both terminals to chassis. Pull the free end of the anode lead out through the chassis holes. This lead is part of the crt and is supplied with the new crt.

3. Grip the 14-pin crt base socket, and pull it backward off the base of the crt.

4. Disconnect the four-pin plug from J470 on the

NOTE

Although it may be convenient, it is not necessary to remove any front panel or subpanel controls or parts. The foregoing steps will allow the front of the crt to be moved to the right of its normal position while slightly bending the plastic subpanel to allow clearance for the crt to be pulled forward out of its

3. Remove the four screws holding the bezel. Remove the bezel.

4. Remove the front panel and the plastic module surrounding it.

9. Gently press forward on the crt base, supporting the front of the crt, until the front extends far enough forward to grasp. Pull the crt the rest of the way out of its shield.

10. To install a new crt, reverse the above procedure.

COMPONENT REPLACEMENT (T922R)

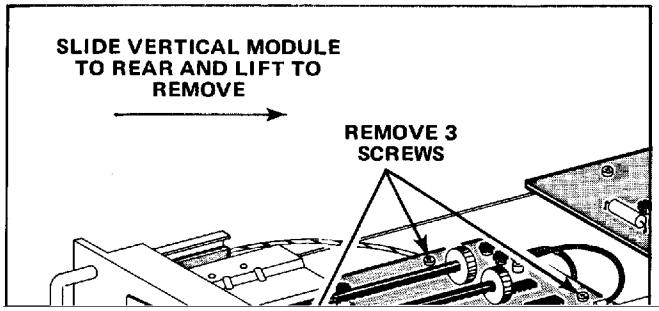
Vertical Module Replacement

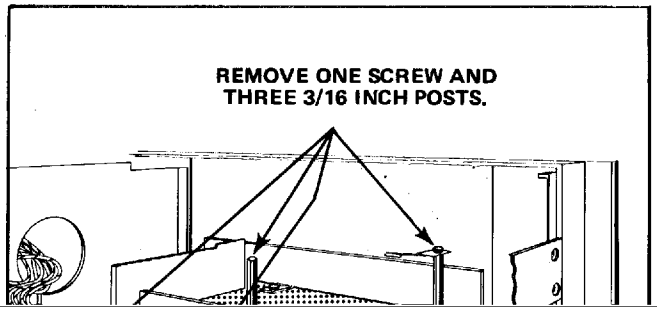
1. Remove right handle. It is held on by two screws on the back of the front panel.

P4 connector

Three vertical input harmonica connectors (3 pin) from FRONT-REAR switch boards.

6. Remove three screws (see Fig. 5-10). Remove vertical module by sliding it forward slightly, lifting the rear to clear the power supply, then sliding it back and out of the instrument.


SLIDE VERTICAL MODULE TO REAR AND LIFT TO REMOVE
REMOVE 3 SCREWS


REMOVE ONE SCREW AND THREE 3/16 INCH POSTS.

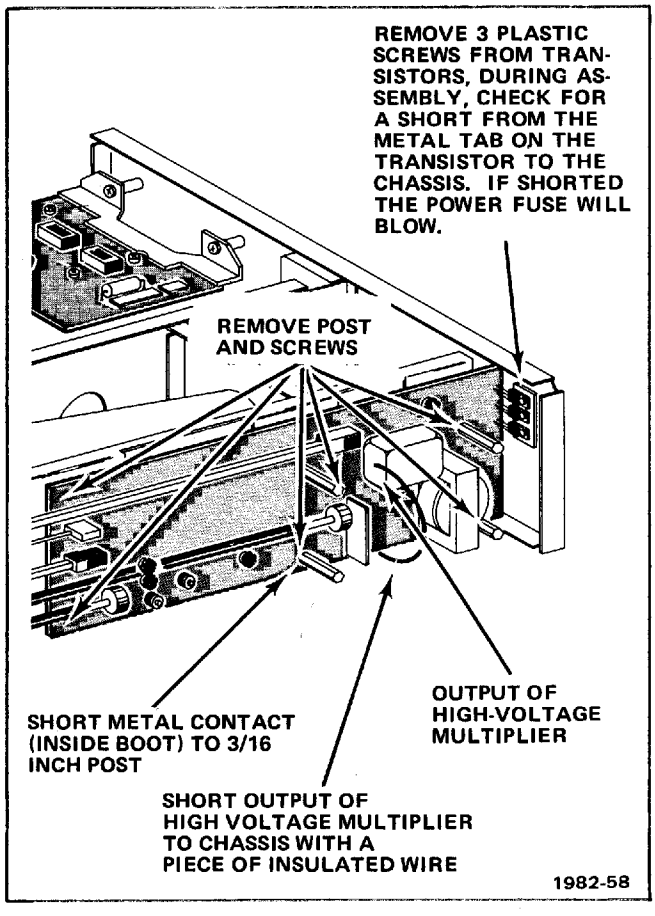


Fig. 5-12. T922R interface board replacement.

7. Remove crt socket.

8. Make note of their location to aid reassembly, then disconnect all harmonica and molex connectors from the interface board. Don't forget to disconnect the vertical crt leads and quide them through the holes in the interface board.

9. Remove the screws and posts from the interface board (see Fig. 5-12).

10. Lift the interface board out of the instrument.

11. During reassembly, use the plastic screws to hold the power transistors (see Fig. 5-12).

Power Module Replacement

1. Remove the plastic shield covering the power module.

2. Remove P7 from the power module.

3. Remove two screws and two bolts from the power module (see Fig. 5-13).

4. Lift the power module away from the instrument.

Buffer Board Replacement

1. To aid in reassembly, make note of the positions of the harmonica connectors on the buffer board. Then, disconnect the harmonica connectors from the buffer board.

2. Remove the four screws from the buffer board.

NOTE

You don't need to remove the switch extensions to remove the buffer board.

3. Slide the buffer board toward the rear of the instrument to remove.

CRT Replacement

1. Remove the four screws from the left side rail and remove the side rail.

2. Remove the four screws from the high-voltage shield and lift the shield away from the instrument.

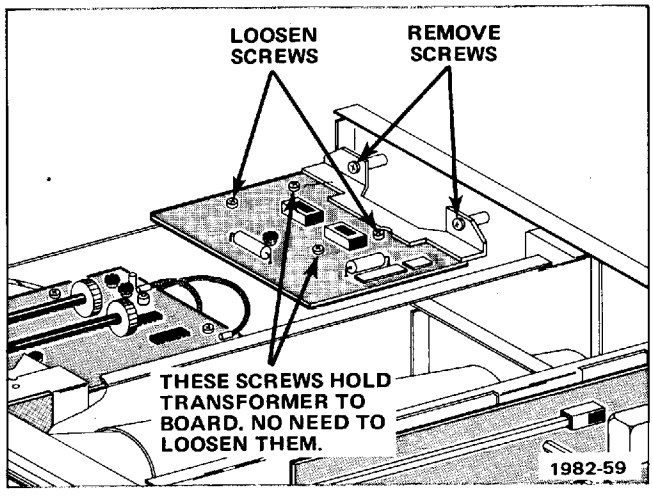


Fig. 5-13. T922R power module replacement.

WARNING

The crt anode and the high-voltage multiplier will hold a charge after you turn off the instrument. To prevent a shock hazard, use only one hand to remove the anode lead. Then, touch the anode lead to one of the posts to discharge the crt (see Fig. 5-12). Also, take a short piece of insulated wire and short the output of the high-voltage multiplier to the chassis (see Fig. 5-12).

3. Slide the crt anode lead out from under the plastic clip which holds it next to the chassis near the interface board.

4. Make note of the positions of the four crt leads to aid in reassembly. Remove the four crt leads from the neck of the crt.

5. Remove crt socket from the base of the crt.

6. Lift the plastic mask and light filter away from the crt to remove.

CAUTION

After you remove the bezel, the crt can slide forward. To avoid crt damage, hold one hand over the crt face if you must turn or move the instrument.

SCALE ILLUM Lamp Replacement

1. Lift the plastic mask and light filter away from crt to remove.

2. Disconnect P816 from the SCALE ILLUM assembly.

3. Pull SCALE ILLUM assembly away from the crt to remove. If this is difficult, push against the two screws from behind the front panel (see Fig. 5-14).

4. Remove the two screws holding the plastic piece to the circuit board. Remove the plastic piece.

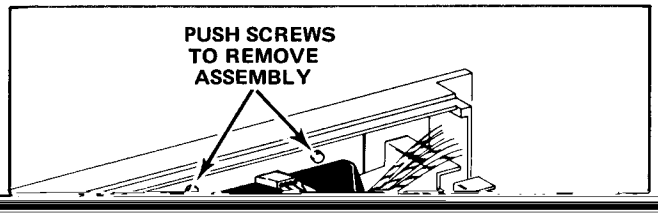
5. Unsolder the defective lamp and replace.

Fuse Replacement

WARNING

Line voltage is present on the fuse whenever the power cord is plugged in. To prevent a shock hazard, disconnect the power cord.

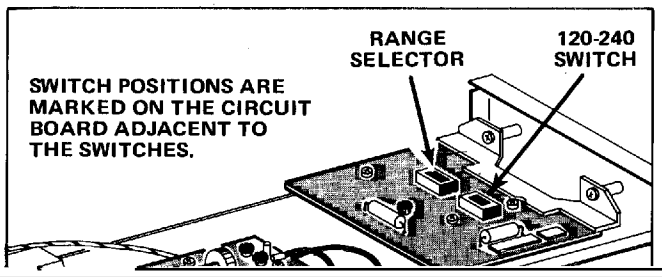
The fuse is located in a holder near the rear of the interface board. To remove, grasp firmly and pull away from the interface board.



T922R LINE VOLTAGE AND RANGE SELECTION

CAUTION

When you change the line voltage range, be sure you change the position of the screw on the AC RMS RANGE indicator on the rear panel.



REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

Changes to Tektronix instruments are sometimes made to accommodate improved

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

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

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

SPECIAL NOTES AND SYMBOLS

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

ITEM NAME

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

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P O BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
05091	TRI-ORDINATE CORPORATION	343 SNYDER AVENUE	BERKELEY HEIGHTS, NJ 07922
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
07910	TELEDYNE SEMICONDUCTOR	12515 CHADRON AVE.	HAWTHORNE, CA 90250
08806	GENERAL ELECTRIC CO., MINIATURE LAMP PRODUCTS DEPARTMENT	NELA PARK	CLEVELAND, OH 44112
12697	CLAROSTAT MFG. CO., INC.	LOWER WASHINGTON STREET	DOVER, NH 03820
14099	SEMTECH CORP.	652 MITCHELL RD.	NEWBURY PARK, CA 91320
15818	TELEDYNE SEMICONDUCTOR	1300 TERRA BELLA AVE.	MOUNTAIN VIEW, CA 94043
19396	IILINOIS TOOL WORKS, INC. PAKTRON DIV.	900 FOLLIN LANE, SE	VIENNA, VA 22180
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
27264	MOLEX PRODUCTS CO.	5224 KATRINE AVE.	DOWNERS GROVE, IL 60515
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED		

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1[1]	670-4235-00			CKT BOARD ASSY:INTERFACE	80009	670-4235-00
A1[2]	670-3738-00	B010100	B010125	CKT BOARD ASSY:INTERFACE	80009	670-3738-00
A1[2]	670-3738-01	B010126	B010756	CKT BOARD ASSY:INTERFACE	80009	670-3738-01
A1[2]	670-3738-03	B010757		CKT BOARD ASSY:INTERFACE	80009	670-3738-03
A1[3]	670-3738-00	B010100	B010349	CKT BOARD ASSY:INTERFACE	80009	670-3738-00
A1[3]	670-3738-01	B010350	B015123	CKT BOARD ASSY:INTERFACE	80009	670-3738-01
A1[3]	670-3738-03	B015124		CKT BOARD ASSY:INTERFACE	80009	670-3738-03
A2	670-3980-00			CKT BOARD ASSY:L.V. POWER SUPPLY	80009	670-3980-00
A6[2]	670-3972-00	B010100	B010549	CKT BOARD ASSY:CH1 ATTENUATOR	80009	670-3972-00
A6[2]	670-3972-02	B010550	019564	CKT BOARD ASSY:CH1 ATTENUATOR	80009	670-3972-02
A6[3]	670-3972-00	B010100	B013399	CKT BOARD ASSY:CH1 ATTENUATOR	80009	670-3972-00
A6[3]	670-3972-02	B013400		CKT BOARD ASSY:CH1 ATTENUATOR	80009	670-3972-02
A6[1]	670-3972-00	B010100	B010429	CKT BOARD ASSY:CH1 ATTENUATOR	80009	670-3972-00
A6[1]	670-3972-02	B010430		CKT BOARD ASSY:CH1 ATTENUATOR	80009	670-3972-02
A7[3]	670-3973-00	B010100	B013399	CKT BOARD ASSY:CH2 ATTENUATOR	80009	670-3973-00
A7[3]	670-3973-02	B013400		CKT BOARD ASSY:CH2 ATTENUATOR	80009	670-3973-02
A7[1]	670-3973-00	B010100	B010409	CKT BOARD ASSY:CH2 ATTENUATOR	80009	670-3973-00
A7[1]	670-3973-02	B010410		CKT BOARD ASSY:CH2 ATTENUATOR	80009	670-3973-02
A8[2]	670-4109-00	B010100	B010756	CKT BOARD ASSY:VERTICAL	80009	670-4109-00
A8[2]	670-4109-01	B010757		CKT BOARD ASSY:VERTICAL	80009	670-4109-01
A8[3]	670-3740-00	B010100	B014355	CKT BOARD ASSY:VERTICAL	80009	670-3740-00
A8[3]	670-3740-01	B014356		CKT BOARD ASSY:VERTICAL	80009	670-3740-01
A8[1]	670-3740-00	B010100	B010409	CKT BOARD ASSY:VERTICAL	80009	670-3740-00
A8[1]	670-3740-01	B010410		CKT BOARD ASSY:VERTICAL	80009	670-3740-01
A11[2]	670-3894-00	B010100	B010129	CKT BOARD ASSY:TRIGGER SWITCH	80009	670-3894-00
A11[2]	670-4230-00	B010130	B010599	CKT BOARD ASSY:TRIGGER SWITCH	80009	670-4230-00
A11[2]	670-4230-01	B010600		CKT BOARD ASSY:TRIGGER SWITCH	80009	670-4230-01

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C423[1]	281-0627-00	B010100	B010739	CAP.,FXD,CER DI:1PF,+/-0.25PF,500V	72982	301-000C0K0109C

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C2114[1]	281-0764-00	B010100	B010129X	CAP.,FXD,CER DI:82PF,5%,100V	72982	314022X5P0820J
C2114[2]	281-0764-00	B010100	B010169X	CAP.,FXD,CER DI:82PF,5%,100V	72982	314022X5P0820J
C2116[2]	281-0775-00	B010100	B010129X	CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2116[1]	281-0775-00	B010100	B010169X	CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2123[1]	290-0114-00	B010100	B010129X	CAP.,FXD,ELCTLT:47UF,20%,6V	56289	150D476X0006B2
C2123[2]	290-0114-00	B010100	B010169X	CAP.,FXD,ELCTLT:47UF,20%,6V	56289	150D476X0006B2
C2125	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C2128	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2132	290-0201-00			CAP.,FXD,ELCTLT:100UF,+75-10%,15V	56289	30D107G015DC9
C2136	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2147	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2156	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2163	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V	72982	390049X5P0470K
C2165	290-0183-00			CAP.,FXD,ELCTLT:1UF,10%,35V	56289	162D105X9035CD2
C2167	290-0183-00			CAP.,FXD,ELCTLT:1UF,10%,35V	56289	162D105X9035CD2
C2173	290-0183-00			CAP.,FXD,ELCTLT:1UF,10%,35V	56289	162D105X9035CD2
C2174	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C2175	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2176	281-0774-00			CAP.,FXD,CER DI:0.022UF,20%,100V	72982	8045A9ABDZ2U223M
C2182	290-0183-00			CAP.,FXD,ELCTLT:1UF,10%,35V	56289	162D105X9035CD2
C2212[1]	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C2213[1]	281-0634-00	XB010300	B010633	CAP.,FXD,CER DI:10PF,+/-0.25PF,500V	72982	374-011C0G0100C
C2213[1]	281-0757-00	B010634		CAP.,FXD,CER DI:10PF,20%,100V	72982	314-022C0G100M
C2213[2]	281-0634-00	XB011000	B014318	CAP.,FXD,CER DI:10PF,+/-0.25PF,500V	72982	374-011C0G0100C
C2213[2]	281-0757-00	B014319		CAP.,FXD,CER DI:10PF,20%,100V	72982	314-022C0G100M
C2213[3]	281-0757-00			CAP.,FXD,CER DI:10PF,20%,100V	72982	314-022C0G100M
C2226	290-0135-00			CAP.,FXD,ELCTLT:15UF,20%,20V	56289	150D156X0020B2
C2233	283-0706-00			CAP.,FXD,MICA D:91PF,+/-1PF,500V	00853	D15-5E910F0
C2234	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C4114[1]	281-0214-00	B010100	B010599	CAP.,VAR,CER DI:0.5-3PF,400V	80031	2222-801-96138
C4114[1]	281-0220-00	B010560		CAP.,VAR,CER DI:1-5.5PF,400V	80031	2222-801-96139
C4114[2]	281-0214-00	B010100	B012199	CAP.,VAR,CER DI:0.5-3PF,400V	80031	2222-801-96138
C4114[2]	281-0220-00	B012200		CAP.,VAR,CER DI:1-5.5PF,400V	80031	2222-801-96139
C4114[3]	281-0220-00			CAP.,VAR,CER DI:1-5.5PF,400V	80031	2222-801-96139
C4116	281-0759-00			CAP.,FXD,CER DI:22PF,10%,100V	72982	390-049X5P0220K
C4123[1]	281-0773-00	B010100	B010339	CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C4123[1]	283-0002-00	B010340		CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
C4376[1]	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005H9AABZ5U104M
C4377[1]	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
C4385[2]	281-0797-00	XB010500		CAP.,FXD,CER DI:15PF,10%,100V	72982	8005-D-C0G-150K
C4385[3]	281-0797-00			CAP.,FXD,CER DI:15PF,10%,100V	72982	8005-D-C0G-150K
C4386[1]	281-0770-00			CAP.,FXD,CER DI:0.001UF,20%,100V	72982	314022X5P0102M
C4392	283-0177-00			CAP.,FXD,CER DI:1UF,+80-20%,25V	72982	8131N039 E 105Z
C4393	283-0177-00			CAP..FXD.CER DI:1UF.+80-20%.25V	72982	8131N039 E 105Z
C4394	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4395[1]	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4396	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4397[1]	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
CR26	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR27	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR416	152-0075-00			SEMICOND DEVICE:GE,25V,40MA	80009	152-0075-00
CR418	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR437	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR443	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR463	152-0639-00			SEMICOND DEVICE:RECT,SI,10KV,10MA	14099	SEF100
CR465	152-0639-00			SEMICOND DEVICE:RECT,SI,10KV,10MA	14099	SEF100
CR721	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR722	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR723	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR724	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR732	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR734	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR737	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR738	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR741	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR742	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR743	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR744	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR758	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR764	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR765	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR766	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR767	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR778	152-0066-03			SEMICOND DEVICE:RECT,SI,400V,1A	80009	152-0066-03
CR816[3]	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR2103[4]	152-0141-02	XB010130		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2103[2]	152-0141-02	XB010170		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2103[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2108[4]	152-0141-02	XB010130		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2108[2]	152-0141-02	XB010170		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2108[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2112[4]	152-0141-02	XB010130		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2112[2]	152-0141-02	XB010170		SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2112[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2115	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2116[4]	152-0141-02	B010100	B010129X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2116[2]	152-0141-02	B010100	B010169X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2118[4]	152-0141-02	B010100	B010129X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2118[2]	152-0141-02	B010100	B010169X	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152

[1] T922 and T922R only
[2] T922 only
[3] T922R only
[4] T921 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR2124	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2135	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2182	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2186	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2227	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2233	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2234[1]	152-0141-02	B010100	B010179	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2234[1]	152-0245-00	B010180		SEMICOND DEVICE:SILICON,10NA AT 5V	80009	152-0245-00
CR2234[2]	152-0141-02	B010100	B010289	SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2234[2]	152-0245-00	B010290		SEMICOND DEVICE:SILICON,10NA AT 5V	80009	152-0245-00
CR2234[3]	152-0245-00			SEMICOND DEVICE:SILICON,10NA AT 5V	80009	152-0245-00
CR2317	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2326	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2331	152-0075-00			SEMICOND DEVICE:GE,25V,40MA	80009	152-0075-00
CR2332	152-0075-00			SEMICOND DEVICE:GE,25V,40MA	80009	152-0075-00
CR2334	152-0061-00			SEMICOND DEVICE:SILICON,175V,100MA	80009	152-0061-00
CR2342	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2356	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2400[3]	150-1029-00			LAMP,LED:2.0V,GREEN	53184	XC209G
CR2404[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2406[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2407[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2409[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR2431[3]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4123	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR4223[4]	152-0246-00			SEMICOND DEVICE:SILICON,400PIV,200MA	07910	CD12676
CR4302[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4303[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4304[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4305[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4312[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4313[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4314[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4315[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4362[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4363[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4364[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4366[4]	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4367	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
DL4339[1]	119-0733-00	B010100	B011052	DELAY LINE,ELEC:200 NSEC,150 OHM,COIL	80009	119-0733-00
DL4339[1]	119-0733-01	B011053		DELAY LINE,ELEC:200 NSEC,150 OHM,COIL	80009	119-0733-01
DL4339[2]	119-0733-00	B010100	B015972	DELAY LINE,ELEC:200 NSEC,150 OHM,COIL	80009	119-0733-00
DL4339[2]	119-0733-01	B015973		DELAY LINE,ELEC:200 NSEC,150 OHM,COIL	80009	119-0733-01
DL4339[3]	119-0733-00	B010100	B010659	DELAY LINE,ELEC:200 NSEC,150 OHM,COIL	80009	119-0733-00
DL4339[3]	119-0733-01	B010660		DELAY LINE,ELEC:200 NSEC,150 OHM,COIL	80009	119-0733-01
DS463	150-0002-00			LAMP,GLOW:0.5 MA 60/125V	08806	NE2T-A1AT
DS465	150-0002-00			LAMP,GLOW:0.5 MA 60/125V	08806	NE2T-A1AT
DS796	150-0035-00			LAMP,GLOW:90V,0.3MA	08806	A1D-T
DS816[3]	150-0088-00			LAMP,INCAND:0.04A,28V	08806	2187D

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
F722	159-0051-00	9/82 Resistor inside		FUSE,CARTRIDGE:3AG,0.062A,250V,20 SEC	71400	MDL1-16
J2	131-1792-00			CONTACT ASSY,EL:12 MALE CONTACT,FLAT WAFER	27264	09-70-2121
J4	131-1795-00			CONNECTOR,RCPT,:12 FEMALE CONTACT,RT-ANGLE	27264	09-62-3121
J7	131-1749-00			CONNECTOR,RCPT,:10 FEMALE CONTACT	27264	09-52-3101
J419	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
J2100	131-1802-00			CONNECTOR,RCPT,:15 CONTACTS	80009	131-1802-00
J2110	131-0106-02			CONNECTOR,RCPT,:BNC	80009	131-0106-02
J2250	131-1801-00			CONNECTOR,RCPT,:9 CONTACTS	80009	131-1801-00
J2260	131-1802-00			CONNECTOR,RCPT,:15 CONTACTS	80009	131-1802-00
J4110	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
J4210	131-0955-00			CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
L470	108-0819-00			COIL,TUBE DEFLE:X-Y ALIGNMENT	80009	108-0819-00
L472	108-0818-00			COIL,TUBE DEFLE:TRACE ROTATION	80009	108-0818-00
Q112	151-0199-00	2N3640		TRANSISTOR:SILICON,PNP	27014	ST65038
Q122	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q134	151-0127-00	2N2369		TRANSISTOR:SILICON,NPN	80009	151-0127-00
Q136	151-0127-00			TRANSISTOR:SILICON,NPN	80009	151-0127-00
Q144	151-0127-00			TRANSISTOR:SILICON,NPN	80009	151-0127-00
Q146	151-0127-00			TRANSISTOR:SILICON,NPN	80009	151-0127-00
Q160[1]	151-0190-06	2N3904		TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q162[1]	151-0190-06			TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q166[1]	151-0188-00	2N3906		TRANSISTOR:SILICON,PNP	01295	2N3906
Q416	151-0190-06	2N3904		TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q424	151-0190-06			TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q426	151-0347-00	2N5551		TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q434	151-0350-00	2N3401		TRANSISTOR:SILICON,PNP	80009	151-0350-00
Q446	151-0126-00	2N2484		TRANSISTOR:SILICON,NPN	15818	2N2484
Q454	151-0188-00	2N3906		TRANSISTOR:SILICON,PNP	01295	2N3906
Q458	151-0423-00	TIP50		TRANSISTOR:SILICON,NPN	01295	TIP50
Q722	151-0347-00	2N5551		TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q726	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q734	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q736	151-0497-00	TIP47		TRANSISTOR:SILICON,NPN	02735	RCA47
Q752	151-0302-00	2N2222A		TRANSISTOR:SILICON,NPN	04713	2N2222A
Q754	151-0302-00	2N2222A		TRANSISTOR:SILICON,NPN	04713	2N2222A
Q756	151-0478-00	TIP31A		TRANSISTOR:SILICON,NPN	01295	TIP31A
Q772	151-0301-00	2N2907A,		TRANSISTOR:SILICON,PNP	04713	2N2907A
Q774	151-0301-00			TRANSISTOR:SILICON,PNP	04713	2N2907A
Q776	151-0478-00	TIP31A		TRANSISTOR:SILICON,NPN	01295	TIP31A
Q792	151-0224-00	2N3904		TRANSISTOR:SILICON,NPN	07263	2N3904
Q796	151-0347-00	2N5551		TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q812[1]	151-0497-01	TEKSPEC (try TIP47?)		TRANSISTOR:SILICON,NPN	80009	151-0497-01
Q816[1]	151-0497-01	~~TIP47~~ TEKSPEC.		TRANSISTOR:SILICON,NPN	80009	151-0497-01
Q818[1]	151-0347-00	2N5551		TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q2104[2] Q2106]	151-1042-00	XB010130 2N5454 Nch. FET		SEMICOND DVC SE:MATCHED PAIR FET	80009	151-1042-00
Q2104[1] Q1026]	151-1042-00			SEMICOND DVC SE:MATCHED PAIR FET	80009	151-1042-00
Q2104[3] Q2106]	151-1042-00	2N5454 XB010170		SEMICOND DVC SE:MATCHED PAIR FET	80009	151-1042-00
Q2108[2]	151-0188-00	XB010130 2N3906		TRANSISTOR:SILICON,PNP	01295	2N3906

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q2108[1]	151-0188-00	2N3906		TRANSISTOR:SILICON,PNP	01295	2N3906
Q2114, Q2116[2]	151-1042-00	B010100	B010129X	SEMICOND DVC SE:MATCHED PAIR FET	80009	151-1042-00
	2N5454					
Q2114, Q2116[3]	151-1042-00	B010100	B010169X	SEMICOND DVC SE:MATCHED PAIR FET	80009	151-1042-00
Q2124	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2134	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2136	151-0188-00	2N3906		TRANSISTOR:SILICON,PNP	01295	2N3906
Q2174	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2176[2]	151-0188-00	B010100	B010524	TRANSISTOR:SILICON,PNP	01295	2N3906
Q2176[2]	151-0216-02	B010525		TRANSISTOR:SILICON,PNP,SELECTED	80009	151-0216-02
2N3906 Q2176[3]	151-0188-00	B010100	B012649	TRANSISTOR:SILICON,PNP	01295	2N3906
Q2176[3]	151-0216-02	B012650		TRANSISTOR:SILICON,PNP,SELECTED	80009	151-0216-02
Q2176[1]	151-0216-02	MPS6523 (NTE159)		TRANSISTOR:SILICON,PNP,SELECTED	80009	151-0216-02
Q2242, Q2244	151-1042-00	2N5454		SEMICOND DVC SE:MATCHED PAIR FET	80009	151-1042-00
Q2246	151-0190-06			TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q2274	151-0190-06	2N3904		TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q2314[2]	151-0190-06	B010100	B010633	TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q2314[2]	151-0192-03	B0106634		TRANSISTOR:SILICON,NPN	80009	151-0192-03
	see below					
Q2314[3]	151-0190-06	2N3904 B010100	B014318	TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q2314[3]	151-0192-03	B014319		TRANSISTOR:SILICON,NPN	80009	151-0192-03
Q2314[1]	151-0192-03	TPS6521 (NTE123AP)		TRANSISTOR:SILICON,NPN	80009	151-0192-03
Q2326	151-0188-00	2N3906		TRANSISTOR:SILICON,PNP	01295	2N3906
Q2332	151-0188-00			TRANSISTOR:SILICON,PNP	01295	2N3906
Q2334	151-0347-00	2N5551		TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q2344	151-0347-00			TRANSISTOR:SILICON,NPN	80009	151-0347-00
Q2354	151-0190-06	2N3904		TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q2412[1]	151-0223-03	2N5769		TRANSISTOR:SILICON,NPN	80009	151-0223-03
Q2422[1]	151-0190-06	2N3904		TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q2432[1]	151-0190-06			TRANSISTOR:SILICON,NPN	80009	151-0190-06
Q4122A,B	151-1090-01	NTE461		TRANSISTOR:SILICON,DUAL,N CHANNEL,FET	80009	151-1090-01
Q4174	151-0199-00	2N3640		TRANSISTOR:SILICON,PNP	27014	ST65038
Q4176	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q4222A,B[4]	151-1090-01	FET, N Channel, Dual NTE461		TRANSISTOR:SILICON,DUAL,N CHANNEL,FET	80009	151-1090-01
Q4274[4]	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q4276[4]	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q4302	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q4303[4]	151-0199-00	2N3640		TRANSISTOR:SILICON,PNP	27014	ST65038
Q4312[4]	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q4313[4]	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q4322[4]	151-0199-00	B010100	B010209	TRANSISTOR:SILICON,PNP	27014	ST65038

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Q4372[1]	151-0223-00			TRANSISTOR:SILICON,NPN	80009	151-0223-00
R22	315-0134-00			RES.,FXD,CMPSN:130K OHM,5%,0.25W	01121	CB1345
R23	315-0434-00			RES.,FXD,CMPSN:430K OHM,5%,0.25W	01121	CB4345
R24	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R25	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R26	321-0235-00			RES.,FXD,FILM:2.74K OHM,1%,0.125W	91637	MFF1816G27400F
R27	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	MFF1816G200R0F
R112	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R114	311-1563-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	73138	91A R1K
R115	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R116	321-0163-00			RES.,FXD,FILM:487 OHM,1%,0.125W	91637	MFF1816G487R0F
R117	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R118A-P	307-0494-00			RES.,FXD,FILM:NETWORK,VERT OUTPUT	80009	307-0494-00
R122	321-0085-00			RES.,FXD,FILM:75 OHM,1%,0.125W	91637	MFF1816G75R00F
R124	315-0560-00			RES.,FXD,CMPSN:56 OHM,5%,0.25W	01121	CB5605
R126	311-1559-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91A-10001M
R158[2]	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R159[2]	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R160[2]	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R162[2]	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
R163[2]	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R165[2]	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R166[2]	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R167[2]	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R168[2]	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R169[2]	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
R412	311-1786-00			RES.,VAR,NONWIR:2K OHM,20%,2W	12697	381-CM40946
R413	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R414	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	01121	CB3325
R416	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
R417	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R419	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R423	315-0513-00			RES.,FXD,CMPSN:51K OHM,5%,0.25W	01121	CB5135
R424	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R425	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R426	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R432	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R433	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R434	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R435[3]	315-0510-00	B010100	B011069	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R435[3]	315-0360-00	B011070		RES.,FXD,CMPSN:36 OHM,5%,0.25W	01121	CB3605
R435[4]	315-0510-00	B010100	B015779	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R435[4]	315-0360-00	B015780		RES.,FXD,CMPSN:36 OHM,5%,0.25W	01121	CB3605
R435[2]	315-0510-00	B010100	B010739	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R435[2]	315-0360-00	B010740		RES.,FXD,CMPSN:36 OHM,5%,0.25W	01121	CB3605
R437	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R443	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
R444A-D	307-0495-01			RES,NTWK,FXD,FI:NETWORK,HV,NON STORAGE	80009	307-0495-01
R445	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R446	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R447	315-0683-00			RES.,FXD,CMPSN:68K OHM,5%,0.25W	01121	CB6835
R453	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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R455	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R457	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R458	301-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.50W	01121	EB5105
R462	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R463	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
R464	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
R465	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R468[1]	311-1784-00			RES.,VAR,NONWIR:5M OHM,20%,1W	12697	381-CM40944
R472[1]	311-0086-00			RES.,VAR,NONWIR:2.5K OHM,20%,0.50W	01121	W-7699
R472	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91A R2K
R473	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A R100K
R474	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91A R2K
R475	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
R476[1]	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
R477[1]	311-1200-00			RES.,VAR,NONWIR:100K OHM,20%,0.50W	01121	W-7861
R477	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91A R100K
R478	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R722	301-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.50W	01121	EB4735
R726	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R732	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
R733	321-0368-00			RES.,FXD,FILM:66.5K OHM,1%,0.125W	91637	MFF1816G66501F
R734	308-0574-00			RES.,FXD,WW:10 OHM,5%,2W	91637	RS2B162K10R00J
R736	321-0385-00			RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816G10002F
R737	321-0280-00			RES.,FXD,FILM:8.06K OHM,1%,0.125W	91637	MFF1816G80600F
R741	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
R742	315-0563-00			RES.,FXD,CMPSN:56K OHM,5%,0.25W	01121	CB5635
R745	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
R746	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R747	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R752	321-0130-00			RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
R753	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R754	308-0755-00			RES.,FXD,WW:0.75 OHM,5%,2W	75042	BWH-R7500J
R756	321-0671-00			RES.,FXD,FILM:8.51K OHM,0.5%,0.125W	91637	MFF1816D85100D
R757	321-0671-00			RES.,FXD,FILM:8.51K OHM,0.5%,0.125W	91637	MFF1816D85100D
R762	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R763	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R764	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
R765	321-0130-00			RES.,FXD,FILM:221 OHM,1%,0.125W	91637	MFF1816G221R0F
R766	301-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.50W	01121	EB3915
R772	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	91637	MFF1816G45300F
R773	311-1563-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	73138	91A R1K
R774	321-0232-00			RES.,FXD,FILM:2.55K OHM,1%,0.125W	91637	MFF1816G25500F
R775	308-0755-00			RES.,FXD,WW:0.75 OHM,5%,2W	75042	BWH-R7500J
R784	308-0781-00			RES.,FXD,WW:1.34K OHM,2%,10W	91637	HLW10R1Z-13400G
R792	321-0400-00			RES.,FXD,FILM:143K OHM,1%,0.125W	91637	MFF1816G14302F
R792	321-0402-00			RES.,FXD,FILM:150K OHM,1%,0.125W	91637	MFF1816G15002F
R793	321-0283-00			RES.,FXD,FILM:8.66K OHM,1%,0.125W	91637	MFF1816G86600F
R794[1]	321-0393-00			RES.,FXD,FILM:121K OHM,1%,0.125W	91637	MFF1816G12102F
R794	321-0394-00			RES.,FXD,FILM:124K OHM,1%,0.125W	91637	MFF1816G12402F
R795	321-0283-00			RES.,FXD,FILM:8.66K OHM,1%,0.125W	91637	MFF1816G86600F
R796	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R797	315-0205-00			RES.,FXD,CMPSN:2M OHM,5%,0.25W	01121	CB2055
R812[1]	311-0881-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	01121	W7674

[1] T922R only

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R813[1]	321-0407-00			RES.,FXD,FILM:169K OHM,1%,0.125W	91637	MFF1816G16902F
R814[1]	321-0372-00			RES.,FXD,FILM:73.2K OHM,1%,0.125W	91637	MFF1816G73201F
R815[1]	321-0403-00			RES.,FXD,FILM:154K OHM,1%,0.125W	91637	MFF1816G15402F
R817[1]	315-0470-00	B010100	B010385	RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R817[1]	308-0298-00	B010386		RES.,FXD,WW:560 OHM,5%,3W	91637	CW2B-B560R0J
R818	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
R1998[1]	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R2101[2]	321-0463-00	XB010130		RES.,FXD,FILM:649K OHM,1%,0.125W	91637	MFF1816G64902F
R2101[3]	321-0463-00	XB010170		RES.,FXD,FILM:649K OHM,1%,0.125W	91637	MFF1816G64902F
R2101[1]	321-0463-00			RES.,FXD,FILM:649K OHM,1%,0.125W	91637	MFF1816G64902F
R2102	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R2103[2]	321-0439-00	XB010130		RES.,FXD,FILM:365K OHM,1%,0.125W	91637	MFF1816G36502F
R2103[3]	321-0439-00	XB010170		RES.,FXD,FILM:365K OHM,1%,0.125W	91637	MFF1816G36502F
R2103[1]	321-0439-00			RES.,FXD,FILM:365K OHM,1%,0.125W	91637	MFF1816G36502F
R2104[2]	315-0510-00	XB010130		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2104[3]	315-0510-00	XB010170		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2104[1]	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2106[2]	315-0510-00	XB010130		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2106[3]	315-0510-00	XB010170		RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2106[1]	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2107[2]	315-0102-00	XB010130	B010149	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2107[2]	315-0202-00	B010150		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2107[3]	315-0102-00	XB010170	B010799	RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2107[3]	315-0202-00	B010800		RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2107[1]	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2108[2]	315-0272-00	XB010130		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2108[3]	315-0272-00	XB010170		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2108[1]	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2109[2]	315-0201-00	XB010130		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R2109[3]	315-0201-00	XB010170		RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015
R2109[1]	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	01121	CB2015

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R2114[1]	321-0251-00	B010170		RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R2114[2]	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R2115[3]	321-0218-00	B010100	B010129	RES.,FXD,FILM:1.82K OHM,1%,0.125W	91637	MFF1816G18200F
R2115[3]	321-0214-00	B010130		RES.,FXD,FILM:1.65K OHM,1%,0.125W	91637	MFF1816G16500F
R2115[1]	321-0218-00	B010100	B010169	RES.,FXD,FILM:1.82K OHM,1%,0.125W	91637	MFF1816G18200F
R2115[1]	321-0214-00	B010170		RES.,FXD,FILM:1.65K OHM,1%,0.125W	91637	MFF1816G16500F
R2115[2]	321-0214-00			RES.,FXD,FILM:1.65K OHM,1%,0.125W	91637	MFF1816G16500F
R2116[3]	315-0510-00	B010100	B010129X	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2116[1]	315-0510-00	B010100	B010169X	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2117[3]	315-0562-00	B010100	B010129X	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R2117[1]	315-0562-00	B010100	B010169X	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
R2118	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R2119[3]	315-0431-00	B010100	B010129X	RES.,FXD,CMPSN:430 OHM,5%,0.25W	01121	CB4315
R2120[3]	315-0510-00	B010100	B010129X	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2120[1]	315-0510-00	B010100	B010169X	RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R2121[3]	315-0101-00	XB010634		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2121[1]	315-0101-00	XB014319		RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2121[2]	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R2122	315-0132-00			RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2123	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2124	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R2125	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R2126	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2127	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R2128	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R2132	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2133	303-0393-00			RES.,FXD,COMP:39K OHM,5%,1W	01121	GB3935
R2134	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R2135[3]	315-0393-00	B010100	B010129	RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935
R2135[3]	315-0303-00	B010130		RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R2135[1]	315-0393-00	B010100	B010169	RES.,FXD,CMPSN:39K OHM,5%,0.25W	01121	CB3935

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R2157[1]	315-0272-00	B010100	B010998	RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2157[1]	315-0222-00	B010999		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2157[2]	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2161	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2162	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
R2163	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2164	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2166	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2167	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R2172	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2173	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R2174[3]	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2175[3]	315-0512-00	B010100	B010524	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R2175[3]	315-0222-00	B010525		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2175[1]	315-0512-00	B010100	B012649	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R2175[1]	315-0222-00	B012650		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2175[2]	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
R2176	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2184	321-0236-00			RES.,FXD,FILM:2.8K OHM,1%,0.125W	91637	MFF1816G28000F
R2188	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2223[3]	315-0152-00	B010100	B010349	RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R2223[3]	315-0911-00	B010350		RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R2223[1]	315-0911-00	B010999		RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R2223[2]	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	01121	CB9115
R2224[3]	315-0272-00	B010100	B010349	RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2224[3]	315-0242-00	B010350		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R2224[1]	315-0272-00	B010100	B010998	RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R2224[1]	315-0242-00	B010999		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R2224[2]	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
R2226	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
R2227[3]	315-0132-00	B010100	B010349	RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2227[3]	315-0102-00	B010350		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2227[1]	315-0132-00	B010100	B010998	RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	01121	CB1325
R2227[1]	315-0102-00	B010999		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R2227[2]	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

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R2255[1]	321-0377-01	B010400		RES.,FXD,FILM:82.5K OHM,0.5%,0.125W	91637	MFF1816G82501D
R2255[2]	321-0377-00	B010100	B011699	RES.,FXD,FILM:82.5K OHM,1%,0.125W	91637	MFF1816G82501F
R2255[2]	321-0377-01	B011700		RES.,FXD,FILM:82.5K OHM,0.5%,0.125W	91637	MFF1816G82501D
R2255[3]	321-0377-01			RES.,FXD,FILM:82.5K OHM,0.5%,0.125W	91637	MFF1816G82501D
R2256	321-0348-00			RES.,FXD,FILM:41.2K OHM,1%,0.125W	91637	MFF1816G41201F
R2257[1]	321-0281-00	B010100	B010399	RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R2257[1]	321-0281-01	B010400		RES.,FXD,FILM:8.25K OHM,0.5%,0.125W	91637	MFF1816G82500D
R2257[2]	321-0281-00	B010100	B011699	RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R2257[2]	321-0281-01	B011700		RES.,FXD,FILM:8.25K OHM,0.5%,0.125W	91637	MFF1816G82500D
R2257[3]	321-0281-01			RES.,FXD,FILM:8.25K OHM,0.5%,0.125W	91637	MFF1816G82500D
R2258[1]	321-0281-00	B010100	B010399	RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R2258[1]	321-0281-01	B010400		RES.,FXD,FILM:8.25K OHM,0.5%,0.125W	91637	MFF1816G82500D
R2258[2]	321-0281-00	B010100	B011699	RES.,FXD,FILM:8.25K OHM,1%,0.125W	91637	MFF1816G82500F
R2258[2]	321-0281-01	B011700		RES.,FXD,FILM:8.25K OHM,0.5%,0.125W	91637	MFF1816G82500D
R2258[3]	321-0281-01			RES.,FXD,FILM:8.25K OHM,0.5%,0.125W	91637	MFF1816G82500D
R2259	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R2262	322-0519-01			RES.,FXD,FILM:2.49M OHM,0.5%,0.25W	91637	HFF143G24903D
R2263[1]	321-0473-00	B010100	B010399	RES.,FXD,FILM:825K OHM,1%,0.125W	91637	MFF1816G82502F
R2263[1]	321-0473-01	B010400		RES.,FXD,FILM:825K OHM,0.5%,0.125W	91637	MFF1816G82502D
R2263[2]	321-0473-00	B010100	B011699	RES.,FXD,FILM:825K OHM,1%,0.125W	91637	MFF1816G82502F
R2263[2]	321-0473-01	B011700		RES.,FXD,FILM:825K OHM,0.5%,0.125W	91637	MFF1816G82502D
R2263[3]	321-0473-01			RES.,FXD,FILM:825K OHM,0.5%,0.125W	91637	MFF1816G82502D
R2264[1]	321-0473-00	B010100	B010399	RES.,FXD,FILM:825K OHM,1%,0.125W	91637	MFF1816G82502F
R2264[1]	321-0473-01	B010400		RES.,FXD,FILM:825K OHM,0.5%,0.125W	91637	MFF1816G82502D
R2264[2]	321-0473-00	B010100	B011699	RES.,FXD,FILM:825K OHM,1%,0.125W	91637	MFF1816G82502F
R2264[2]	321-0473-01	B011700		RES.,FXD,FILM:825K OHM,0.5%,0.125W	91637	MFF1816G82502D
R2264[3]	321-0473-01			RES.,FXD,FILM:825K OHM,0.5%,0.125W	91637	MFF1816G82502D
R2273	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2275	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	01121	CB4735
R2276	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
R2312[1]	321-0299-00	B010100	B010129	RES.,FXD,FILM:12.7K OHM,1%,0.125W	91637	MFF1816G12701F
R2312[1]	321-0298-00	B010130	B010633	RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816G12401F
R2312[1]	321-0297-00	B010634		RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
R2312[2]	321-0299-00	B010100	B010169	RES.,FXD,FILM:12.7K OHM,1%,0.125W	91637	MFF1816G12701F
R2312[2]	321-0298-00	B010170	B014318	RES.,FXD,FILM:12.4K OHM,1%,0.125W	91637	MFF1816G12401F
R2312[2]	321-0297-00	B014319		RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
R2312[3]	321-0297-00			RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
R2313	321-0279-00			RES.,FXD,FILM:7.87K OHM,1%,0.125W	91637	MFF1816G78700F
R2315	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2316	311-1788-00			RES.,VAR,NONWIR:20K OHM,20%,2W	12697	470-CM40948
R2317	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
R2322	311-1789-00			RES.,VAR,NONWIR:100K OHM,10%,1W	12697	381-CM40949
R2323	321-0197-00			RES.,FXD,FILM:1.1K OHM,1%,0.125W	91637	MFF1816G11000F
R2324	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R2325	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925

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R2332[1]	311-1239-00	B010900		RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	73138	72X-76-0252K
R2332[2]	311-1239-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	73138	72X-76-0252K
R2333	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2334	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2335	315-0753-00			RES.,FXD,CMPSN:75K OHM,5%,0.25W	01121	CB7535
R2336	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R2337	308-0334-00			RES.,FXD,WW:7K OHM,1%,3W	91637	RS2B-B70000H
R2342	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R2344	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2345	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
R2347	308-0334-00			RES.,FXD,WW:7K OHM,1%,3W	91637	RS2B-B70000H
R2352	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
R2353	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R2354	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R2355	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R2356	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
R2357	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
R2392[3]	301-0240-00	B010100	B010149	RES.,FXD,CMPSN:24 OHM,5%,0.50W	01121	EB2405
R2392[3]	301-0270-00	B010150		RES.,FXD,CMPSN:27 OHM,5%,0.50W	01121	EB2705
R2392[1]	301-0240-00	B010100	B010499	RES.,FXD,CMPSN:24 OHM,5%,0.50W	01121	EB2405
R2392[1]	301-0270-00	B010500		RES.,FXD,CMPSN:27 OHM,5%,0.50W	01121	EB2705
R2392[2]	301-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.50W	01121	EB2705
R2401[2]	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725

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R4118	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R4122	321-0481-00			RES.,FXD,FILM:1M OHM,1%,0.125W	91637	MFF1816G10003F
R4123	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	01121	CB4745
R4126	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	91637	MFF1816G20R00F
R4127	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	91637	MFF1816G20R00F
R4128[1]	315-0823-00	XB010340		RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R4128[2]	315-0823-00	XB011100		RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R4128[3]	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R4129[1]	315-0122-00	XB010340		RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R4129[2]	315-0122-00	XB011100		RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R4129[3]	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R4132	311-1557-00			RES.,VAR,NONWIR:25K OHM,20%,0.50W	73138	91A R25K
R4133	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R4134	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R4136	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4137	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4138	321-0077-00			RES.,FXD,FILM:61.9 OHM,1%,0.125W	91637	MFF1816G61R90F
R4143	321-0062-00			RES.,FXD,FILM:43.2 OHM,1%,0.125W	91637	MFF1816G43R20F
R4144	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	91637	MFF1816G150R0F
R4145	321-0771-01			RES.,FXD,FILM:50 OHM,0.5%,0.125W	91637	MFF1816G50R00D
R4146	321-0771-01			RES.,FXD,FILM:50 OHM,0.5%,0.125W	91637	MFF1816G50R00D
R4147	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	91637	MFF1816G20R00F
R4151	311-1563-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	73138	91A R1K
R4152	311-1785-00			RES.,VAR,NONWIR:1K OHM,5%,.2W	12697	381-CM40945
R4154	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F
R4155	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4156	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R4158	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R4161	321-0154-00			RES.,FXD,FILM:392 OHM,1%,0.125W	91637	MFF1816G392R0F
R4162	321-0070-00			RES.,FXD,FILM:52.3 OHM,1%,0.125W	91637	MFF1816G52R30F
R4163	321-0072-00			RES.,FXD,FILM:54.9 OHM,1%,0.125W	91637	MFF1816G54R90F
R4164	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F

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R4228[1]	315-0823-00	XB011100		RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R4228[2]	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
R4229[1]	315-0122-00	XB011100		RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R4229[2]	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
R4232[3]	311-1557-00			RES.,VAR,NONWIR:25K OHM,20%,0.50W	73138	91A R25K
R4233[3]	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R4234[3]	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
R4236[3]	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4237[3]	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4238[3]	321-0077-00			RES.,FXD,FILM:61.9 OHM,1%,0.125W	91637	MFF1816G61R90F
R4243[3]	321-0062-00			RES.,FXD,FILM:43.2 OHM,1%,0.125W	91637	MFF1816G43R20F
R4244[3]	321-0114-00			RES.,FXD,FILM:150 OHM,1%,0.125W	91637	MFF1816G150R0F
R4245[3]	321-0771-01			RES.,FXD,FILM:50 OHM,0.5%,0.125W	91637	MFF1816G50R00D
R4246[3]	321-0771-01			RES.,FXD,FILM:50 OHM,0.5%,0.125W	91637	MFF1816G50R00D
R4247[3]	321-0030-00			RES.,FXD,FILM:20 OHM,1%,0.125W	91637	MFF1816G20R00F
R4251[3]	311-1563-00			RES.,VAR,NONWIR:1K OHM,20%,0.50W	73138	91A R1K
R4252[3]	311-1785-00			RES.,VAR,NONWIR:1K OHM,5%,2W	12697	381-CM40945
R4254[3]	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F
R4255[3]	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4256[3]	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R4258[3]	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
R4261[3]	321-0154-00			RES.,FXD,FILM:392 OHM,1%,0.125W	91637	MFF1816G392R0F
R4262[3]	321-0070-00			RES.,FXD,FILM:52.3 OHM,1%,0.125W	91637	MFF1816G52R30F
R4263[3]	321-0072-00			RES.,FXD,FILM:54.9 OHM,1%,0.125W	91637	MFF1816G54R90F
R4264[3]	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F
R4265[3]	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
R4266[3]	321-0172-00			RES.,FXD,FILM:604 OHM,1%,0.125W	91637	MFF1816G604R0F
R4268[3]	315-0912-00			RES.,FXD,CMPSN:9.1K OHM,5%,0.25W	01121	CB9125
R4273[3]	321-0039-00			RES.,FXD,FILM:24.9 OHM,1%,0.125W	91637	MFF1816G24R90F
R4274[3]	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R4275[3]	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
R4302[1]	315-0361-00	B010100	B010499	RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R4302[1]	321-0150-00	B010500		RES.,FXD,FILM:357 OHM,1%,0.125W	91637	MFF1816G357R0F
R4302[2]	321-0150-00			RES.,FXD,FILM:357 OHM,1%,0.125W	91637	MFF1816G357R0F

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R4342	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R4344	311-1557-00			RES.,VAR,NONWIR:25K OHM,20%,0.50W	73138	91A R25K
R4346	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
R4347	315-0750-00			RES.,FXD,CMPSN:75 OHM,5%,0.25W	01121	CB7505
R4348	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4349[1]	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R4364[1]	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4365[1]	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4366[2]	315-0471-00	XB010500		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R4366[3]	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R4367[2]	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
R4368[2]	315-0101-00	B010100	B010499	RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R4368[2]	315-0241-00	B010500		RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R4368[3]	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R4369[2]	315-0101-00	B010100	B010499	RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
R4369[2]	315-0241-00	B010500		RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R4369[3]	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
R4370[2]	315-0471-00	XB010500		RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R4370[3]	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
R4371[1]	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4372[1]	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4373[1]	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R4374[1]	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
R4375[2]	315-0202-00	B010100	B010499	RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R4375[2]	315-0272-00	B010500		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4375[3]	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4377[2]	315-0202-00	B010100	B010499	RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
R4377[2]	315-0272-00	B010500		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4377[3]	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
R4382[1]	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
R4384[2]	315-0102-00	XB010500		RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4384[3]	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
R4385[2]	315-0153-00	B010100	B010499	RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R4385[2]	315-0622-00	B010500		RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R4385[3]	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	01121	CB6225
R4386[1]	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
R4392[1]	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
R4394	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R4395	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R4396	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R4397[1]	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
S100	260-1421-00			SWITCH,PUSH:1 STA,MOMENTARY,NON-SHORT	80009	260-1421-00
S700	260-1768-00			SWITCH,PUSH:DPDT,3A,125VAC	82389	14S-7102C
S701	260-1776-00			SWITCH,SLIDE:DPDT,3A,125VAC	80009	260-1776-00
S705	260-1776-00			SWITCH,SLIDE:DPDT,3A,125VAC	80009	260-1776-00
S1998[3]	260-1363-00			SWITCH,PUSH:6 PDT,PUSH-PUSH	80009	260-1363-00
S2100[4]	214-2288-01	B010100	B010129	LEVER SWITCH:STYLE A,17.5 DEG W/CONTACTS	80009	214-2288-01
S2100[4]	214-2288-02	B010130		LEVER,SWITCH:STYLE A,17.5 DEG,W/CONTACTS	80009	214-2288-02
S2100[2]	214-2288-01	B010100	B010169	LEVER SWITCH:STYLE A,17.5 DEG W/CONTACTS	80009	214-2288-01
S2100[2]	214-2288-02	B010170		LEVER,SWITCH:STYLE A,17.5 DEG,W/CONTACTS	80009	214-2288-02
S2100[3]	214-2288-02			LEVER,SWITCH:STYLE A,17.5 DEG,W/CONTACTS	80009	214-2288-02
S2140	260-1445-01			SWITCH,PUSH:1 BUTTON	80009	260-1445-01

[1] T922 and T922R only
[2] T922 only
[3] T922R only
[4] T921 only

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
S2150[1]	214-2289-01	B010100	B010129	LEVER SWITCH:STYLE B,W/CONTACTS	80009	214-2289-01
S2150[1]	214-2289-02	B010130		LEVER,SWITCH:STYLE B,W/CONTACTS	80009	214-2289-02
S2150[2]	214-2289-01	B010100	B010169	LEVER SWITCH:STYLE B,W/CONTACTS	80009	214-2289-01
S2150[2]	214-2289-02	B010170		LEVER,SWITCH:STYLE B,W/CONTACTS	80009	214-2289-02
S2150[3]	214-2289-02			LEVER,SWITCH:STYLE B,W/CONTACTS	80009	214-2289-02
S2250[4]						
S2400A,B[3]	260-1465-00			SWITCH,PUSH:2 STA,NON-SHORT	80009	260-1465-00
S2408[3]	260-1208-00			SWITCH,PUSH:DPDT	80009	260-1208-00
S4099[3]	260-1363-00			SWITCH,PUSH:6 PDT,PUSH-PUSH	80009	260-1363-00
S4100[1]	105-0678-00	B010100	B010549	DRUM,CAM SWITCH:W/LEVER	80009	105-0678-00
S4100[1]	105-0678-01	B010550		DRUM,CAM SWITCH:AC-DC GND,CHANNEL 1	80009	105-0678-01
S4100[2]	105-0678-00	B010100	B013440	DRUM,CAM SWITCH:W/LEVER	80009	105-0678-00
S4100[2]	105-0678-01	B013441		DRUM,CAM SWITCH:AC-DC GND,CHANNEL 1	80009	105-0678-01
S4100[3]	105-0678-00	B010100	B010229	DRUM,CAM SWITCH:W/LEVER	80009	105-0678-00
S4100[3]	105-0678-01	B010230		DRUM,CAM SWITCH:AC-DC GND,CHANNEL 1	80009	105-0678-01
S4110	105-0679-00			DRUM,CAM SWITCH:	80009	105-0679-00
S4199[3]	260-1363-00			SWITCH,PUSH:6 PDT,PUSH-PUSH	80009	260-1363-00
S4200[2]	105-0678-00	B010100	B013440	DRUM,CAM SWITCH:W/LEVER	80009	105-0678-00
S4200[2]	105-0678-02	B013441		DRUM,CAM SWITCH:W/LEVER	80009	015-0678-02
S4200[3]	105-0678-00	B010100	B010229	DRUM,CAM SWITCH:W/LEVER	80009	105-0678-00
S4200[3]	105-0678-02	B010230		DRUM,CAM SWITCH:W/LEVER	80009	105-0678-02
S4210[5]	105-0679-00			DRUM,CAM SWITCH:	80009	105-0679-00
S4370[5]	260-1782-00			SWITCH,PUSH:3 BUTTON,DPDT,10MM	80009	260-1782-00
T460	120-0996-00			XFMR,PWR,STU:HIGH VOLTAGE	80009	120-0996-00
T700	120-0994-00			XFMR,PWR,STPDN:	80009	120-0994-00
U24	156-0067-10	741 GOOD LUCK!		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	80009	156-0067-10
U460	152-0637-02			SEMICOND DEVICE:SI,HV MULTR,6.6KV-10KV	80009	152-0637-02
U742A,B	156-0158-02	LM 3086		MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	80009	156-0158-02
U2126A-E	156-0197-03			MICROCIRCUIT,LI:5-XSTR ARRAY	80009	156-0197-03
U2156A-D	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT AND GATE	80009	156-0030-00
U2212A-D	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT AND GATE	80009	156-0030-00
U2224A,B	156-0405-01	N9602N/F		MICROCIRCUIT,DI:DUAL RETRIG ONE-SHOT	80009	156-0405-01
U2234A-D[2]	156-0030-00	B010100	B010499	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2234A-D[2]	156-0113-00	B010500	B010999	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	80009	156-0113-00
U2234A-D[2]	156-0030-00	B011000		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2234A-D[3]	156-0030-00			MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2234A-D[1]	156-0030-00	B010100	B010149	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2234A-D[1]	156-0113-00	B010150	B010299	MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	80009	156-0113-00
U2234A-D[1]	156-0030-00	B010300		MICROCIRCUIT,DI:QUAD 2-INPUT POS NAND GATE	01295	SN7400N
U2402A,B[3]	156-0041-03			MICROCIRCUIT,DI:DUAL D-TYPE,FLIP-FLOP	80009	156-0041-03
U4134A-D	156-0197-03	LM3086		MICROCIRCUIT,LI:5-XSTR ARRAY	80009	156-0197-03
U4234A-D	156-0197-03			MICROCIRCUIT,LI:5-XSTR ARRAY	80009	156-0197-03
U4364A,B[5]	156-0041-00			MICROCIRCUIT,DI:DUAL D-TYPE FLIP-FLOP	27014	DM7474N
U4376A-D[5]	156-0030-01			MICROCIRCUIT,DI:QUAD 2-INPUT AND GATE	80009	156-0030-01
V470	154-0729-00			ELECTRON TUBE:P31,INT SCALE,	80009	154-0729-00
VR412	152-0280-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	80009	152-0280-00
VR746	152-0306-00			SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	81483	1N960B
VR762	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0195-00
VR784	152-0293-00			SEMICOND DEVICE:ZENER,1W,33V,5%	04713	1N3032B
VR818[3]	152-0241-00			SEMICOND DEVICE:ZENER,0.4W,33V,5%	04713	1N973B

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
VR2123[1]	152-0226-00	B010150		SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR2123[2]	152-0279-00	B010100	B010499	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0279-00
VR2123[2]	152-0226-00	B010500		SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR2123[3]	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	81483	69-6584
VR2392	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0279-00
VR2401[3]	152-0278-00			SEMICOND DEVICE:ZENER,0.4W,3V,5%	07910	1N4372A
VR4367	152-0395-00			SEMICOND DEVICE:ZENER,0.4W,4.3V,5%	04713	1N749A
VR4392[4]	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	80009	152-0279-00

[1] T921 only
[2] T922 only
[3] T922R only
[4] T922 and T922R only

OPTIONS

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

Option 1	Differential Mode	Described in this Section

(Schematic diagrams for Option 1 are included at the end of the Diagrams section in this manual.)

T922/T922R OPTION 1 DIFFERENTIAL MODE

NOTE

This description includes the operation and maintenance of the added features of Option 1. For all other information concerning the T922 or T922R, refer to the appropriate section of this manual. Schematic Diagrams for Option 1 are included at the end of the Diagrams section in this manual.

OPERATING INFORMATION

Introduction

The T922 or T922R Option 1 includes a fourth vertical mode pushbutton (labeled DIFF) which, when pressed in [illegible] CH 2 signal and displays the [illegible] of the CH 1 and CH 2 signals. (If the DUAL TRACE button is pressed along with the DIFF button, CH 2 is inverted and each signal is displayed but not summed.) The algebraic sum (difference) of the CH 1 and CH 2 signals is a useful feature for rejecting unwanted common-mode signals such as line-frequency components. The DIFF button may also be used in conjunction with other mode buttons to provide a variety of modes as shown in the table.

DIFF Mode Operation

To operate the instrument in the DIFF mode, perform the appropriate First Time Operation steps in Section 2 of this manual, then:

1. Connect the signal you wish to view to CH 1 input.

2. Connect a sample of the unwanted signal to CH 2 input.

3. Set: Vertical Mode . DIFF

SOURCE For desired trigger condition

4. Adjust the CH 1 and CH 2 VOLTS/DIV and VAR controls to obtain the desired display (null of common-mode signal).

Option 1 Vertical Modes
(button in and display normal unless otherwise stated)

Vertical Mode Button	Displayed Signal	Internal Trigger Source
DIFF & CH 2	CH 2 Inverted	CH 2
DUAL TRACE & DIFF	CH 1 and Inverted CH 2	CH 1
DUAL TRACE, DIFF, & CH 2	CH 1 and Inverted CH 2	CH 2
DUAL TRACE & CH 2	CH 1 and CH 2	CH 2
CH 1 & CH 2	CH 1 & CH 2 Alternate	CH 2
DIFF	Differential (CH 1 — CH 2)	CH 1
All Buttons Out	CH 1 & CH 2 Added	CH 1

CIRCUIT DESCRIPTION

Introduction

The following paragraphs describe circuitry unique to Option 1. Refer to the Circuit Description section of this

Vertical Switching

The vertical switching circuit determines whether CH 1, CH 2, or both CH 1 and CH 2 are connected to the delay line driver stage. This circuit is controlled by the Vertical Mode switch. In the DUAL TRACE alternate or chopped modes, both channels are alternately displayed

SEC/DIV switch setting. Chopped mode is obtained for sweep speeds of 1 ms and slower; alternate mode is obtained for sweep speeds of 0.5 ms and faster.

trigger signal from entering the trigger input amplifier. With the Vertical Mode switch set to CH 2, CR4366 becomes forward biased while CR4364 is reverse biased

In the DUAL TRACE mode CR4360 and CR4361 are forward biased so that pins 10 and 13 of U4364B are HI. This allows U4364B to change state upon arrival of a clock pulse.

In the chopped mode, pin 1 of U4376A is ungrounded, allowing the multivibrator, U4376A and U4376B, to free run at about 500 kHz. The output at pin 11 of U4376D serves as a clock pulse for U4364B. The state of U4364B changes on each negative transition of U4376D pin 11. Pins 8 and 9 of U4364B switch the diode gates at a 250 kHz rate.

The clock pulse is also fed to U4364A which provides an output pulse to the Z-axis amplifier to blank out the transitions between channel 1 and channel 2 traces.

because CR4363 is now connected to −8 volts. Refer to the Circuit Description section of this manual for a discussion of the rest of the Trigger Pickoff circuitry, which is common to all versions of the T922 or T922R.

CMRR PERFORMANCE CHECK (Perform after Step 7 of Section 3, PERFORMANCE CHECK)

Equipment Required

(See Table 3-1 in Section 3 of this manual for equipment specifications and recommended types.)

1. Sine-Wave Generator
2. 50 Ω BNC Cable
3. 50 Ω BNC Termination

DIFFERENTIAL BALANCE ADJUSTMENT (Perform after Step 6 of VERTICAL AMPLIFIER ADJUSTMENTS)

1. Set: CH 1 and CH 2 AC-GND-DC — GND
   Vertical Mode — CH 1

2. Adjust CH 1 POSITION to move the trace to the center horizontal graticule line.

3. Set: Vertical Mode — CH 2
   CH 2 POSITION — Midrange

4. ADJUST—Differential Balance, R4259. Alternately push the CH 2 and DIFF buttons. The adjustment is correct when there is no vertical trace shift while alternately pushing the CH 2 and DIFF buttons. You may need to readjust the CH 2 POSITION control to keep the trace on the screen.

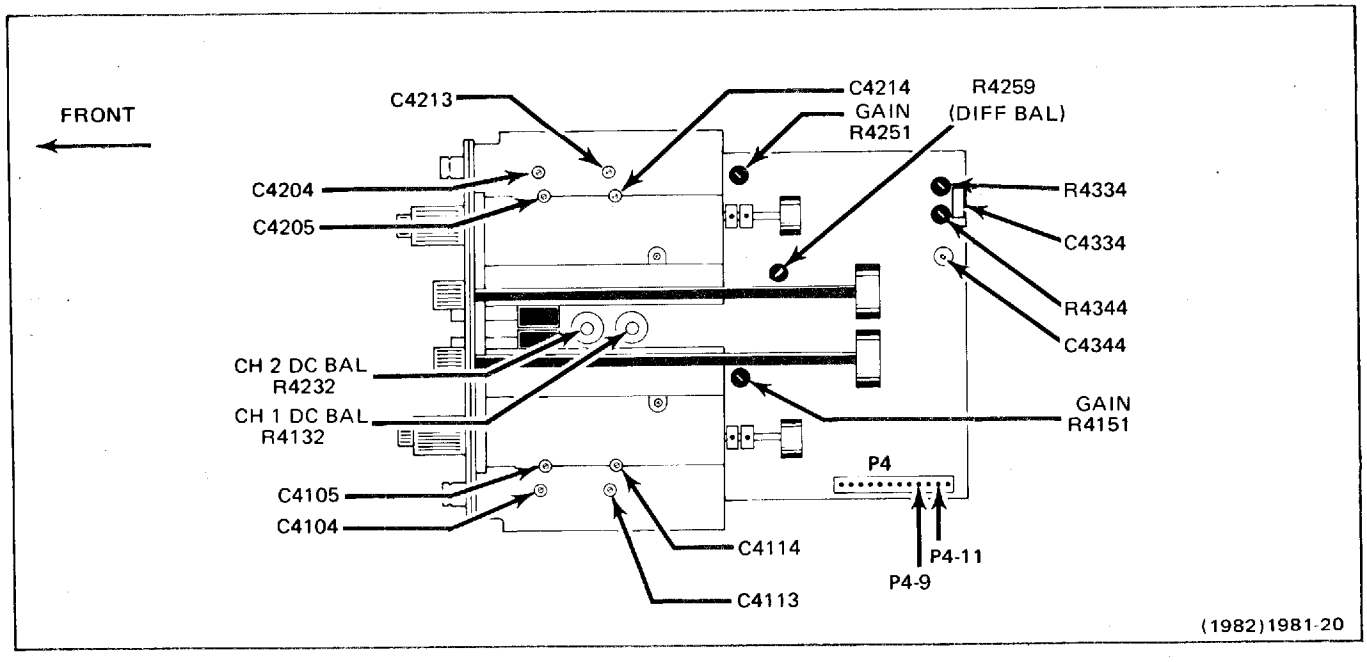


Fig. Option 1-1. Adjustment locations.

Ckt No.	Part No.	Eff	Dscont	Name & Description	Code	Mfr Part Number
CHANGE TO:						
A8	670-4389-00			CKT BOARD ASSY:VERTICAL	80009	670-4389-00
C4155	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
C4165	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
C4255	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
C4265	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
Q4322	151-0434-00			TRANSISTOR:SILICON,PNP	80009	151-0434-00
Q4324	151-0434-00			TRANSISTOR:SILICON,PNP	80009	151-0434-00
R4174	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R4175	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
R4256	321-0170-00			RES.,FXD,FILM:576 OHM,1%,0.125W	91637	MFF1816G576R0F
R4302	321-0169-00			RES.,FXD,FILM:562 OHM,1%,0.125W	91637	MFF1816G562R0F
R4303	321-0158-00			RES.,FXD,FILM:432 OHM,1%,0.125W	91637	MFF1816G432R0F
R4392	315-0390-00			RES.,FXD,CMPSN:39 OHM,5%,0.25W	01121	CB3905
S4370	260-1823-00			SWITCH,PUSH:VERTICLE MODE,2 POLE INTLK	80009	260-1823-00
ADD:						
C4303	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4368	283-0103-00			CAP.,FXD,CER DI:180PF,5%,500V	56289	40C638
CR4360	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
CR4361	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	07910	1N4152
Q4310	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
Q4311	151-0199-00			TRANSISTOR:SILICON,PNP	27014	ST65038
R4128	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
REMOVE:						
C4143	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V	72982	390049X5P0470K
C4243	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V	72982	390049X5P0470K
C4362	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C4363	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	72982	8005H9AADW5R103K
C4365	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
C4366	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
R4395	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705
R4397	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	01121	CB4705

[1]Changes to Standard T922 or T922R when instrument is equipped with Option 1. Applies to all serial numbers of Option 1 unless otherwise stated.

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty 1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
ADD:							
-57	366-1559-00			1	PUSH BUTTON:GRAY	80009	366-1559-00
-61	426-1072-00			1	FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
DELETE:							
-63	333-2040-00			1	PANEL,FRONT:VERTICAL	80009	333-2040-00
ADD:							
-63	333-2150-00			1	PANEL,FRONT:VERTICAL	80009	333-2150-00
-91	384-1136-00			1	EXTENSION SHAFT:0.95 INCH LONG	80009	384-1136-00

DIAGRAMS AND CIRCUIT DESCRIPTION

Symbols and Reference Designators

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

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

Resistors = Ohms (Ω).

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 goes to the low state.

Abbreviations are based on ANSI Y1.1-1972.

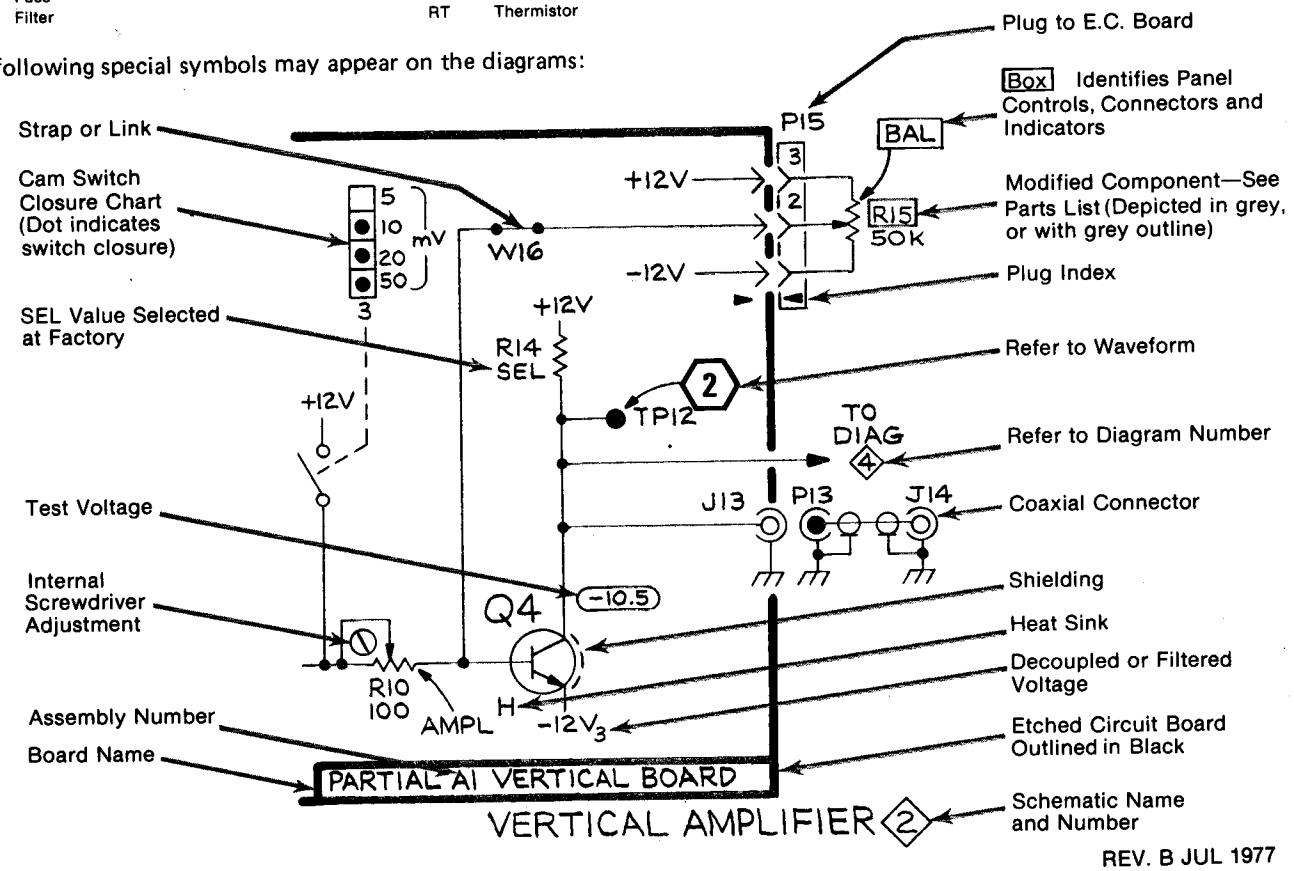
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

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.

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

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

The following special symbols may appear on the diagrams:



BLOCK DIAGRAM DESCRIPTION

Most of the circuitry described in this section is common to the T921, T922, and T922R. References to channel 2, dual trace, chop mode, and vertical switching do not pertain to T921. The T922R circuitry that differs from the bench version T922 is described with the three diagrams at the end of this section.

VERTICAL INPUT

Signals to be displayed on the crt are applied to either the channel 1 (Y) or channel 2 input connector. The input signals are amplified by the preamplifier circuits. Each preamplifier circuit includes separate input coupling, attenuators, gain switching, variable attenuators, balance, and gain adjustments.

A Trigger Pickoff circuit in each channel supplies a sample of the vertical input signal to the Trigger Input Amplifier via the Trigger Switching circuit and the SOURCE switch.

VERTICAL SWITCHING

The Vertical Mode switch selects which channel supplies the trigger signal. The vertical signal passes through the Input Buffer Amplfiier circuit which isolates the preamplifier circuits from the Delay Line Driver. In the T922, the output of each Input Buffer Amplifier is connected to the Delay Line Driver through a Diode Gate circuit. The Diode Gate circuits are controlled by the Vertical Switching circuit to select the channel(s) to be displayed. An output from the Vertical Switching circuit (through the Chop Blanking Pulse Generator) is connected to the Z Axis Amplifier to

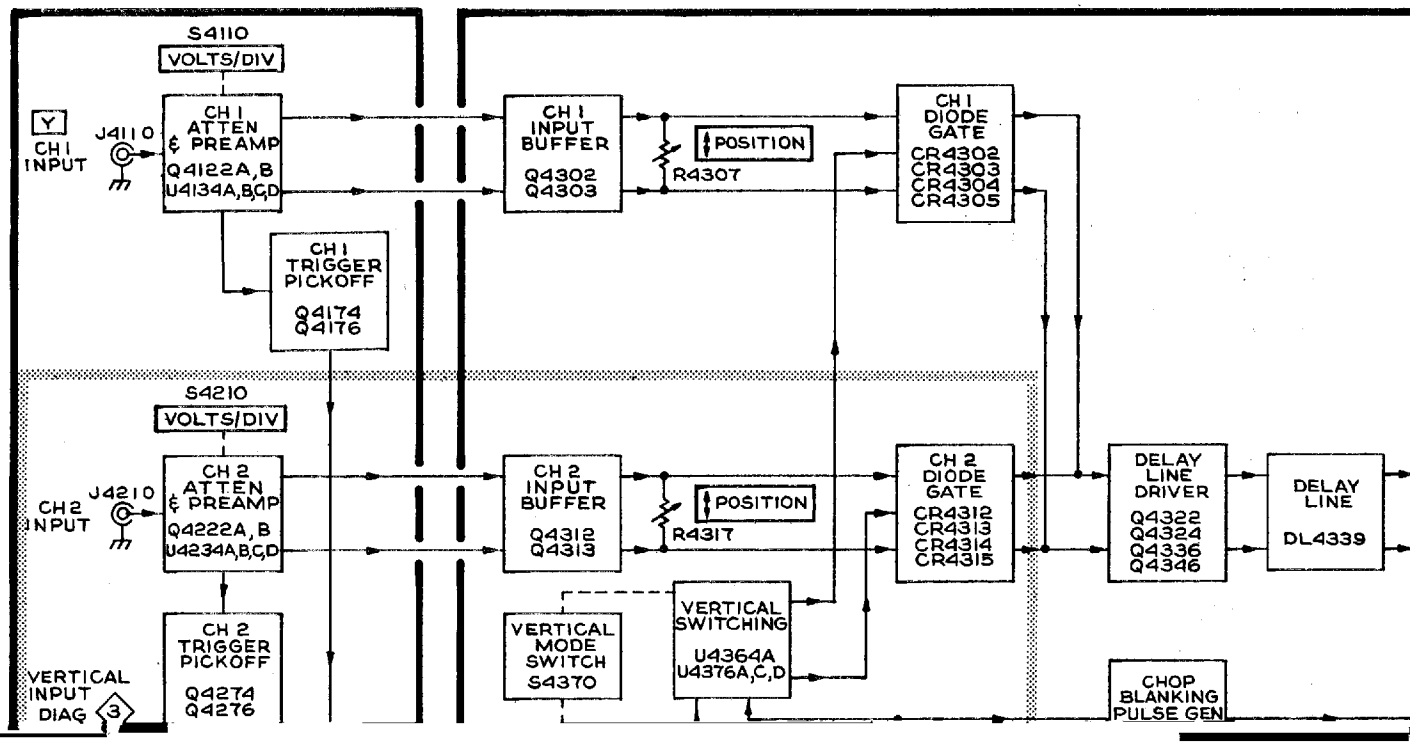
The selected trigger signal is amplified and inverted by the Trigger Input Amplifier. The trigger signal passes through coupling capacitor C2132 to the Trigger Level Comparator, which determines the voltage level (on the trigger waveform) at which triggering occurs. The SLOPE switch selects the slope or sync (TV) polarity. The Trigger Level comparator also supplies a signal to the TV Sync Separator circuit.

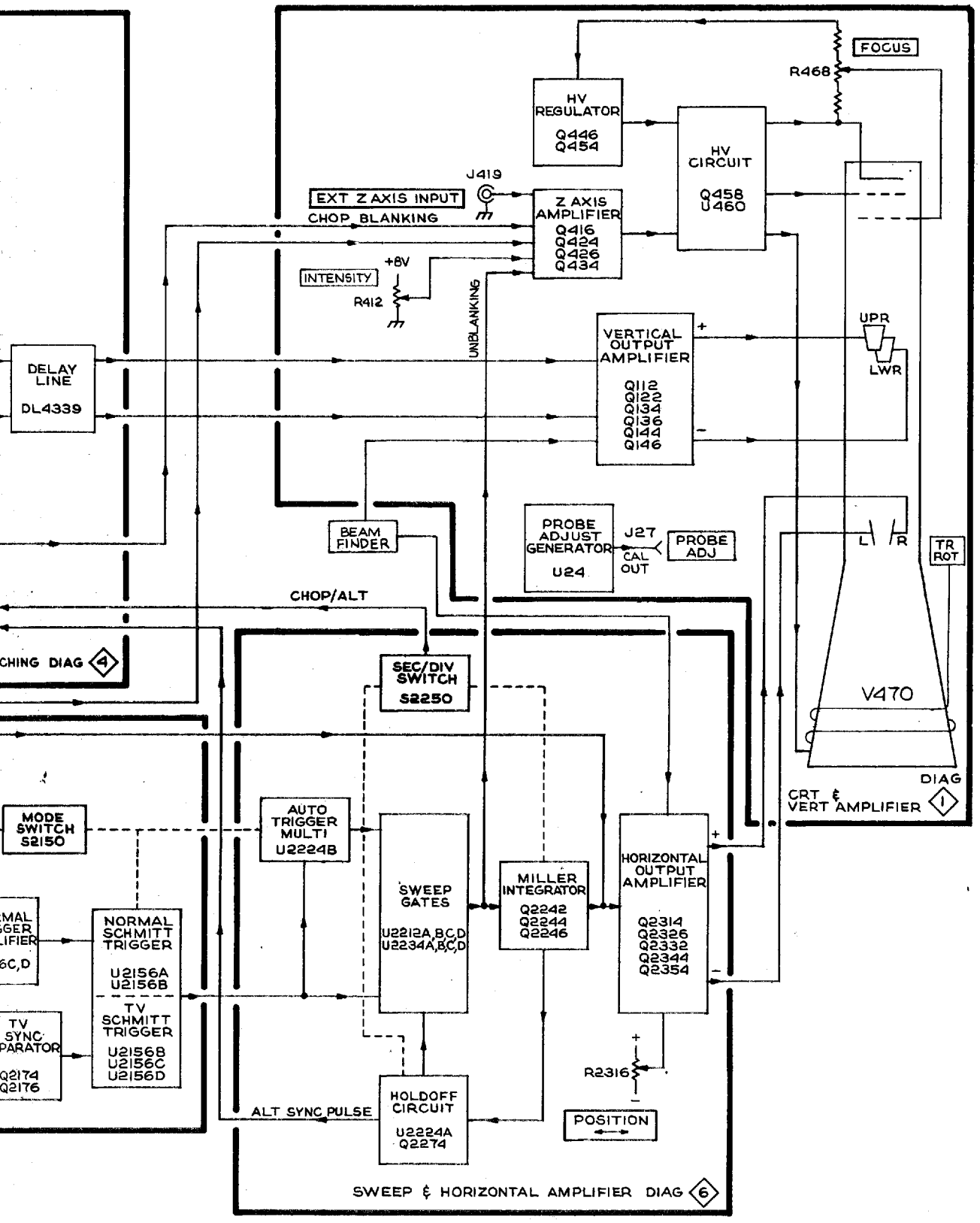
Two Schmitt Trigger circuits produce the logic trigger signal; one is for conventional trigger signals and the other is for TV signals. The MODE switch selects which Schmitt Trigger circuit is operating.

SWEEP AND HORIZONTAL AMPLIFIER

The Sweep circuit, when triggered by the Trigger circuit, produces a linear sawtooth output signal to the Horizontal Amplifier. The slope of the sawtooth is controlled by the SEC/DIV switch. When the sawtooth output reaches a predetermined level, the Holdoff circuit resets the Sweep circuit, blanks the crt (through the Z Axis Amplifier) and prevents subsequent triggers from initiating another sweep until the sweep reset is completed.

The sawtooth output from the Sweep circuit is amplified by the


S4110
VOLTS/DIV
Y
CH 1 INPUT
J4110
CH 1 ATTEN & PREAMP
Q4122A,B
U4134A,B,C,D
CH 1 INPUT BUFFER
Q4302
Q4303
POSITION
R4307
CH 1 DIODE GATE
CR4302
CR4303
CR4304
CR4305
CH 1 TRIGGER PICKOFF
Q4174
Q4176
S4210
VOLTS/DIV
CH 2 INPUT
J4210
CH 2 ATTEN & PREAMP
Q4222A,B
U4234A,B,C,D
CH 2 INPUT BUFFER
Q4312
Q4313
POSITION
R4317
CH 2 DIODE GATE
CR4312
CR4313
CR4314
CR4315
DELAY LINE DRIVER
Q4322
Q4324
Q4336
Q4346
DELAY LINE
DL4339
VERTICAL MODE SWITCH
S4370
VERTICAL SWITCHING
U4364A
U4376A,C,D
CH 2 TRIGGER PICKOFF
Q4274
Q4276
VERTICAL INPUT DIAG 3
CHOP BLANKING PULSE GEN



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BLOCK DIAGRAM

CRT & VERT AMPL CIRCUIT DESCRIPTION

PROBE ADJUST

The Probe Adjust circuit provides an output of approximately 0.5 V peak-to-peak negative from ground at approximately 1 kHz.

When the output (pin 6) of U24 is positive, the voltage divider, R22-R23, sets pin 3 at a positive voltage. Feedback through R24 charges C24 until the pin 2 level reaches the same positive voltage as pin 3. When pin 3 and pin 2 are at the same voltage, U24 output (pin 6) switches from positive to negative. The output of U24 is about 7.2 V either positive or negative. Then C24 starts charging negative. When pin 2 and pin 3 are at the same voltage again, U24 output (pin 6) switches positive, and the cycle repeats.

During the positive half cycle, CR26 is forward biased and CR27 is reverse biased keeping the output at ground level. During the negative half cycle CR26 is reverse biased and CR27 is forward biased causing current to flow from ground through R27, CR27 and R26 to −8 V. This sets the output level to approximately −0.5 V.

VERTICAL OUTPUT AMPLIFIER

The vertical output amplifier circuit provides final amplification for the signal to drive the vertical deflection plates of the crt.

Q112, Q122, Q134, Q136, Q144, and Q146 form a common-emitter shunt-feedback amplifier. Shunt-feedback transistors Q134, Q136, Q144, and Q146 are stacked. Resistors R118K, R118L, R118H, and R118J provide the feedback. The output voltage at the collectors of Q136 and Q146 is proportional to the collector current of Q112 and Q122 through feedback resistors R118K-R118L and R118H-R118J.

When BEAM FINDER button S100A is pressed, R117 is placed in series with R118B and R118C, limiting Q112 and Q122 emitter current. This limits the maximum vertical deflection to within the crt screen area. Another section of the BEAM FINDER switch limits the horizontal deflection.

The current signals from the various inputs are connected to the emitter of Q416. The algebraic sum of the signals determines the collector conduction level. In case of overdrive from any input, Q416 cuts off and CR416 conducts the excess current to ground and thereby prevents the output stage from saturating.

Transistors Q424, Q426, Q434, and associated circuitry form an inverting operational amplifier. Components R423 and C423 are the feedback elements. Any current into the input summing point, the base of Q424, results in an output voltage at the collectors of Q426 and Q434. This output voltage controls the display intensity level by changing the dc voltage level at the junction of R462, C463 and C464.

HIGH VOLTAGE OSCILLATOR

Transistor Q458 and associated circuitry make up the high-voltage oscillator that produces the drive for high-voltage transformer T460. When the instrument is turned on, current through Q454 provides forward bias for Q458. Transistor Q458 conducts and the collector current increases, which develops a voltage across the primary (Q458 collector) winding of T460. This produces a corresponding voltage increase in the feedback winding of T460, which is connected via R457 to the base of Q458, and Q458 conducts even harder. Eventually the rate of collector current increase in Q458 becomes less than that required to maintain the voltage across the collector winding, and the output voltage drops. This turns off Q458 by way of the feedback voltage to the base. The voltage waveform at the collector of Q458 is a sine wave at the resonant frequency of T460. During the negative half cycle, Q458 remains off and the field collapses in the primary of T460. When the field is collapsed sufficiently, the base of Q458 becomes forward biased into conduction again and the cycle begins anew. The amplitude of sustained oscillation depends upon the average current delivered to the base of Q458 by the regulator circuitry. The frequency of oscillation is approximately 50 kHz. Components C458 and R458 decouple the unregulated +100 V supply line.

HIGH-VOLTAGE REGULATOR

Transistors Q446-Q454 and associated circuitry control the output voltage of the High Voltage supply. Components R443 and C443 provide a slow start up for the high-voltage oscillator. When

Any c
signal at
applied
T460. Re

If the
(less neg
of Q446
conduct
Q458 thr
closer to
sooner t
T460. Th
at the cr
By samp
manner,
relatively

Comp
regulato
unblanke

Resis
high-vol

The h
One win
filament
ting cath
high ac
anode a
rectified
Compon

Any change in the level at the base of Q446 produces an error signal at the collector of Q446, which is amplified by Q454 and applied to the base of Q458 through the feedback winding of T460. Regulation occurs as follows:

If the cathode voltage at the −2000 V point starts to go positive

The third winding is used to control the crt intensity. Components CR463, C462, C463, C464, R462, and R463 rectify and filter the secondary voltage to provide approximately −2100 V which is applied to the crt grid. The entire winding is referenced to the output of the Z axis amplifier whose output voltage variations are used to control the crt intensity by varying the grid to cathode voltage. The dc path for the Z axis signal to the grid is through

VOLTAGE CONDITIONS

Voltages shown on this schematic diagram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical input or the X (external trigger) input. Refer to Waveform Conditions for T921, T922, or T922R control settings. In the crt circuit, set the INTENSITY control for a voltage measurement of +22 volts at the collector of Q426 and of Q434 before attempting to measure voltages in the rest of the circuit.

WAVEFORM CONDITIONS

NOTE

Waveforms are for T922, unless otherwise noted.

Waveforms below were monitored with a Tektronix 7704A Oscilloscope, 7B71 Time Base, 7A15A Amplifier and 10X probe. The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

A 1 kHz, 50 mV sine wave was applied to CH 1 input and a 1 kHz, 50 mV square wave was applied to CH 2 input. A Tektronix FG 501 Function Generator provides either of the input waveforms.

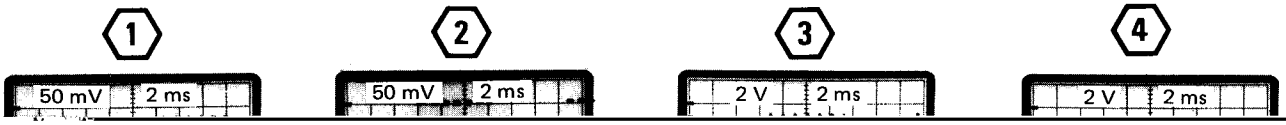
The T922 controls were set as follows:

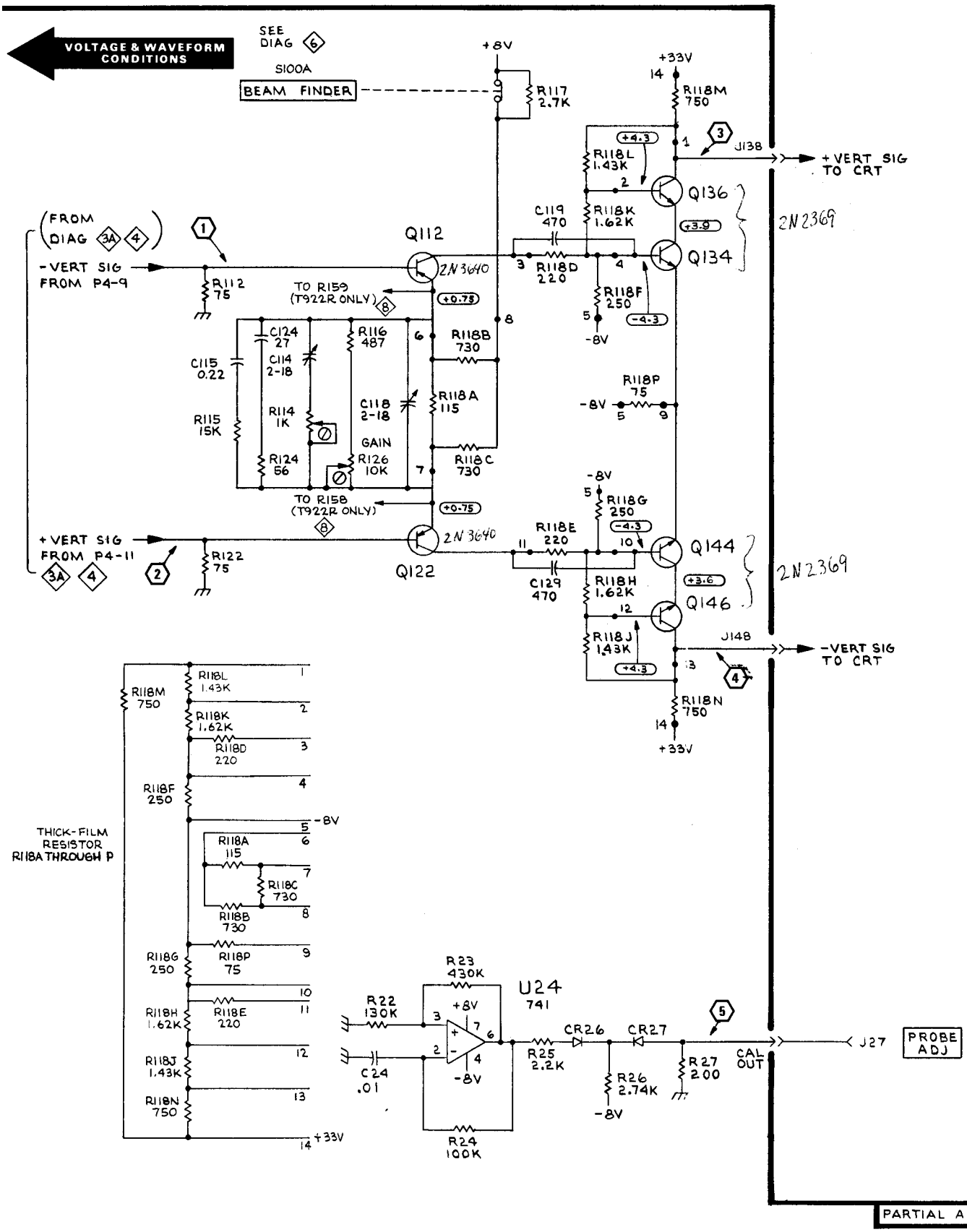
VOLTS/DIV (both)	20 mV	MODE	AUTO
AC-GND-DC (both)	DC	SLOPE	+OUT
Vertical Mode	DUAL TRACE	SEC/DIV	.5 ms
SOURCE	INT		

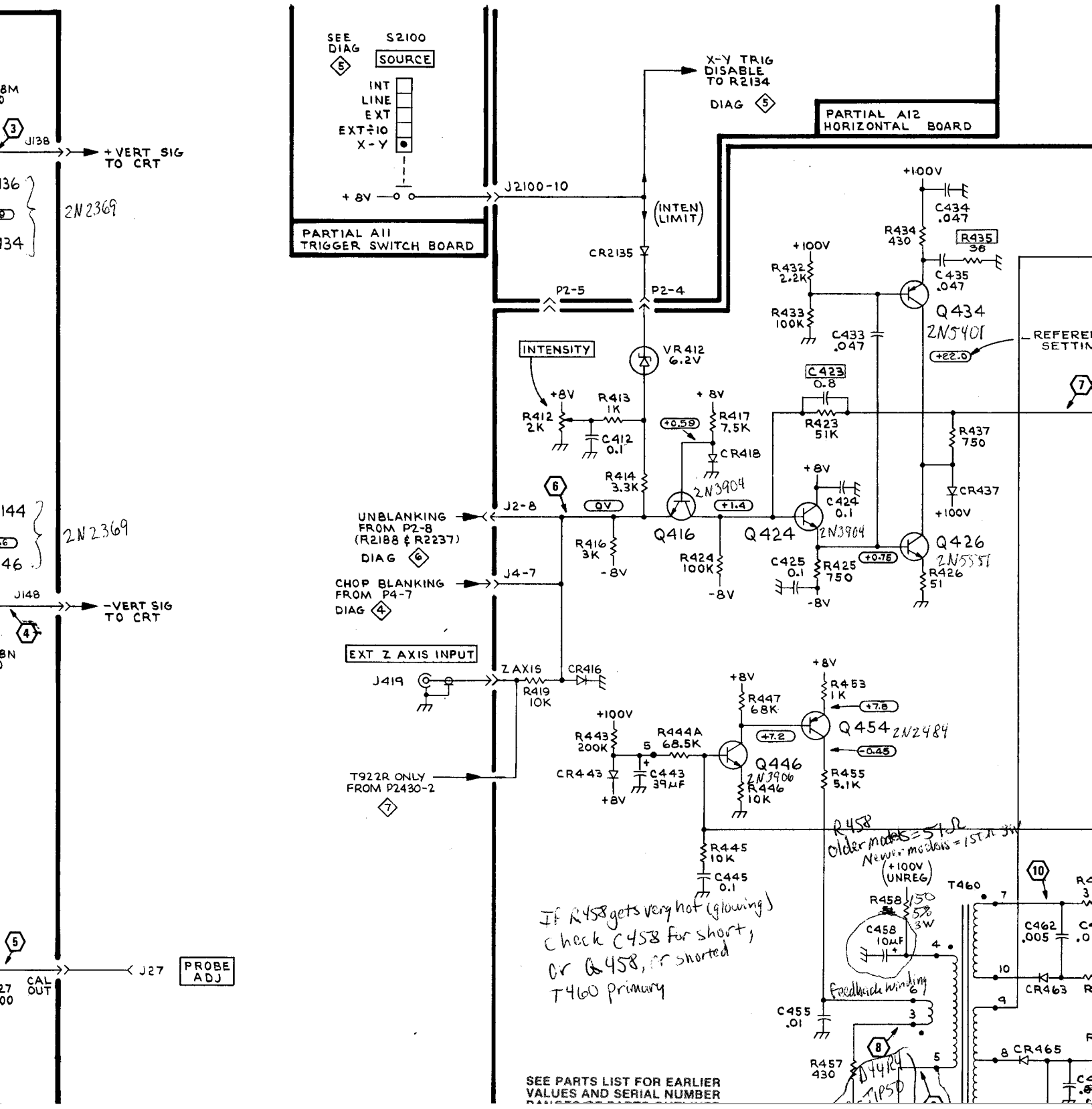
The other controls were set as needed to obtain a display.

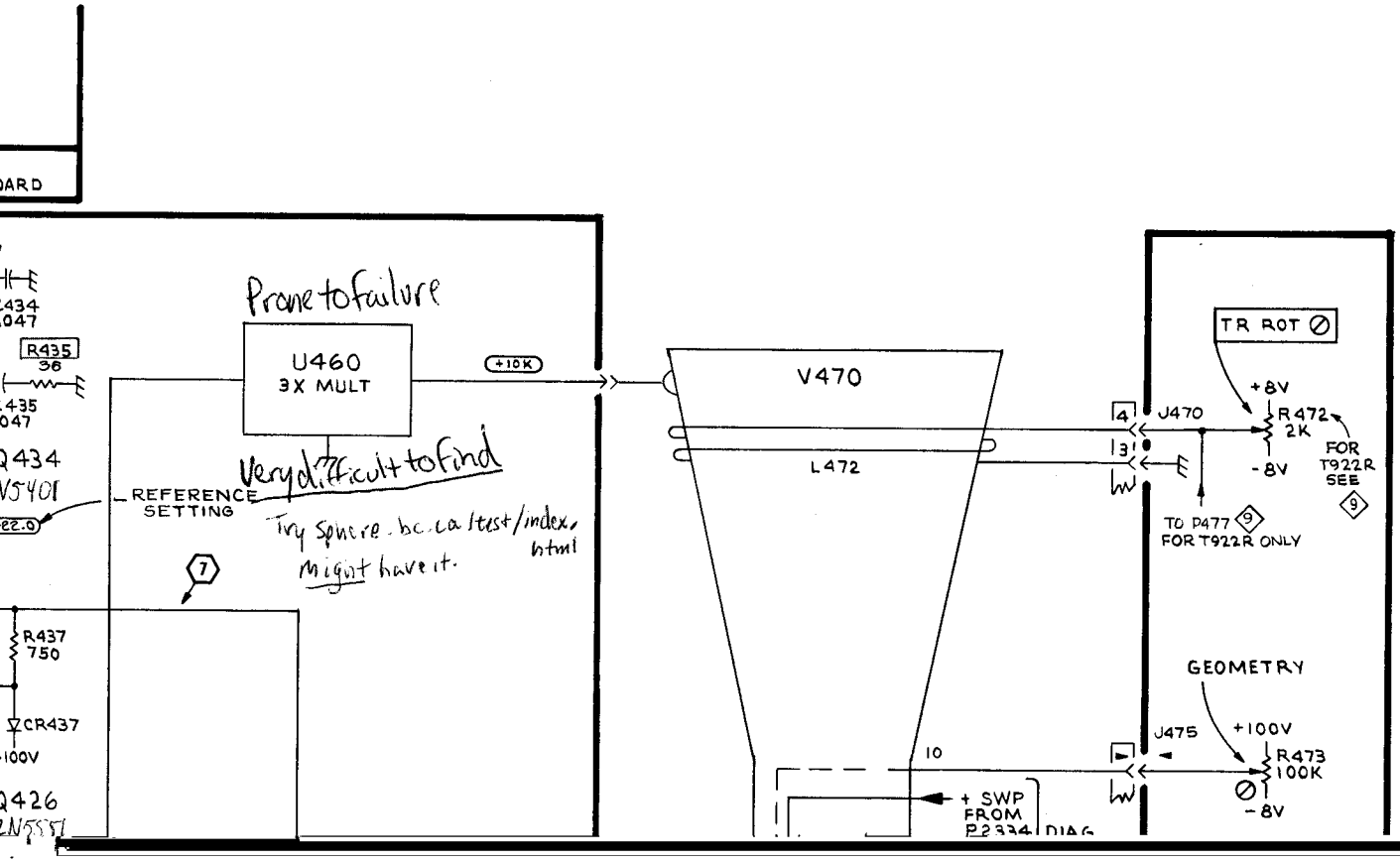
The CH 1 POSITION control was adjusted so that the bottom of the sine wave was on the first horizontal graticule line above the center and the CH 2 POSITION control was adjusted so that the top of the square wave was on the first horizontal graticule line below the center.

For waveforms 6 and 7, the AC-GND-DC switches were set to GND and SOURCE to LINE. Also for waveforms 6, and 7, the LEVEL and INTENSITY controls were set to approximately midrange.




VOLTAGE & WAVEFORM CONDITIONS
SEE DIAG 6
S100A
BEAM FINDER
+8V
R117 2.7K
+33V
14
R118M 750
+4.3
R118L 1.43K
1
3
J138
+VERT SIG TO CRT
2
Q136
2N2369
C119 470
R118K 1.62K
+3.9
Q134
(FROM DIAG 3A 4)
1
-VERT SIG FROM P4-9
Q112
2N3640
3
R118D 220
4
R112 75
TO R159 (T922R ONLY) 8
+0.75
8
R118F 250
-4.3
5
-8V
C124 27
C114 2-18
R116 487
6
R118B 730
C115 0.22
C118 2-18
R118A 115
R118P 75
-8V
5
9
R115 15K
R114 1K
GAIN
R126 10K
R124 56
R118C 730
7
TO R158 (T922R ONLY) 8
+0.75
-8V
5
R118G 250
-4.3
+VERT SIG FROM P4-11
3A 4
2
R122 75
2N3640
Q122
R118E 220
11
10
Q144
2N2369
C129 470
R118H 1.62K
+3.6
Q146
12
R118J 1.43K
+4.3
J148
-VERT SIG TO CRT
3
4
R118N 750
14
+33V
THICK-FILM RESISTOR R118A THROUGH P
R118L 1.43K
R118K 1.62K
R118D 220
R118F 250
-8V
R118A 115
R118C 730
R118B 730
R118P 75
R118E 220
R118J 1.43K
R118N 750
+33V
R23 430K
U24 741
R22 130K
+8V
-8V
C24 .01
R24 100K
CR26
CR27
5
R25 2.2K
R26 2.74K
R27 200
CAL OUT
J27
PROBE ADJ
PARTIAL A1 INTERFACE BOAR


SEE DIAG 5
S2100
SOURCE
INT
LINE
EXT
EXT÷10
X-Y
+8V
J2100-10
X-Y TRIG DISABLE TO R2134
DIAG 5
PARTIAL A11 TRIGGER SWITCH BOARD
PARTIAL A12 HORIZONTAL BOARD
(INTEN) LIMIT
CR2135
P2-5
P2-4
INTENSITY
VR412 6.2V
R412 2K
R413 1K
C412 0.1
R414 3.3K
R416 3K
-8V
R417 7.5K
CR418
+0.59
2N3904
Q416
R424 100K
+1.4
Q424
+100V
C434 .047
R434 430
R435 36
C435 .047
Q434 2N5401
R432 2.2K
R433 100K
C433 .047
+22.0
C423 0.8
R423 51K
R437 750
CR437
C424 0.1
2N3904
Q426 2N5551
C425 0.1
R425 750
+0.75
R426 51
UNBLANKING FROM P2-8 (R2188 & R2237)
DIAG 6
J2-8
QV
CHOP BLANKING FROM P4-7
DIAG 4
J4-7
EXT Z AXIS INPUT
J419
Z AXIS
R419 10K
CR416
T922R ONLY FROM P2430-2
DIAG 7
R443 200K
R444A 68.5K
CR443
C443 .39µF
R447 68K
+7.2
Q446 2N3906
R446 10K
R453 1K
+7.8
Q454 2N2484
-0.45
R455 5.1K
R458
Older models = 51Ω
Newer models = 1ST Ω 3W
R445 10K
C445 0.1
(+100V UNREG)
T460
R458 150 5% 3W
C458 10µF
Feedback winding
C455 .01
R457 430
D44K4
TIP50
C462 .005
CR463
CR465
IF R458 gets very hot (glowing)
Check C458 for short,
or Q458, or shorted
T460 primary
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER
+VERT SIG TO CRT
J138
2N2369
-VERT SIG TO CRT
J148
CAL OUT
J27
PROBE ADJ


Prone to failure
U460
3X MULT
+10K
Very difficult to find
REFERENCE SETTING
Try Sphere.bc.ca/test/index.html might have it.
V470
L472
TR ROT
+8V
R472
2K
J470
-8V
FOR T922R SEE 9
TO P477 9 FOR T922R ONLY
GEOMETRY
+100V
J475
R473
100K
-8V
10
+ SWP FROM P2334 DIAG
R435
36
R437
750
CR437
Q434
Q426

POWER SUPPLY CIRCUT DESCRIPTION

POWER INPUT

Ac power is applied to the primary of T700 through line fuse F700, POWER switch S700, Line Selector switch S701, and Range Selector switch S705.

The Line Selection switch, S701, connects the split primary windings of T700 in parallel for 120 V operation or in series for 240 V. When changing the nominal line voltage, also change the line fuse. See parts list for correct fuse falues.

The Range Selector switch, S705, selects either LO (100 or 220 V) or HI (120 or 240 V) nominal line-voltage range.

SECONDARY CIRCUITS

The secondary circuit supplies four regulated voltages: −8 V, +8 V, +33 V, and +100 V.

Operational amplifiers U742A (+8 V supply) and U742B (−8 V supply) have differential inputs that monitor output voltage variations and provide correction signals to the series-regulating transistors. For example, suppose the +8 volt supply drops. This negative change is coupled to the inverting input of U742A through sense resistor R756, causing pin 7 to go positive. Since

Regulated +33 V is provided by Zener diode VR784 from the +100 V supply. A different circuit provides a similar voltage for the T922R (see T922R circuit description at the end of this section). Current divider, R741, R742, R2102 (see diagram 5) provides a sample of the line voltage for line triggering.

POWER-ON LAMP CIRCUIT

The ON lamp, DS796, remains on as long as the line voltage does not vary more than approximately 10% from the nominal selected line voltage (100, 120, 220, or 240 V). When the line voltage is not within the 10% limit, the ON lamp blinks.

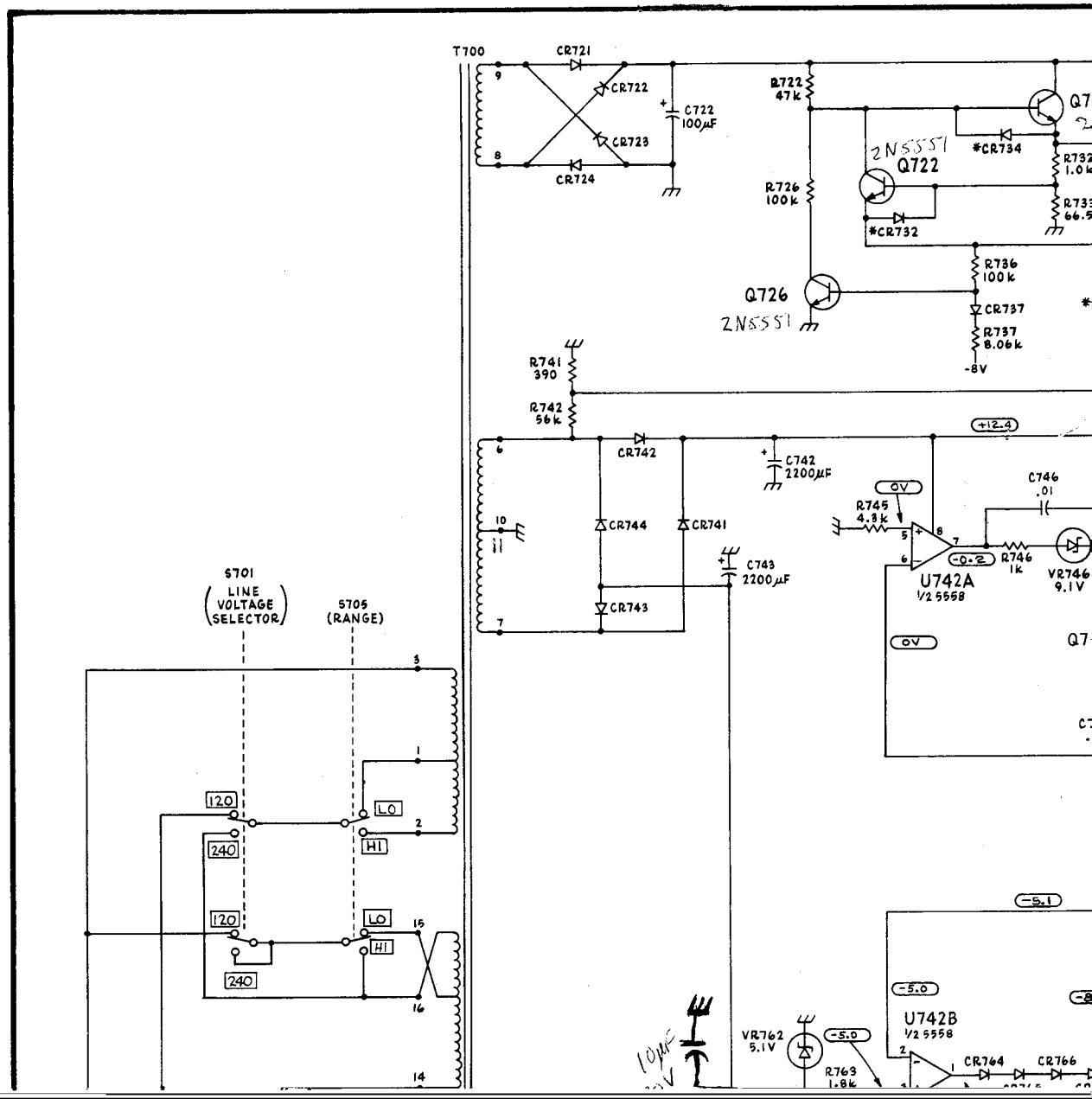
As long as Q796 is conducting, DS796 remains on. If Q796 is biased off, DS796 goes out, allowing C796 to charge through R796 and R797. When C796 reaches about 80 V, it discharges through DS796 causing it to turn on momentarily. Capacitor C796 again is charged through R796-R797 and discharged through DS796. This cycle repeats, causing the ON lamp to blink until the line voltage is within the 10% limit and Q796 conducts.

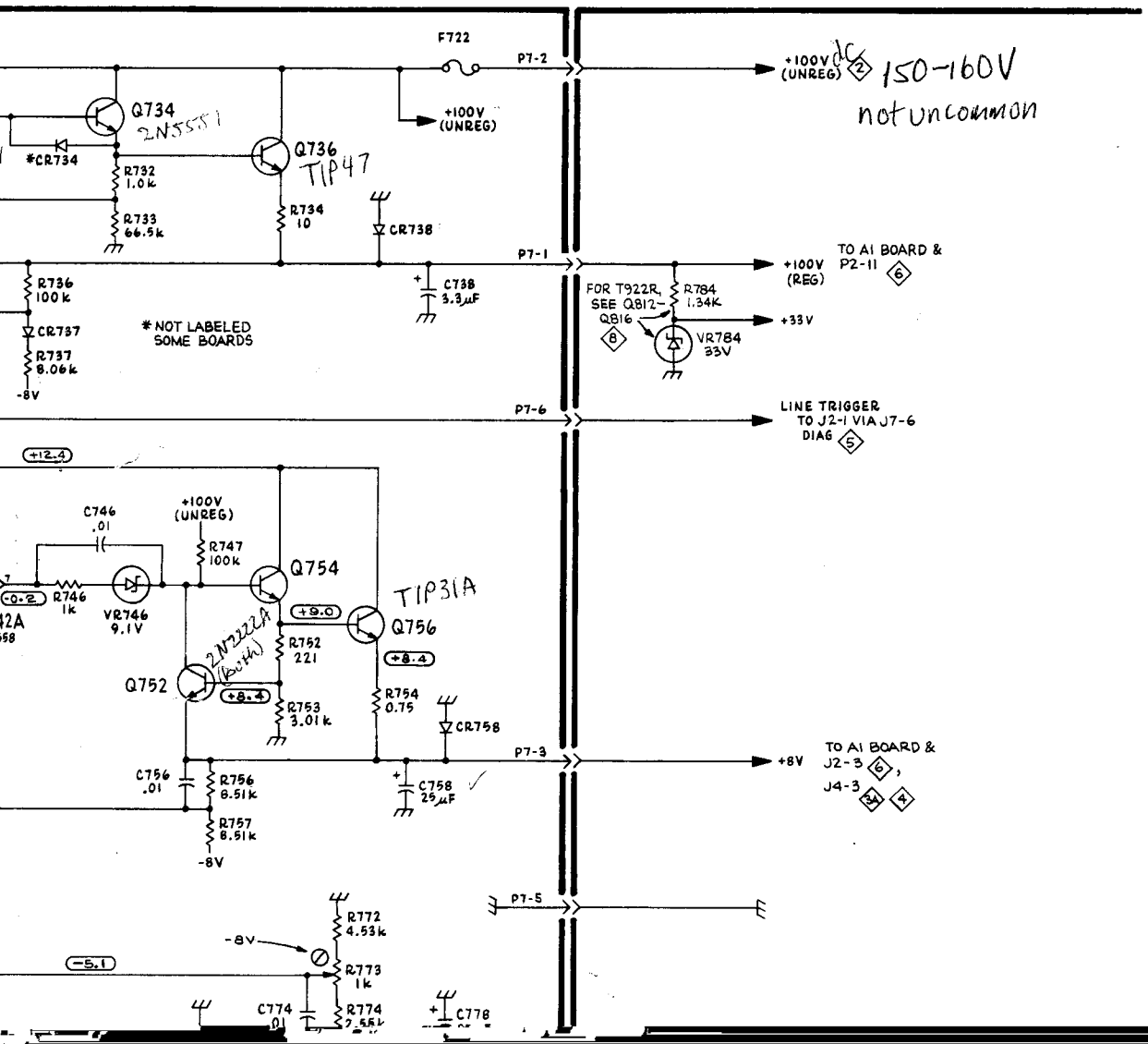
When the 100 V unregulated supply at voltage divider R792 and R793 increases to more than about 10% above the nominal value, Q792 turns on and Q796 turns off, causing DS796 to blink. When the 100 V unregulated supply at voltage divider R794 and R795 decreases to less than about 10% below the nominal value, Q796 turns off, causing DS796 to blink.

VOLTAGE CONDITIONS

Voltages shown on this schematic diagram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical input or the X (external trigger) input.

Components prone to fail with age:
C472 - 2200μF filter cap
C473 - " " " "
C722 100μF 160V





150-160V not uncommon

VERT INPUT (T921) CIRCUIT DESCRIPTION

INPUT COUPLING SWITCH

Paraphase amplifier stage, U4134A and U4134D, converts the

nverts the
ull current
river stage
isolate the
trol R4306
o vertically
65 provide
age excur-

DELAY LINE

The delay line, DL4339, provides approximately 200 ns delay in the vertical signal. This allows the sweep generator circuit time to initiate a sweep before the vertical signal reaches the crt vertical deflection plates.

TRIGGER PICKOFF

converted to a current signal. This current signal is applied to the trigger input amplifier (see diagram 5). When the SOURCE switch is set to INT, approximately −4 volts from the trigger input amplifier appears at the Q4176 collector circuit, reverse biasing CR4267. When the source switch is set to LINE, EXT, EXT ÷ 10, or X-Y, the internal trigger signal is disconnected from the trigger input amplifier, permitting CR4367 to conduct and set the collector of Q4176 at about −3 volts. This maintains conduction

VOLTAGE CONDITIONS

Voltages shown on this schematic diagram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical input or the X (external trigger) input. See Waveform Conditions for T921 control settings.

WAVEFORM CONDITIONS

Waveforms below were monitored with a Tektronix 7704A Oscilloscope, 7B71 Time Base, 7A15A Amplifier and 10X probe. The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

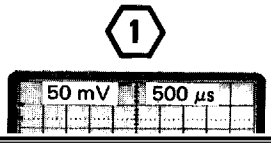
A 1 kHz, 50 mV sine wave was applied to the Y input. A Tektronix FG 501 Function Generator provided the input waveform.

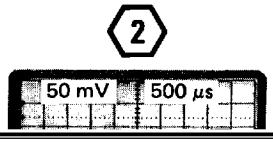
The T921 controls were set as follows:

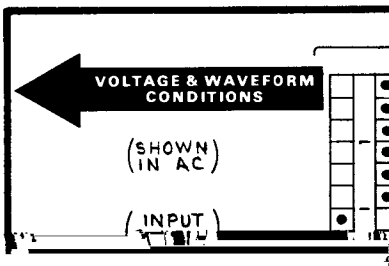
VOLTS/DIV	10 mV
AC-GND-DC	DC
SOURCE	INT
MODE	AUTO
SLOPE	+OUT
SEC/DIV	.5 ms

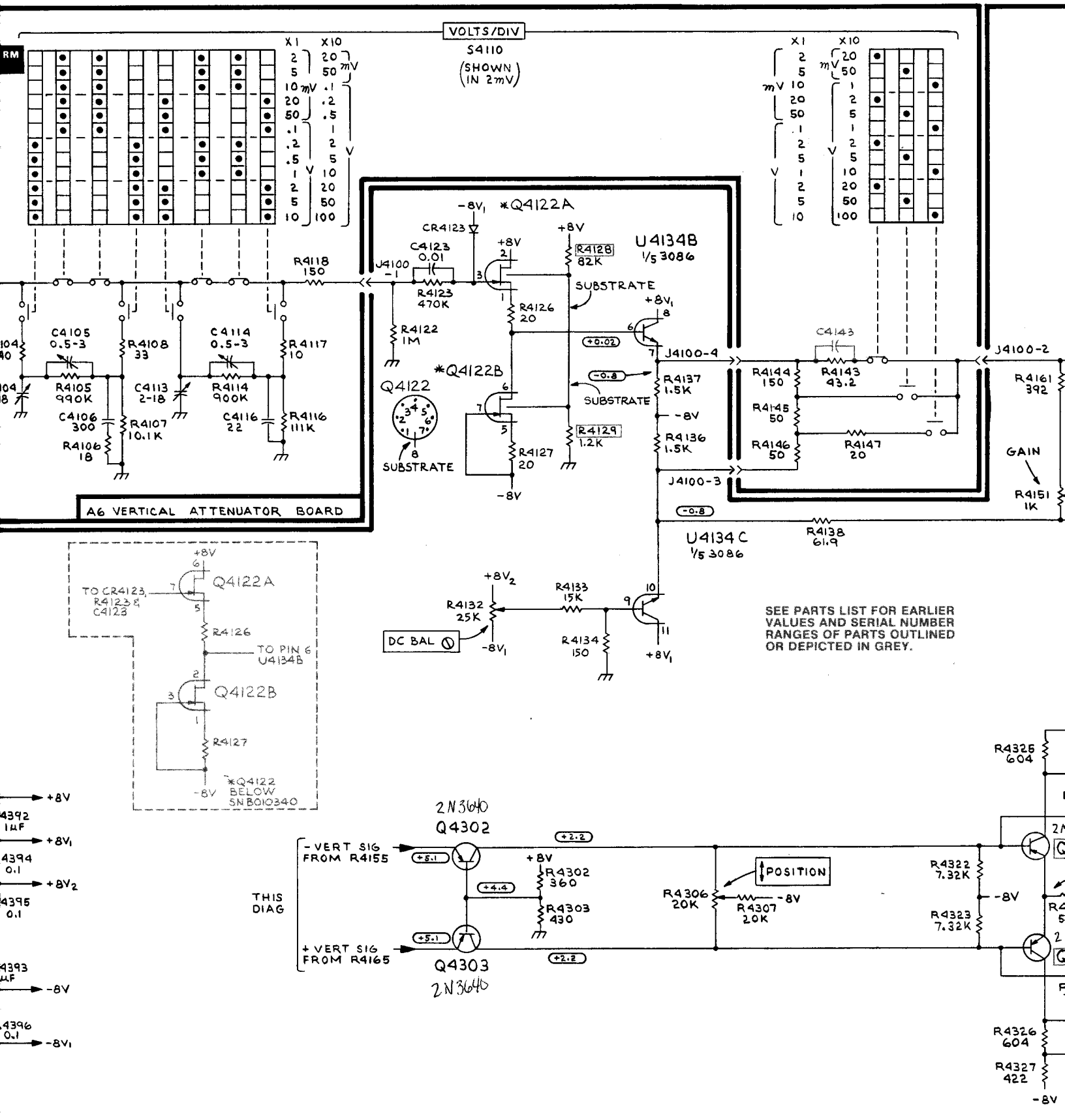
The other controls were set as needed to obtain a display.

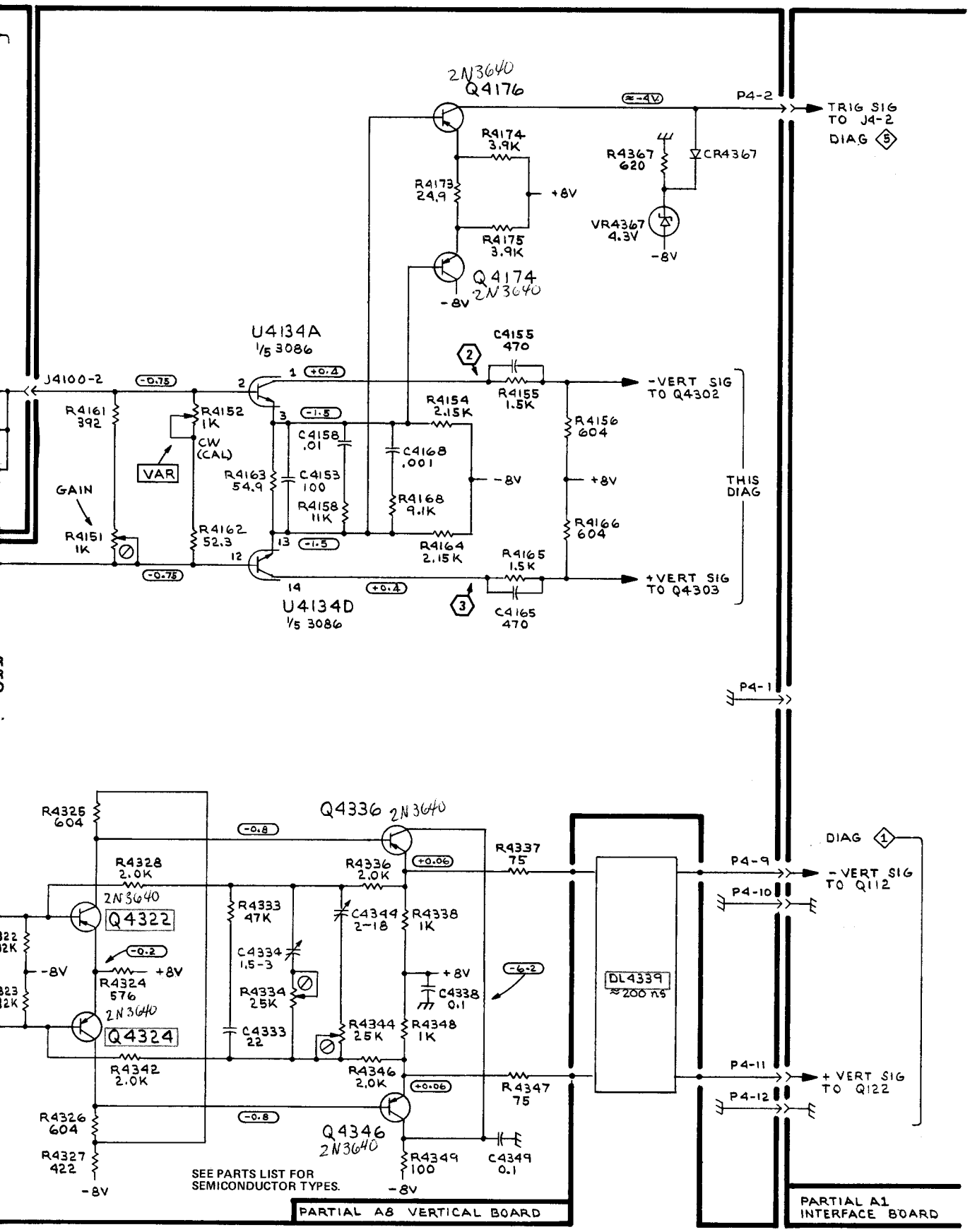
For waveform 3, the test oscilloscope was triggered externally from pin 1 of U4134.






VOLTAGE & WAVEFORM CONDITIONS
(SHOWN IN AC)
(INPUT


VOLTS/DIV
S4110
(SHOWN IN 2mV)
X1 X10
2 20 mV
5 50
10 mV .1
20 .2
50 .5
.1 1
.2 2
.5 5
1 V 10
2 20
5 50
10 100
A6 VERTICAL ATTENUATOR BOARD
R4118 150
C4105 0.5-3
R4105 990K
R4108 33
C4113 2-18
C4106 300
R4107 10.1K
R4106 18
C4114 0.5-3
R4114 900K
C4116 22
R4116 111K
R4117 10
J4100 -1
C4123 0.01
R4123 470K
R4122 1M
CR4123
-8V1
*Q4122A
+8V
R4128 82K
U4134B 1/5 3086
SUBSTRATE
R4126 20
+8V1
+0.02
J4100-4
*Q4122B
Q4122
SUBSTRATE
-0.8
R4137 1.5K
R4129 1.2K
R4127 20
-8V
R4136 1.5K
J4100-3
C4143
R4144 150
R4143 43.2
R4145 50
R4146 50
R4147 20
J4100-2
R4161 392
GAIN
R4151 1K
U4134C 1/5 3086
R4138 61.9
+8V2
R4133 15K
R4132 25K
DC BAL
R4134 150
SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.
TO CR4123, R4123 & C4123
Q4122A
R4126
TO PIN 6 U4134B
Q4122B
R4127
*Q4122 BELOW SN B010340
2N3640
Q4302
-VERT SIG FROM R4155
+VERT SIG FROM R4165
THIS DIAG
+2.2
+5.1
+4.4
R4302 360
R4303 430
Q4303
2N3640
R4306 20K
POSITION
R4307 20K
R4322 7.32K
R4323 7.32K
R4325 604
R4326 604
R4327 422
+8V
-8V
+8V1
+8V2
-8V1



VERTICAL INPUT (T921) 3A

VERT INPUT (T922/T922R) CIRCUIT DESCRIPTION

Since Channel 1 and Channel 2 vertical input circuits are identical, only Channel 1 is discussed in detail. The 4100 series circuit numbers identify the Channel 1 components and 4200 series numbers identify the Channel 2 components.

INPUT COUPLING SWITCH

Vertical input signal is ac-coupled, dc-coupled, or grounded by S4100. In the DC position, the input signal is coupled directly to the VOLTS/DIV switch attenuator. In the AC position, the input signal passes through C4102 to the attenuator. In the GND position, the signal path from the input connector to the attenuator is grounded through C4102-R4102. This provides a ground reference without disconnecting the signal from the input connector. In the GND position, C4102 is charged to the average signal level through R4102 so that the trace remains on screen when S4100 is changed to the AC position.

VOLTS/DIV SWITCH

The VOLTS/DIV switch selects attenuator ratio and preamplifier gain to determine the deflection factor. The basic 1X deflection factor of the vertical deflection system is 2 mV/division. At this setting, no attenuators are switched in and the gain switching circuit sets the preamplifier gain to maximum. To provide the complete range of deflection factors indicated on the front panel, precision attenuators are switched in and out of the attenuator and gain switching circuit.

The attenuators are frequency compensated voltage dividers which provide constant attenuation at all frequencies within the bandwidth of the instrument. The input RC characteristics (approximately 1 MΩ times approximately 30 pF) are maintained for each setting of the VOLTS/DIV switch. The attenuator circuit consists of a 10X and a 100X attenuator. 1000X is obtained when the 10X and 100X attenuators are cascaded.

The gain switching circuit consists of R4143 through R4147 and three VOLTS/DIV switch contacts. Three preamplifier gains are selected: 1X (maximum), 2.5X reduction, and 5X reduction. Refer to Table 7-2 for the attenuator and gain switching sequence.

Transistors U4134B and U4134C are emitter followers. The signal at the emitter of U4134B follows the signal at the gate of Q4122A. Divider network R4143 through R4147 attenuates the signal from U4134B which drives the base of U4134A. DC BAL, R4132, adjusts for minimum trace shift when switching between adjacent positions of the VOLTS/DIV switch.

Paraphase amplifier stage, U4134A and U4134D, converts the single-ended signal at the base of U4134A to a push-pull current signal. These current signals are fed to the delay line driver stage via buffer stages Q4302 and Q4303. The buffer stages isolate the preamplifier from the delay line driver. POSITION control R4306 varies the dc voltage at the bases of Q4322 and Q4324 to vertically position the trace on the crt. Resistors R4155 and R4165 provide compensation to maintain average power during voltage excursions. Capacitors C4155 and C4165 reduce Miller effect through U4134A and U4134D.

The components connected between U4134A and U4134D emitters compensate for high-frequency losses in the preamplifier. Gain adjustment R4151 determines the gain of the preamplifier. The VAR control, R4152, provides uncalibrated deflection factors between VOLTS/DIV switch settings by attenuating the signal to the base of U4134A. When R4152 is rotated clockwise, its full resistance is in series with R4162, and the deflection factors are calibrated.

TABLE 7-2

Attenuator and Gain Switching Sequence

VOLTS/DIV Setting	Attenuator (signal attenuation)	Gain Switch (preamp gain reduction)

TRIGGER PICKOFF

A sample of the vertical voltage signal from the emitters of U4134A and U4134D is applied to Q4176 and Q4174 where it is converted to a current signal. This current signal is applied to the trigger input amplifier (see diagram 5) via trigger source switching circuitry (see diagram 4). When the SOURCE switch is set to INT, approximately −4 volts from the trigger input amplifier appears at the Q4176 collector circuit, reverse biasing CR4367. When the source switch is set to LINE, EXT, EXT ÷ 10, or X-Y, the internal trigger signal is disconnected from the trigger input amplifier, permitting CR4367 to conduct and set the collector of Q4176 at about −3 volts. This maintains conduction of Q4176, providing a constant load to prevent distortion of the main vertical signal.

VOLTAGE CONDITIONS

Voltages shown on this schematic digaram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical or the X (external trigger) input. See Waveform Conditions for T922 or T922R control settings.

WAVEFORM CONDITIONS

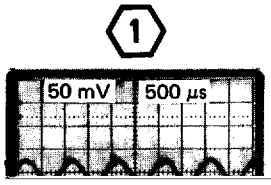
Waveforms below were monitored with a Tektronix 7704A Oscilloscope, 7B71 Time Base, 7A15A Amplifier and 10X probe (unless otherwise noted). The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

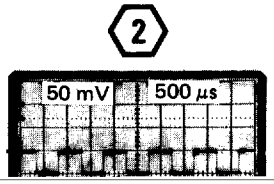
A 1 kHz, 50 mV sine wave was applied to CH 1 input and a 1 kHz, 50 mV square wave was applied to CH 2 input. A Tektronix FG 501 Function Generator provides either of the input waveforms.

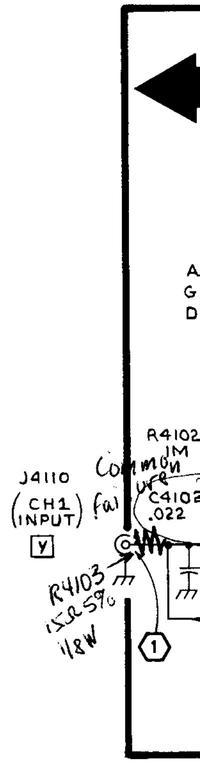
The T922 or T922R controls were set as follows:

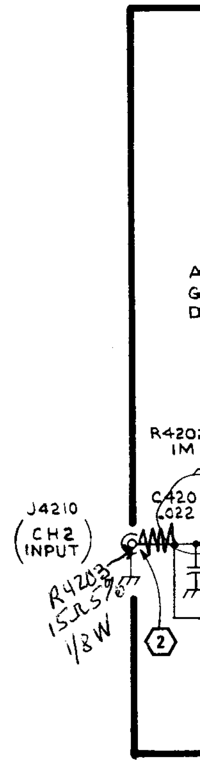
VOLTS/DIV (both)	10 mV
AC-GND-DC (both)	DC
Vertical Mode	CH 1
SOURCE	INT
MODE	AUTO
SLOPE	+OUT
SEC/DIV	.5 ms

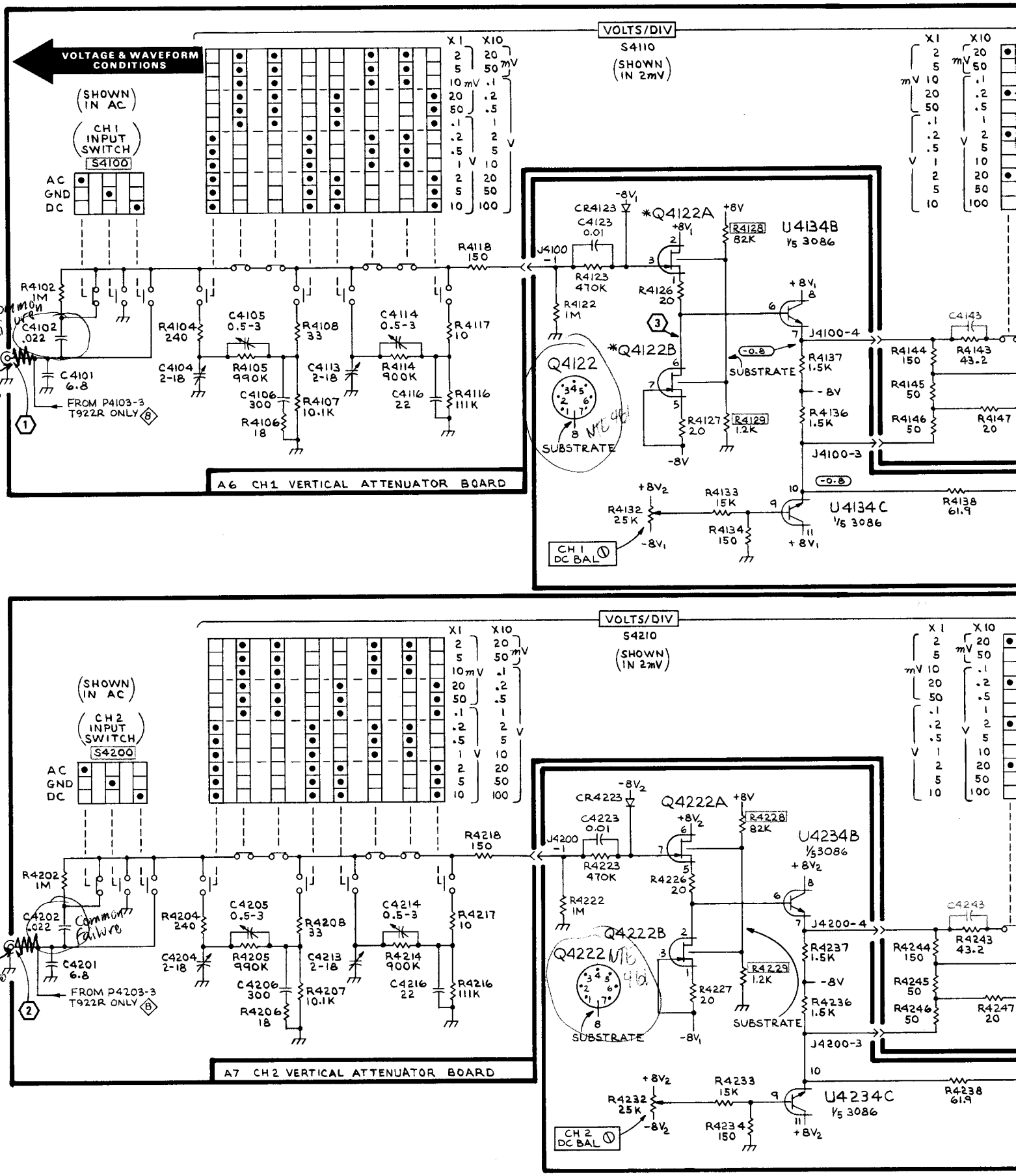
The other controls were set as needed to obtain a display.

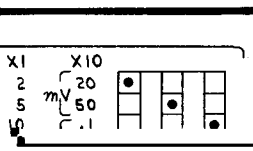





R4102
1M
C4102
.022
J4110
(CH1 INPUT)
Y
R4103
15Ω 5%
1/8W
Common failure
1


R4202
1M
.022
J4210
(CH2 INPUT)
R4203
15Ω 5%
1/8W
2


VOLTAGE & WAVEFORM CONDITIONS
(SHOWN IN AC)
CH 1 INPUT SWITCH S4100
AC
GND
DC
VOLTS/DIV
S4110
(SHOWN IN 2mV)
X1 X10
2 20 mV
5 50
10 mV .1
20 .2
50 .5
.1 1
.2 2
.5 5
1 V 10
2 20
5 50
10 100
R4102 1M
C4102 .022
C4101 6.8
R4103 150Ω 5% 1/8W
FROM P4103-3 T922R ONLY
R4104 240
C4104 2-18
R4105 990K
C4105 0.5-3
R4106 18
C4106 300
R4107 10.1K
R4108 33
C4113 2-18
R4114 900K
C4114 0.5-3
R4116 22
R4117 111K
R4118 150
A6 CH1 VERTICAL ATTENUATOR BOARD
J4100-1
R4123 470K
R4122 1M
CR4123
C4123 0.01
-8V1
*Q4122A
*Q4122B
Q4122
SUBSTRATE
R4126 20
R4127 20
R4128 82K
R4129 1.2K
U4134B 1/5 3086
+8V1
-8V1
R4137 1.5K
R4136 1.5K
J4100-4
J4100-3
-0.8
R4144 150
R4145 50
R4146 50
R4143 43.2
R4147 20
C4143
U4134C 1/6 3086
+8V2
R4132 25K
R4133 15K
R4134 150
R4138 61.9
CH 1 DC BAL
(SHOWN IN AC)
CH 2 INPUT SWITCH S4200
AC
GND
DC
VOLTS/DIV
S4210
(SHOWN IN 2mV)
R4202 1M
C4202 .022
C4201 6.8
R4203 150Ω 5% 1/8W
FROM P4203-3 T922R ONLY
R4204 240
C4204 2-18
R4205 990K
C4205 0.5-3
R4206 18
C4206 300
R4207 10.1K
R4208 33
C4213 2-18
R4214 900K
C4214 0.5-3
R4216 22
R4217 111K
R4218 150
A7 CH2 VERTICAL ATTENUATOR BOARD
J4200-1
R4223 470K
R4222 1M
CR4223
C4223 0.01
-8V2
Q4222A
Q4222B
SUBSTRATE
R4226 20
R4227 20
R4228 82K
R4229 1.2K
U4234B 1/3 3086
+8V2
-8V2
R4237 1.5K
R4236 1.5K
J4200-4
J4200-3
R4244 150
R4245 50
R4246 50
R4243 43.2
R4247 20
C4243
U4234C 1/5 3086
R4232 25K
R4233 15K
R4234 150
R4238 61.9
CH 2 DC BAL



2N3640
Q4176 CH-1

VERT SWITCHING (T922/T922R) CIRCUIT DESCRIPTION

Digital logic devices are used to perform some of the functions in this instrument. LO and HI designations are used in this circuit description to indicate the state of the digital circuit. HI indicates the more positive of the two levels. The specific voltages that consitute a LO and HI logic state, may vary between individual devices.

PREAMP BUFFER

The buffer stages Q4302 and Q4303 isolate the preamplifier from the delay line driver.

DELAY LINE DRIVER

The delay line driver is a push-pull feedback amplifier stage composed of Q4322, Q4324, Q4336, Q4346, and associated circuitry. A sample of the output of Q4346 and Q4336 is fed back through R4336-R4328 and R4346-R4342 to the bases of Q4322 and Q4324. Due to this feedback, this stage forms an inverting operational amplifier with a virtual ground at the bases of Q4322 and Q4324. Any current into these virtual grounds (multiple pins)

In the CH 2 mode, the above conditions are reversed. Diodes CR4312 and CR4313 are reverse biased, passing the CH 2 signal and blocking the CH 1 signal.

In the DUAL TRACE Vertical Mode, CH 1 and CH 2 are alternately connected to the delay line driver. There are two dual trace modes: chopped and alternate. These modes are determined by the SEC/DIV switch setting. Chopped mode is obtained for sweep speeds of 1 ms and slower and alternate for sweep speeds of 0.5 ms and faster.

VOLTAGE CONDITIONS

Voltages shown on this schematic digaram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical or the X (external trigger) input. See Waveform Conditions for T922 or T922R control settings.

WAVEFORM CONDITIONS

Waveforms below were monitored with a Tektronix 7704A Oscilloscope, 7B71 Time Base, and 7A15A Amplifier and a 10X probe. The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

A 1 kHz, 50 mV sine wave was applied to Channel 1 input and a 1 kHz, 50 mV square wave was applied to Channel 2 input. A Tektronix FG 501 Function Generator provides either of the input waveforms..

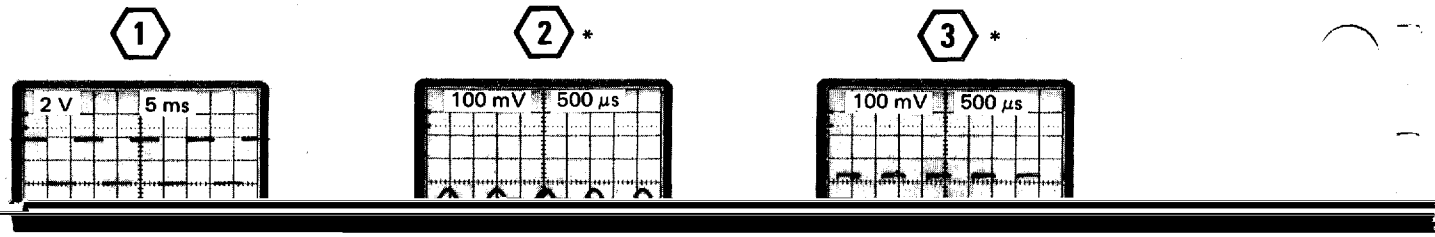
The T922 or T922R controls were set as follows:

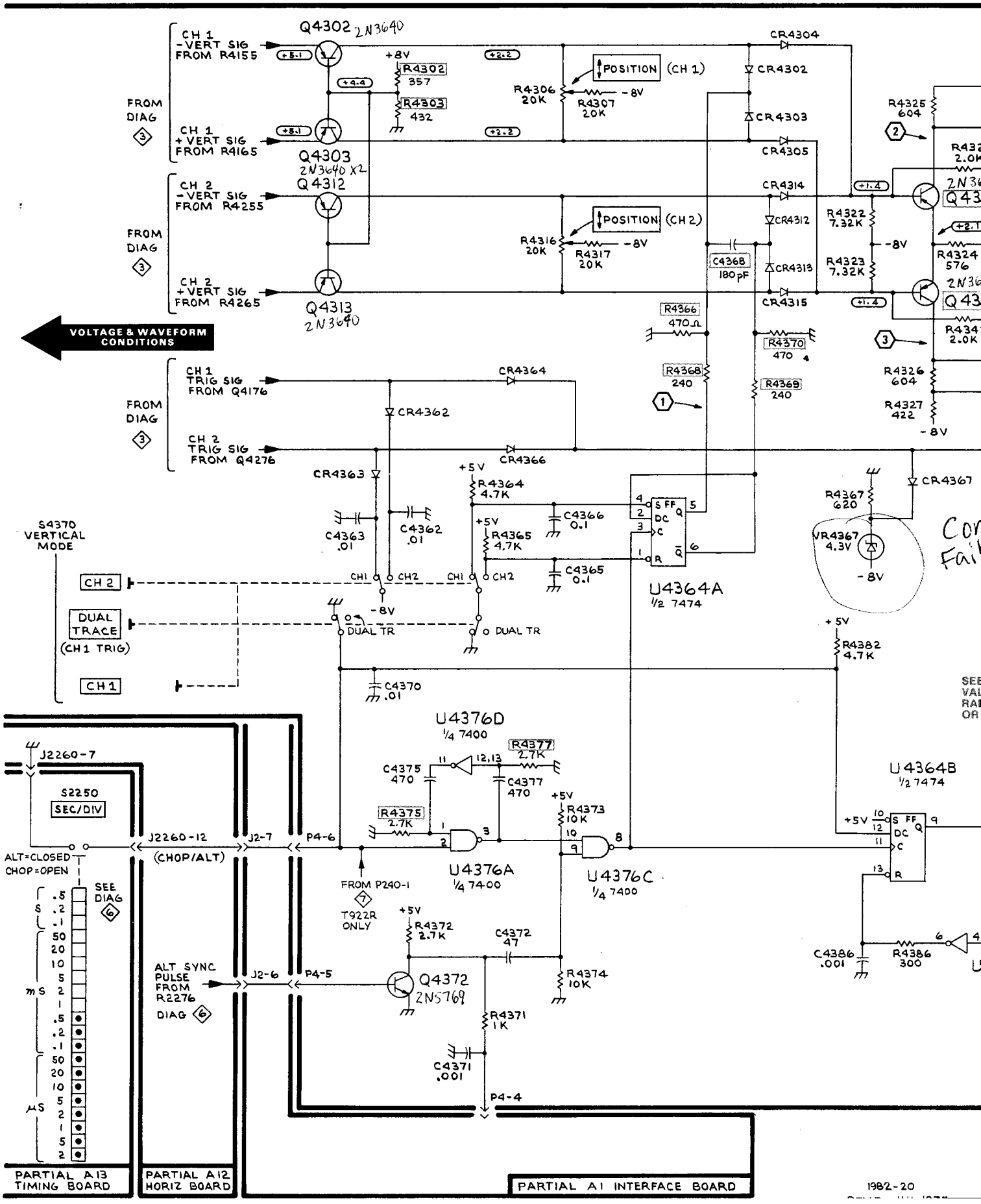
VOLTS/DIV (both)	20 mV
AC-GND-DC (both)	DC
Vertical Mode	DUAL TRACE
SOURCE	INT
MODE	AUTO
SLOPE	+OUT
SEC/DIV	.5 ms
LEVEL	As required

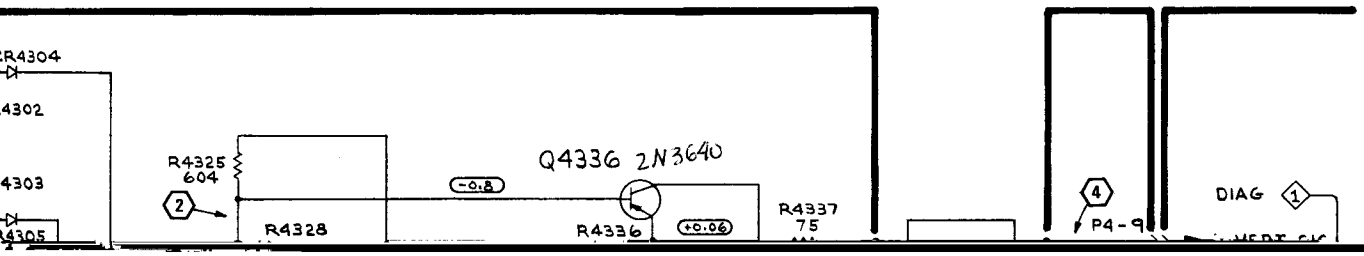
The other controls were set as needed to obtain a display.

The CH 1 POSITION control was adjusted so that the bottom of the sine wave was on the first horizontal graticule line above the center and the CH 2 POSITION control was adjusted so that the top of the square wave was on the first horizontal graticule line below the center.

***Screen positions for waveforms 2, 3, 4, and 5 are affected by settings of the T922 or T922R POSITION controls.**




VOLTAGE & WAVEFORM CONDITIONS
Q4302 2N3640
CH 1 -VERT SIG FROM R4155
CH 1 +VERT SIG FROM R4165
FROM DIAG 3
Q4303 2N3640 X2
Q4312
CH 2 -VERT SIG FROM R4255
CH 2 +VERT SIG FROM R4265
Q4313 2N3640
POSITION (CH 1)
POSITION (CH 2)
R4302 357
R4303 432
R4306 20K
R4307 20K
R4316 20K
R4317 20K
CR4302
CR4303
CR4304
CR4305
CR4312
CR4313
CR4314
CR4315
C4368 180pF
R4322 7.32K
R4323 7.32K
R4324 576
R4325 604
R4326 604
R4327 422
R4366 470Ω
R4368 240
R4369 240
R4370 470
CH 1 TRIG SIG FROM Q4176
CH 2 TRIG SIG FROM Q4276
CR4362
CR4363
CR4364
CR4366
CR4367
R4364 4.7K
R4365 4.7K
C4362 .01
C4363 .01
C4365 0.1
C4366 0.1
U4364A 1/2 7474
R4367 620
VR4367 4.3V
S4370 VERTICAL MODE
CH 2
DUAL TRACE (CH1 TRIG)
CH 1
CH1 CH2 DUAL TR
C4370 .01
R4382 4.7K
U4364B 1/2 7474
U4376D 1/4 7400
R4377 2.7K
C4375 470
C4377 470
R4373 10K
R4375 2.7K
U4376A 1/4 7400
U4376C 1/4 7400
J2260-7
S2250 SEC/DIV
J2260-12 (CHOP/ALT)
J2-7
P4-6
ALT=CLOSED CHOP=OPEN
SEE DIAG 6
FROM P240-1 7 T922R ONLY
R4372 2.7K
C4372 47
R4374 10K
ALT SYNC PULSE FROM R2276 DIAG 6
J2-6
P4-5
Q4372 2N5769
R4371 1K
C4371 .001
C4386 .001
R4386 300
P4-4
PARTIAL A13 TIMING BOARD
PARTIAL A12 HORIZ BOARD
PARTIAL A1 INTERFACE BOARD
1982-20


R4304
4302
4303
4305
R4325
604
2
R4328
Q4336 2N3640
-0.8
R4336
+0.06
R4337
75
4
P4-9
DIAG
1

TRIGGER CIRCUIT DESCRIPTION
(For T921 SN B010130-up, T922 B010170-up & T922R all SN)

Digital logic devices are used to perform some of the functions in this instrument. LO and HI designations are used in this circuit description to indicate the state of the digital circuit. HI indicates the more positive of the two levels. The specific voltages that constitute a LO and HI logic state may vary between individual devices.

[redacted]

SOURCE Switch

The SOURCE switch, S2100, selects trigger signals from INT, LINE, X-Y, EXT, and EXT. (EXT: 10)

INT. Signal from the trigger pickoff circuit in the vertical amplifier is connected to the trigger input amplifier, U2126B.

LINE. A sample of the line voltage, obtained from the power transformer, is connected to the trigger input amplifier U2126B.

circuit (U2126E, Q2174, Q2176) and the normal trigger generator circuit is disabled. In this mode, the SLOPE switch is used to supply the sync separator with a signal of the proper polarity. For SEC/DIV settings of .1 ms/div or slower, the sweep is triggered by vertical sync pulses which occur at a field rate. For SEC/DIV settings of 50 μs and faster, the sweep is triggered by the TV horizontal line signals.

TRIGGER INPUT AMPLIFIER

The trigger input amplifier consists of U2126A, U2126B, Q2124, and associated circuitry. Resistors R2127 and R2128 set [redacted]

Transistor U2126E is a high gain feedback amplifier. To achieve stable triggering on TV signals, the LEVEL control must be set at a point that will allow the sync pulses to appear within the dynamic range of the amplifier.

The sync separator circuit consists of Q2174 and associated circuitry. It processes sync-positive pulses when the SLOPE switch is in the +OUT position and sync-negative pulses in the −IN position. Transistor Q2174 produces large positive-going pulses from negative-going sync signals at the collector of U2126E.

In the TV field mode (SEC/DIV switch set for .1 ms or slower), [illegible] and the integrator

(composed of C2174, C2176, R2174, and R2176) is switched into the circuit (effectively connected to +8 volts through saturated Q2176). The integrator filters out the horizontal sync pulses, leaving only the integrated vertical sync pulses, which trigger the TV Schmitt trigger U2156B and U2156C.

In the TV line mode (SEC/DIV switch set for 50 μs or faster). [illegible]

SCHMITT TRIGGERS

The Schmitt trigger for the NORM and AUTO triggering modes consists of U2156A, U2156B, and associated circuitry. Hysteresis of this trigger circuit is determined by R2152, R2153, and R2147.

The Schmitt trigger for the TV triggering mode is U2156B, U2156C, U2156D, and associated circuitry. Resistors R2154 and R2178 determine the sensitivity.

When the MODE switch S2150 is in AUTO or NORM, +8 volts is applied to R2156 which causes pin 1 of U2156A to go HI, enabling

Schmitt trigger U2156A-U2156B. At the same time, pins 12 and 13 of U2156D are also HI disabling Schmitt trigger U2156C-U2156B. A trigger signal from U2126D triggers Schmitt trigger U2156A-U2156B to produce a logic trigger signal at pin 6 of U2156B.

When the MODE switch S2150 is in TV, +8 volts is removed from R2156 and pin 1 of U2156A is LO, disabling Schmitt trigger [illegible]

VOLTAGE CONDITIONS

Voltages shown on this schematic diagram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical input or the X (external trigger) input. Refer to Waveform Conditions for T922 or T922R control settings.

WAVEFORM CONDITIONS

NOTE

Waveforms are for T922 unless otherwise noted.

Waveforms below were monitored with a Tektronix 7704A Oscilloscope, 7B71 Time Base, 7A15A Amplifier and 10X probe. The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

A 1 kHz, 50 mV sine wave was applied to CH 1 input and a 1 kHz, 50 mV square wave was applied to CH 2 input. A Tektronix FG 501 Function Generator provides either of the input waveforms.

The T921, T922, or T922R controls were set as follows:

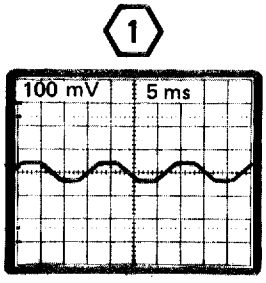
VOLTS/DIV (both)	20 mV
AC-GND-DC (both)	DC
Vertical Mode	DUAL TRACE
SOURCE	LINE
MODE	AUTO*
SLOPE	+OUT
SEC/DIV	.5 ms

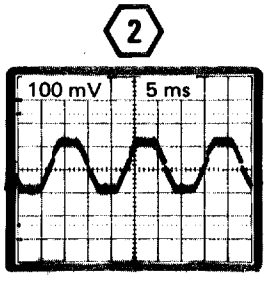
The other controls were set as needed to obtain a display.

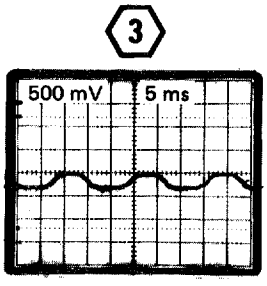
***For waveforms 5 and 6, the MODE switch was set to TV.**

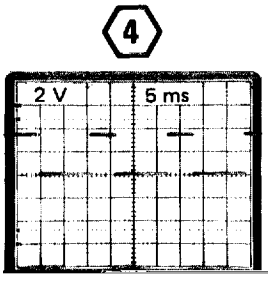
NOTE

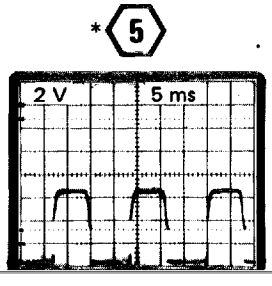
To obtain voltages and waveforms on the Horizontal board, the Vertical Amplifier must be operated separately from the instrument, using a Vertical Amplifier Extender Troubleshooting Fixture. See Troubleshooting Equipment and Vertical Amplifier Replacement in the Service Information section of this manual.

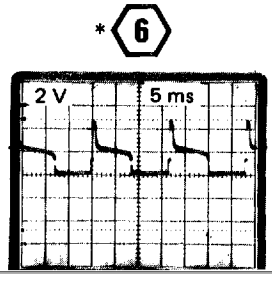


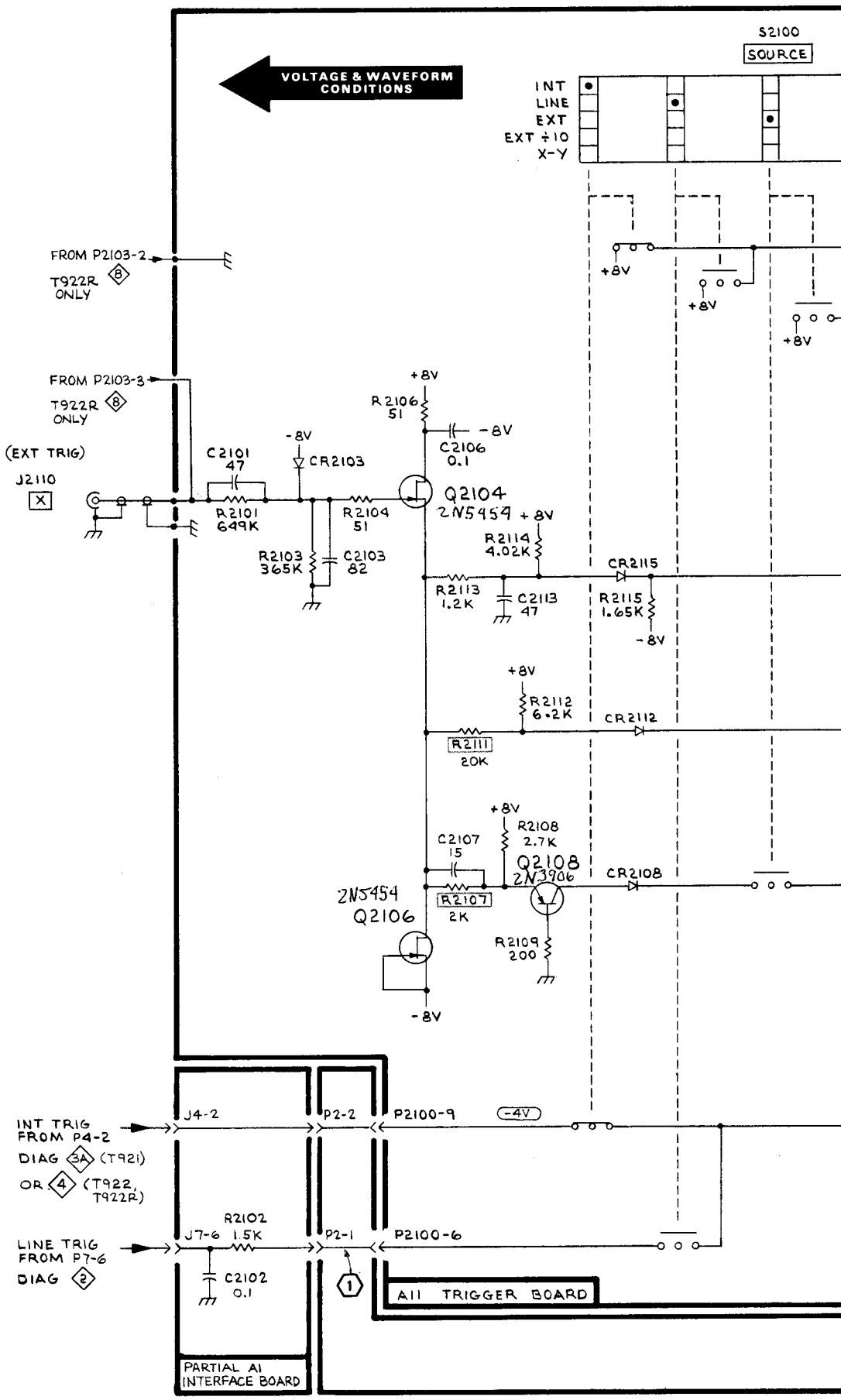




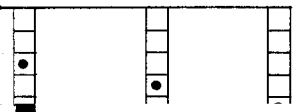




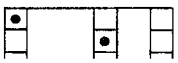



VOLTAGE & WAVEFORM CONDITIONS
S2100
SOURCE
INT
LINE
EXT
EXT ÷10
X-Y
FROM P2103-2
T922R ONLY
8
FROM P2103-3
T922R ONLY
8
(EXT TRIG)
J2110
X
+8V
R2106 51
-8V
C2106 0.1
-8V
CR2103
C2101 47
R2101 649K
R2104 51
Q2104 2N5459
+8V
R2114 4.02K
R2103 365K
C2103 82
CR2115
R2113 1.2K
C2113 47
R2115 1.65K
-8V
+8V
R2112 6.2K
CR2112
R2111 20K
+8V
R2108 2.7K
C2107 15
Q2108 2N3906
CR2108
2N5454 Q2106
R2107 2K
R2109 200
-8V
INT TRIG FROM P4-2
DIAG 3A (T921)
OR 4 (T922, T922R)
J4-2
P2-2
P2100-9
-4V
R2102 1.5K
LINE TRIG FROM P7-6
DIAG 2
J7-6
P2-1
P2100-6
C2102 0.1
1
A11 TRIGGER BOARD
PARTIAL A1 INTERFACE BOARD

S2100
SOURCE
(SHOWN IN INT)

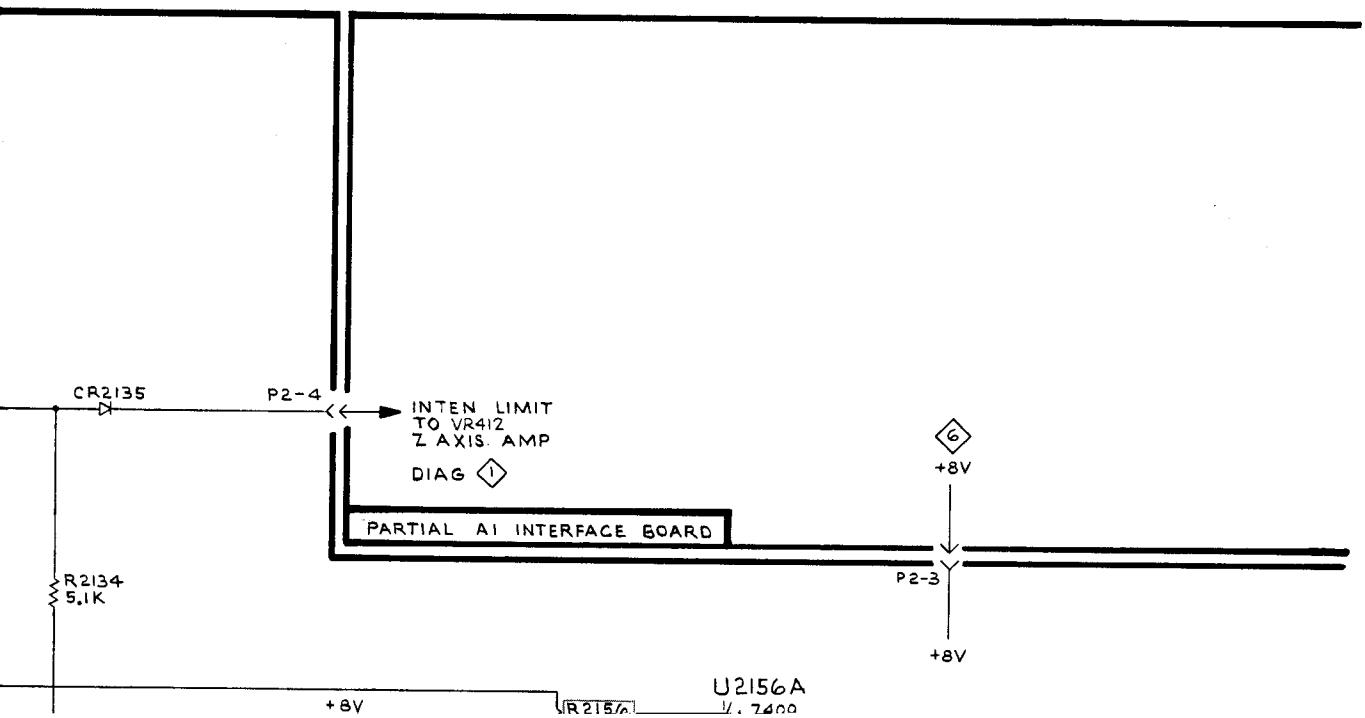


(SHOWN IN NORM)
S2150
MODE



* SOME BOARDS MARKED WITH THIS CKT NO., OR UNMARKED.

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED


CR2135
P2-4
INTEN LIMIT
TO VR412
Z AXIS AMP
DIAG 1
6
+8V
PARTIAL A1 INTERFACE BOARD
P2-3
+8V
R2134
5.1K
+8V
U2156A

TRIGGER CIRCUIT DESCRIPTION
(For T921 Below SN B010130 and T922 Below SN B010170)

Digital logic devices are used to perform some of the functions in this instrument. LO and HI designations are used in this circuit desciption to indicate the state of the digital circuit. HI indicates the more positive of the two levels. The specific voltages which constitute a LO and HI logic state may vary between individual devices.

INPUT AND SWITCHING

SOURCE Switch

The SOURCE switch, S2100, selects trigger signals from INT, LINE, VERT, and EXT.

INT. Signal from the trigger pickoff circuit in the vertical amplifier is connected to the trigger input amplifier U2126B.

LINE. A sample of the line voltage, obtained from the power transformer, is connected to the trigger input amplifier U2126B.

NORM. Connects +8 volts to R2223 in the sweep generator circuit. Allows the sweep to run only when a suitable triggering signal is present.

The trigger signal is applied to the TV sync separator circuit is disabled. In this mode, the SLOPE switch is used to supply the sync separator with a signal of the proper polarity. For SEC/DIV settings of .1 ms/div or slower, the sweep is triggered by vertical sync pulses which occur at a field rate. For SEC/DIV settings of 50 μs and faster, the sweep is triggered by the TV horizontal line signals.

[redacted]

TV TRIGGER CIRCUIT

The TV trigger circuit comprises U2126E, Q2174, Q2176, U2156B, C, D, and associated circuitry. When the MODE switch is in TV, R2161 is disconnected from +8 volts which allows trigger signals from the collectors of Q2134 and Q2136 to pass through the TV trigger circuit. (In AUTO and NORM, the +8 volts applied to R2161 biases U2126E to saturation.)

Transistor U2126E is a high gain feedback amplifier. To achieve stable triggering on TV signals, the LEVEL control must be set at a point that will allow the sync pulses to appear within the dynamic range of the amplifier.

The sync separator circuit consists of Q2174 and associated circuitry. It processes sync-positive pulses when the SLOPE switch is in the +OUT position and sync-negative pulses in the −IN position. Transistor Q2174 produces large positive-going pulses from negative-going sync signals at the collector of

In the TV line mode (SEC/DIV switch set for 50 μs or faster), Q2176 is turned off (base open), disconnecting C2174 and C2176 from +8 volts. Capacitors C2174 and C2176 no longer integrate the pulses, thus allowing both the horizontal and vertical sync pulses to pass through to the TV Schmitt trigger.

SCHMITT TRIGGERS

The Schmitt trigger for the NORM and AUTO triggering modes consists of U2156A, U2156B, and associated circuitry. Hysteresis of this trigger circuit is determined by R2152, R2153, and R2147.

The Schmitt trigger for the TV triggering mode is U2156B, U2156C, U2156D, and associated circuitry. Resistors R2154 and R2178 determine the sensitivity.

When the MODE switch S2150 is in AUTO or NORM, +8 volts is applied to R2156 which causes pin 1 of U2156A to go HI, enabling Schmitt trigger U2156A-U2156B. At the same time, pins 12 and 13 of U2156D are also HI disabling Schmitt trigger U2156C-U2156B.

VOLTAGE CONDITIONS

Voltages shown on this schematic diagram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical input or the X (external trigger) input. Refer to Waveform Conditions for T921, T922, or T922R control settings.

WAVEFORM CONDITIONS

NOTE

Waveforms are for T922 unless otherwise noted.

Waveforms below were monitored with a Tektronix 7704A Oscilloscope, 7B71 Time Base, 7A15A Amplifier and 10X probe. The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

A 1 kHz, 50 mV sine wave was applied to CH 1 input and a 1 kHz, 50 mV square wave was applied to CH 2 input. A Tektronix FG 501 Function Generator provides either of the input waveforms.

The T921, T922, or T922R controls were set as follows:

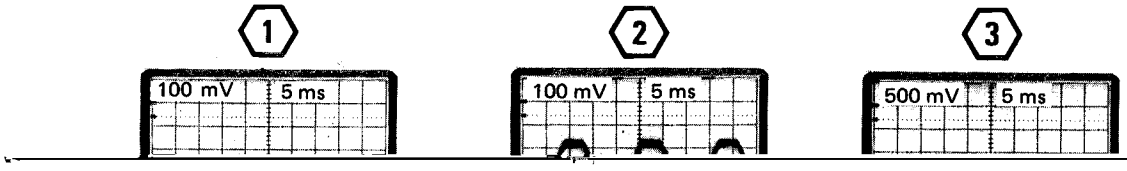
VOLTS/DIV (both)	20 mV
AC-GND-DC (both)	DC
Vertical Mode	DUAL TRACE
SOURCE	LINE
MODE	AUTO*
SLOPE	+OUT
SEC/DIV	.5 ms

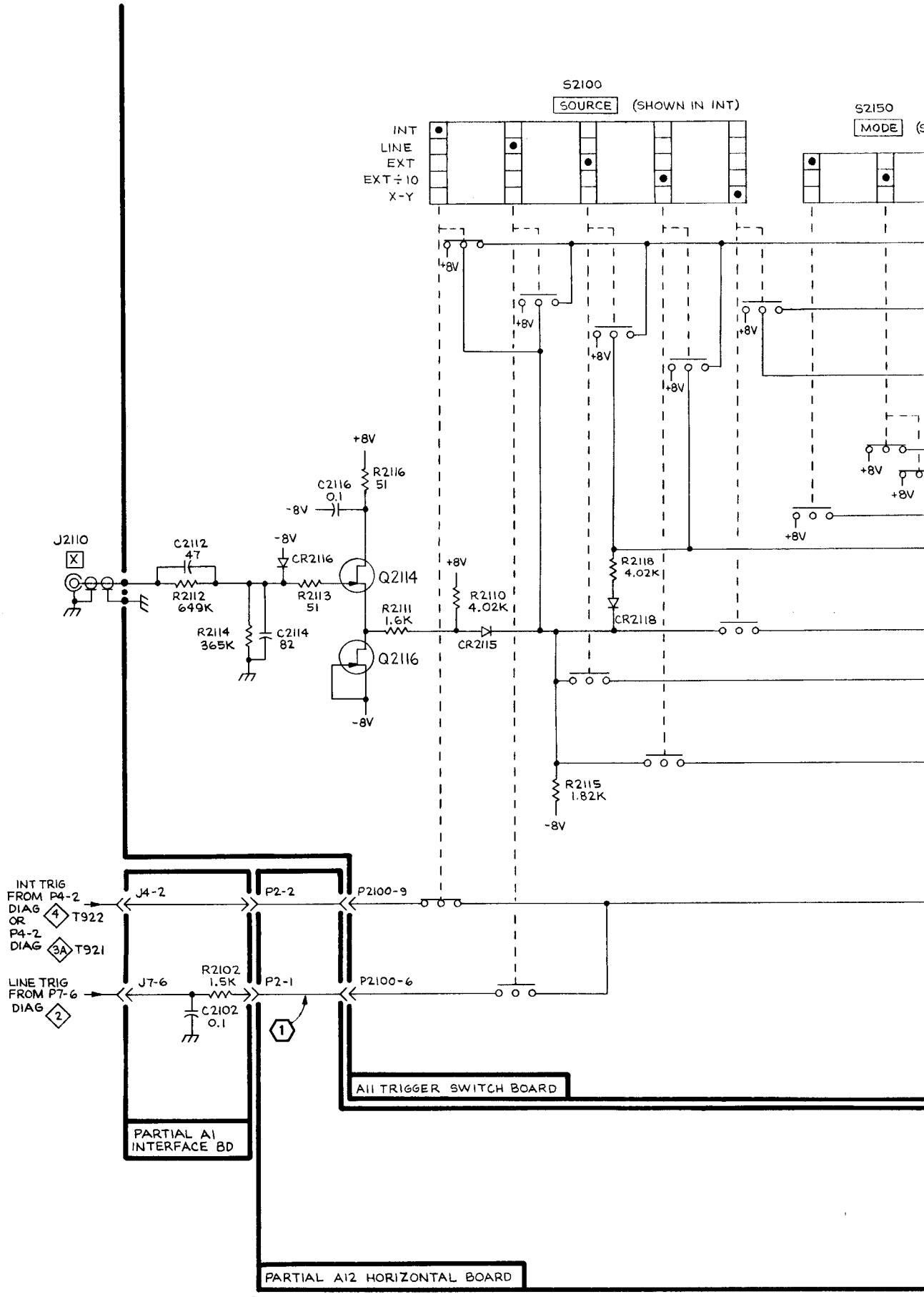
The other controls were set as needed to obtain a display.

***For waveforms 5 and 6, the MODE switch was set to TV.**

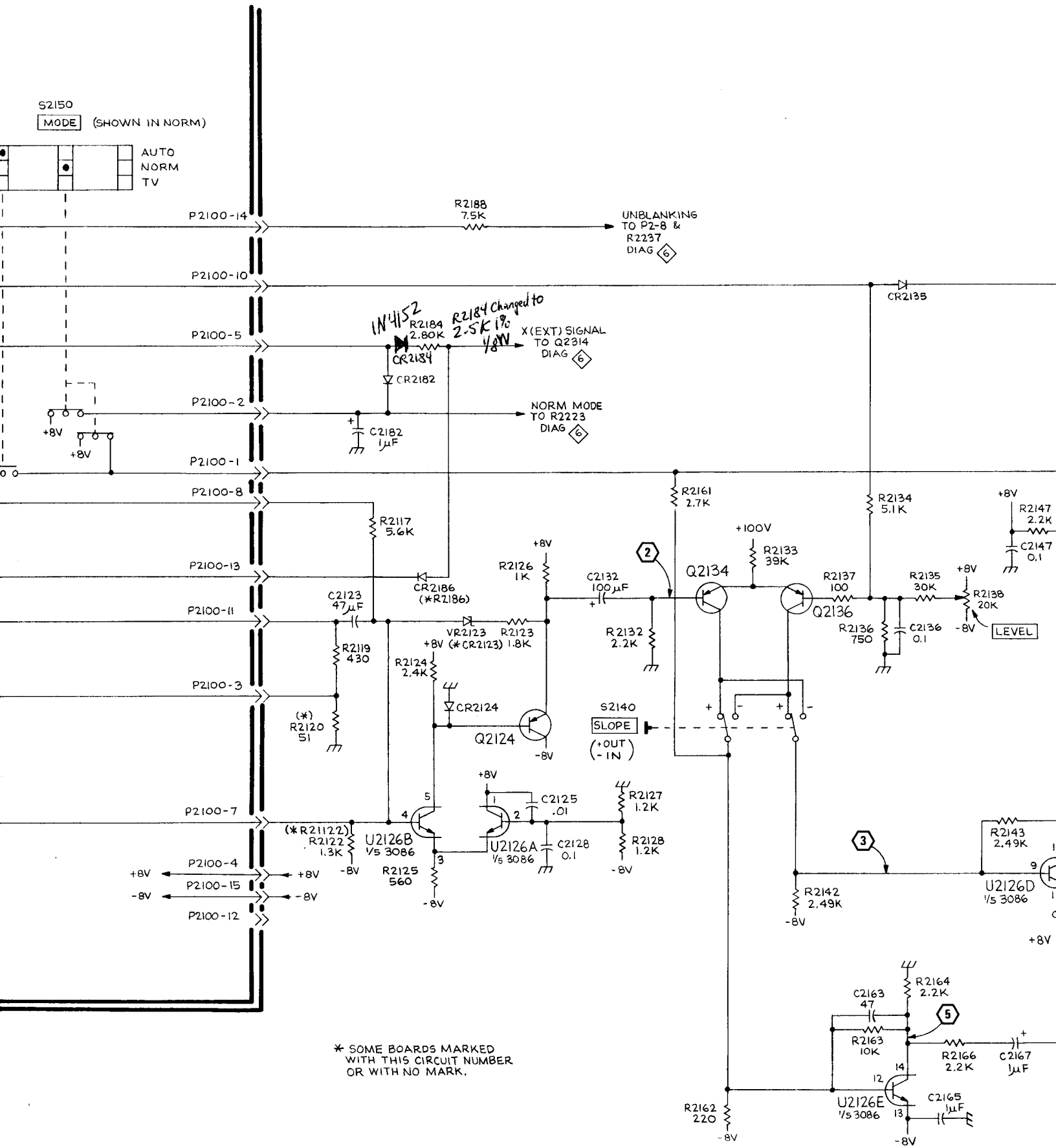
NOTE

To obtain voltages and waveforms on the Horizontal board, the Vertical Amplifier must be operated separately from the instrument, using a Vertical Amplifier Extender Troubleshooting Fixture. See Troubleshooting Equipment and Vertical Amplifier Replacement in the Service Information section of this manual.

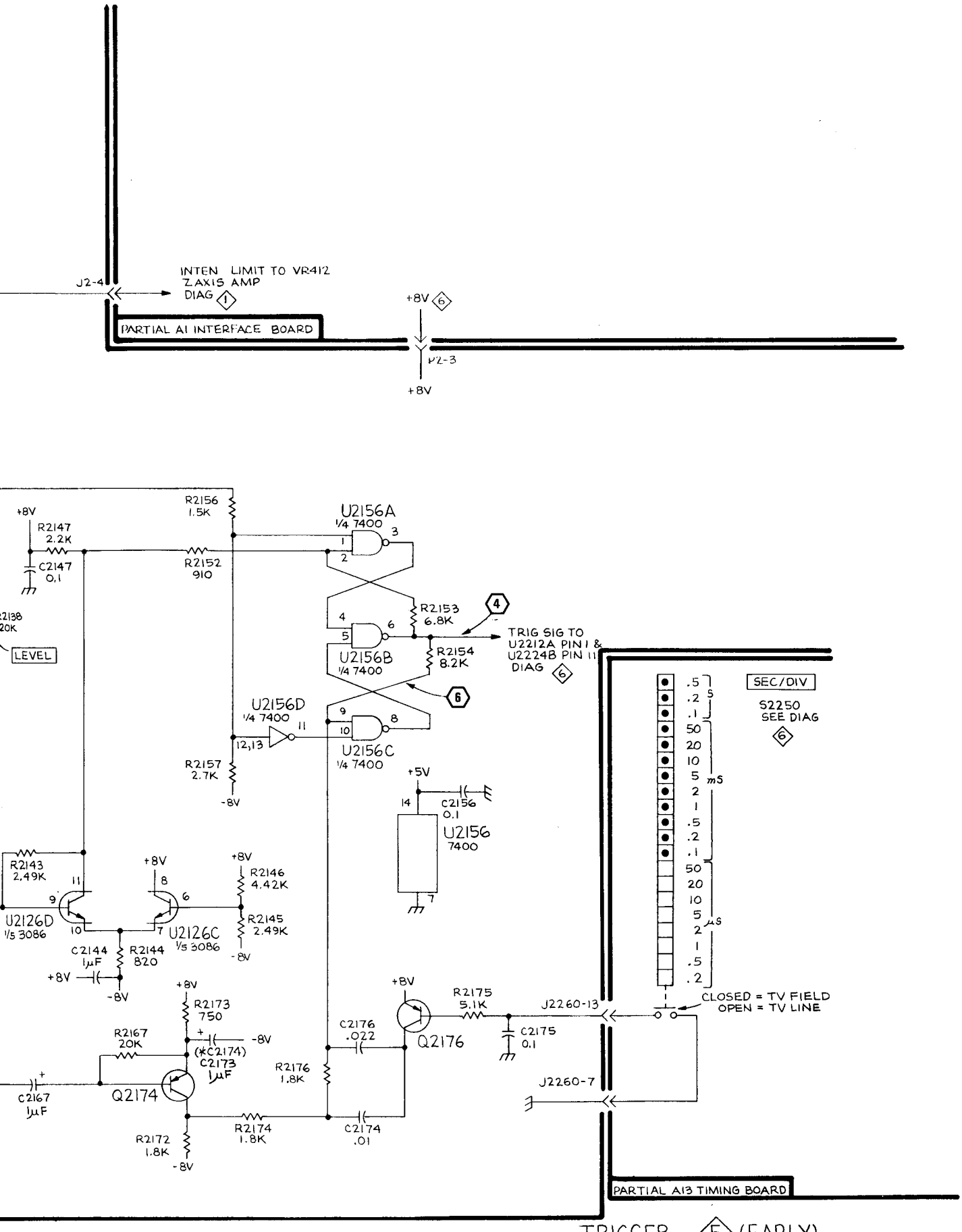




TRIGGER FOR T921 BELOW SN B010130 & T



* SOME BOARDS MARKED WITH THIS CIRCUIT NUMBER OR WITH NO MARK.



TRIGGER 5 (EARLY)

SWEEP AND HORIZ AMPL CIRCUIT DESCRIPTION

Digital logic devices are used to perform some of the functions in this instrument. LO and HI designations are used in this circuit description to indicate the state of the digital circuit. HI indicates the more positive of the two levels. The specific voltages which constitute a LO and HI logic state may vary between individual devices.

SWEEP

The sweep is produced by a Miller Integrator circuit consisting of Q2242, Q2244, and Q2246. A sweep ramp is initiated at the collector of Q2246 when pin 3 of U2234A goes LO and is terminated when pin 3 goes HI (see Timing diagram, Fig. 7-2).

In the NORM triggering mode, pin 2 of U2212A is HI, allowing a positive-going trigger signal at pin 1 of U2212A through U2212D and U2234C to cause pin 3 of U2234A to go LO. This reverse biases CR2233 and CR2234 and allows the timing capacitor (selected by the SEC/DIV switch, S2250) to charge, producing a sweep ramp at the collector of Q2246. When the sweep ramp reaches about 12 volts, Q2274 turns on. This causes pin 7 of U2224A to go LO, pin 8 of U2234C to go LO and pin 3 of U2234A to go HI. When pin 3 of U2234A goes HI, CR2233 and CR2234 are forward biased, terminating the sweep. Pin 7 of U2224A remains LO for a length of time (holdoff time) determined by C2275, C2274, R2275, and R2279. Three holdoff times are selected by the SEC/DIV switch S2250. After the selected holdoff time, pin 7 goes HI. This allows the next trigger signal to switch pin 3 of U2234A LO and again start the sweep.

In the AUTO triggering mode, when no trigger signal occurs at pin 11 of U2224B for about 50 ms, pin 10 of U2224B goes LO, causing the sweep to start after the holdoff time ends. This allows the sweep to free run and provide a reference display. When a trigger signal is present, pin 11 of U2224B goes HI, then LO (when trigger signal ends), and the time constant of C2226-R2226 prevents pin 10 from going LO as long as the repetition rate of the trigger signal is higher than about 20 Hz.

When pin 3 of U2234A goes HI, the current set by R2236, R2235, and R2237 is sent to the Z Axis Amplifier to blank the crt during hold-off.

HORIZONTAL AMPLIFIER

The horizontal amplifier converts the single-ended signal to a push-pull signal, which drives the crt horizontal deflection plates. The input to the horizontal amplifier comes from either the sweep generator or the X (external trigger) input connector. In the X-Y mode, the trace is shifted to the center of the screen by the current through R2184. In the AUTO and NORM modes, the input to the horizontal amplifier is a linear ramp from the sweep generator.

Transistors Q2314, Q2326, and associated circuitry, form an operational amplifier with a variable gain range of over 10 to 1. The gain is set by feedback elements R2312, R2323, and X1-X10 control, R2322. The horizontal POSITION control, R2316, positions the crt display horizontally by varying the current into the base of Q2314.

When the BEAM FINDER switch, S100B, is pressed, the dynamic range of Q2326 is decreased. This limits the horizontal deflection to the crt screen area. The BEAM FINDER switch also limits the vertical deflection to the crt screen area.

Transistors Q2332, Q2334, Q2344, and assoicated circuitry, compose a paraphase amplifier. Transistor Q2332 is a low-impedance input for Q2334. HORIZ CAL adjustment R2332 sets the gain of the paraphase amplifier. When the current through the collector of Q2334 increases, the current through the collector of Q2344 decreases and is 180° out of phase with the current at the

VOLTAGE CONDITIONS

Voltages shown on this schematic diagram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical input or the X (external trigger) input. See Waveform Conditions for T921, T922, or T922R control settings.

WAVEFORM CONDITIONS

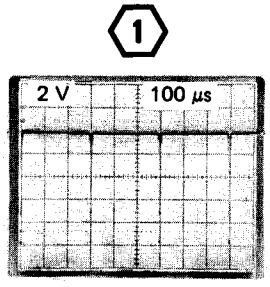
Waveforms below were monitored with a Tektronix 7704A Oscilloscope, 7B71 Time Base, 7A15A Amplifier and a 10X probe. The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

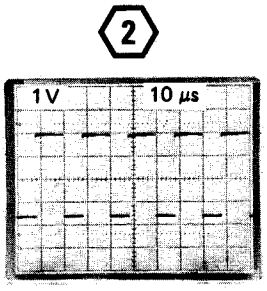
A 1 kHz, 50 mV sine wave was applied to CH 1 input and a 1 kHz, 50 mV square wave was applied to CH 2 input. A Tektronix FG 501 Function Generator provides either of the input waveforms.

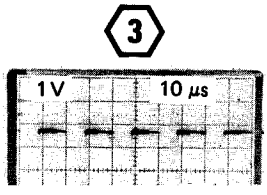
The T921, T922, or T922R controls were set as follows:

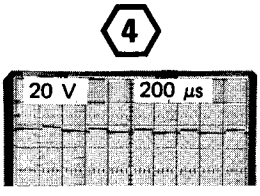
VOLTS/DIV (both	20 mV
AC-GND-DC (both)	DC
Vertical Mode	DUAL TRACE
SOURCE	INT*
MODE	AUTO
SLOPE	+OUT
SEC/DIV	.5 ms
LEVEL	For triggered display

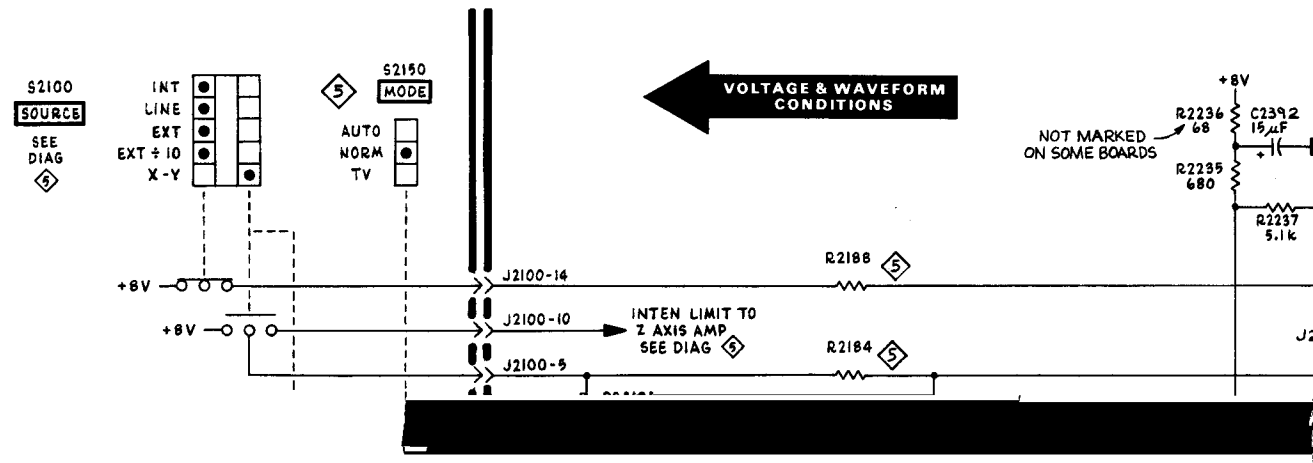
The other controls were set as needed to obtain a display.

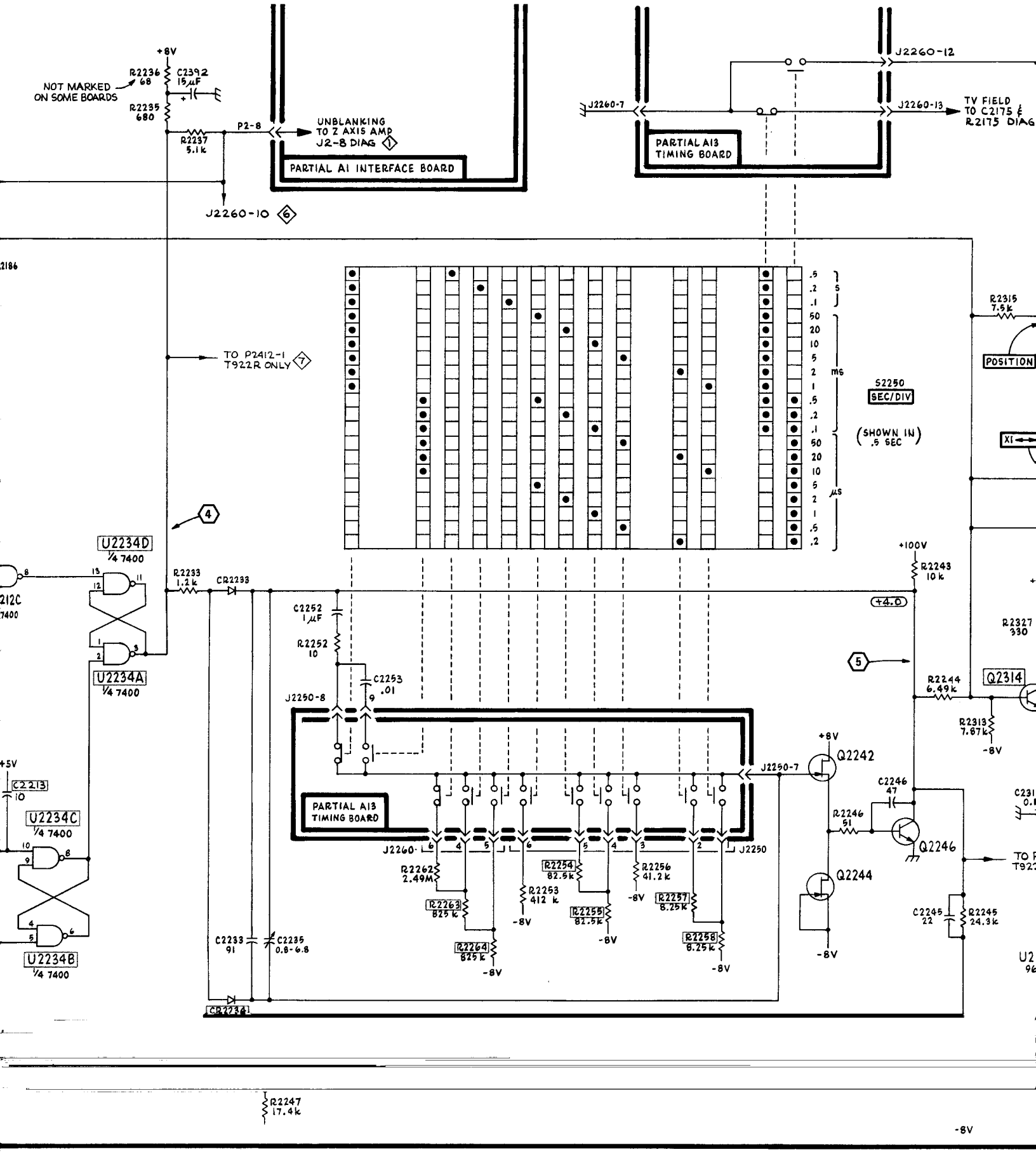


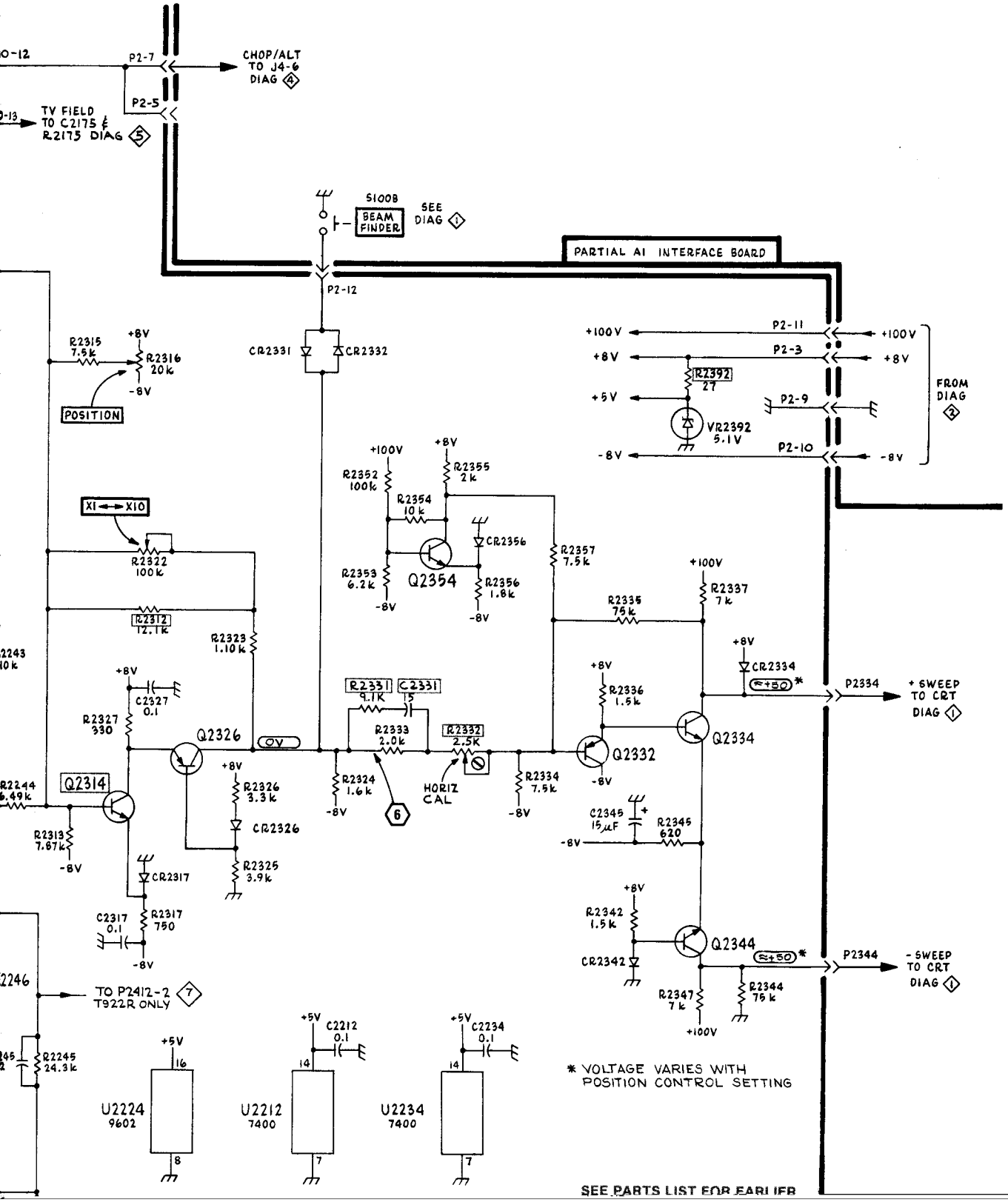







S2100
SOURCE
SEE DIAG 5
INT
LINE
EXT
EXT ÷ 10
X-Y
5
S2150
MODE
AUTO
NORM
TV
VOLTAGE & WAVEFORM CONDITIONS
+8V
R2236 68
C2392 15μF
NOT MARKED ON SOME BOARDS
R2235 680
R2237 5.1k
R2188 5
+8V
J2100-14
+8V
J2100-10
INTEN LIMIT TO Z AXIS AMP SEE DIAG 5
J2100-5
R2184 5


+8V
R2236 68
C2392 15μF
NOT MARKED ON SOME BOARDS
R2235 680
R2237 5.1k
P2-8
UNBLANKING TO Z AXIS AMP J2-8 DIAG 1
PARTIAL A1 INTERFACE BOARD
J2260-10 6
J2260-12
J2260-7
J2260-13
TV FIELD TO C2175 & R2175 DIAG
PARTIAL A13 TIMING BOARD
TO P2412-1 T922R ONLY 7
.5 .2 .1 50 20 10 5 2 1 .5 .2 .1 50 20 10 5 2 1 .5 .2
mS
μS
S2250 SEC/DIV
(SHOWN IN .5 SEC)
R2315 7.5k
POSITION
4
U2234D 1/4 7400
R2233 1.2k
CR2233
+100V
R2243 10k
+4.0
C2252 1μF
R2252 10
C2253 .01
J2250-8
5
R2244 6.49k
Q2314
R2313 7.87k
-8V
R2327 330
+8V
Q2242
J2250-7
C2246 47
R2246 51
Q2246
Q2244
PARTIAL A13 TIMING BOARD
J2260-6 4 5 1 6 5 4 3 2 J2250
R2262 2.49M
R2263 825k
R2264 825k
R2253 412k
R2254 82.5k
R2255 82.5k
R2256 41.2k
R2257 8.25k
R2258 8.25k
C2245 22
R2245 24.3k
+5V
C2213 10
U2234C 1/4 7400
U2234A 1/4 7400
U2234B 1/4 7400
C2233 91
C2235 0.8-6.8
CR2234
R2247 17.4k
-8V
SYNC PULSE DIAG
TO J4-5 4
AI INTERFACE BOARD


P2-7
CHOP/ALT TO J4-6 DIAG 4
P2-5
TV FIELD TO C2175 & R2175 DIAG 5
S1008 BEAM FINDER
SEE DIAG 1
PARTIAL AI INTERFACE BOARD
P2-12
CR2331
CR2332
R2315 7.5k
R2316 20k
+8V
-8V
POSITION
+100V
P2-11
+8V
P2-3
+5V
R2392 27
VR2392 5.1V
P2-9
-8V
P2-10
FROM DIAG 3
R2352 100k
R2354 10k
R2355 2k
R2353 6.2k
Q2354
CR2356
R2356 1.8k
R2357 7.5k
X1 X10
R2322 100k
R2312 12.1k
R2323 1.10k
R2335 75k
R2337 7k
CR2334
P2334
+ SWEEP TO CRT DIAG 1
C2327 0.1
R2327 330
Q2326
OV
R2331 9.1k
C2331 15
R2333 2.0k
R2332 2.5k
HORIZ CAL
R2336 1.5k
Q2334
Q2332
R2324 1.6k
R2334 7.5k
Q2314
R2326 3.3k
CR2326
R2325 3.9k
R2313 7.87k
CR2317
C2317 0.1
R2317 750
C2345 15µF
R2345 620
R2342 1.5k
Q2344
CR2342
P2344
- SWEEP TO CRT DIAG 1
R2347 7k
R2344 75k
TO P2412-2 T922R ONLY 7
R2245 24.3k
U2224 9602
U2212 7400
U2234 7400
C2212 0.1
C2234 0.1
* VOLTAGE VARIES WITH POSITION CONTROL SETTING
SEE PARTS LIST FOR EARLIER

T922R
SINGLE SWEEP, OUTPUT BUFFER, & Z AXIS

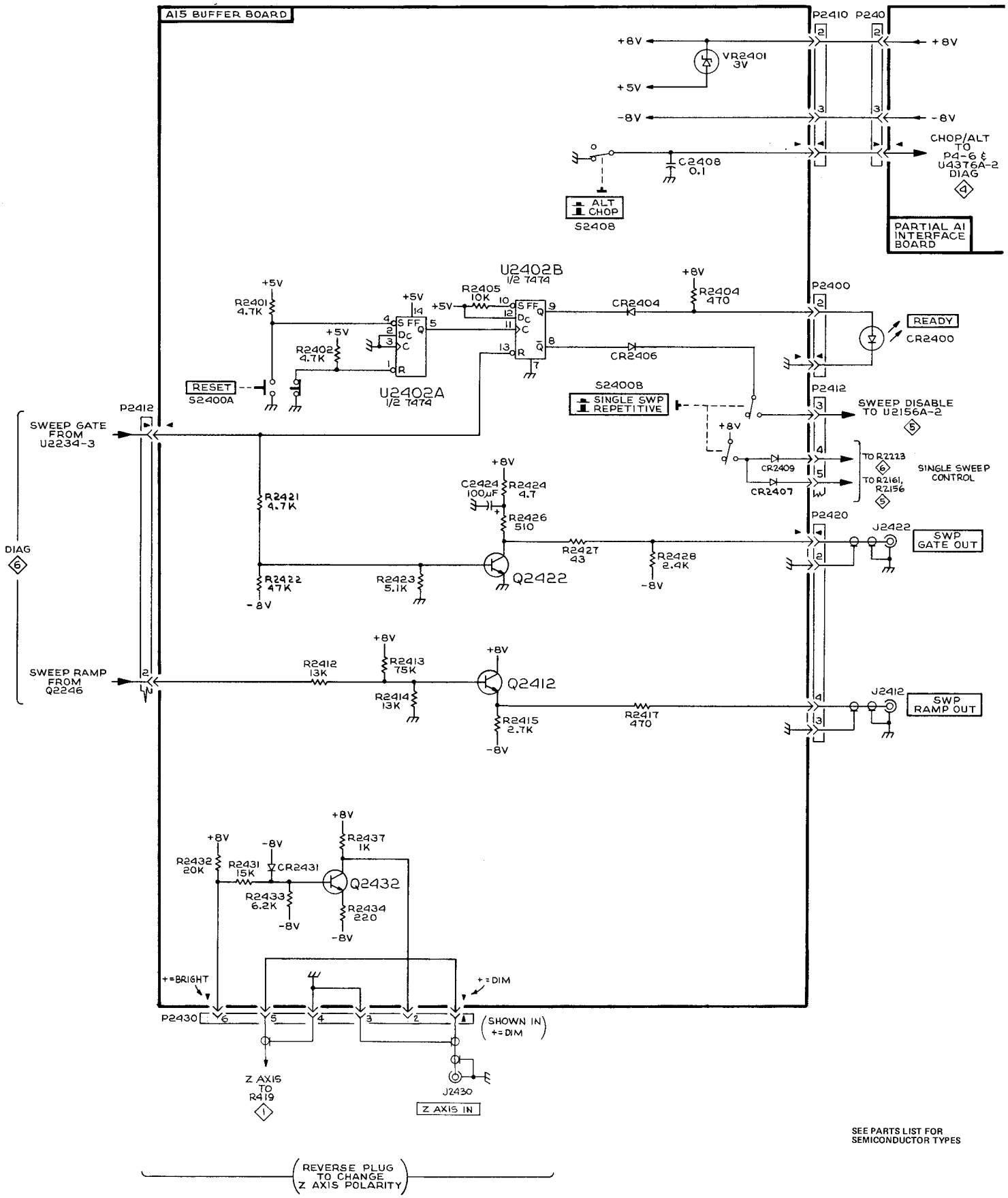
Diagrams 7, 8, and 9, and associated circuit descriptions, pertain to circuitry that is used only in the T922R and is not present in the T921 and T922 bench versions. For circuit descriptions and diagrams of circuitry common to the T921, T922, and

SWEEP RAMP OUT AMPLIFIER

The Sweep Ramp signal is picked off the collector of Q2246 (see diagram 6) and applied via P2412-2 to emitter follower Q2412. Transistor Q2412 provides isolation between the output connector and the Sweep Generator.

CHOP-ALTERNATE SELECTION

In the T922 bench version, a contact on the SEC/DIV switch selects either the CHOP or ALT dual-trace modes. In the T922R, this function is performed by a front-panel mounted pushbutton switch (S2408). This allows manual selection of either CHOP or ALT when operating in the DUAL TRACE mode.


A15 BUFFER BOARD
P2410 P240
+8V
VR2401 3V
+5V
-8V
C2408 0.1
CHOP/ALT TO P4-6 & U4376A-2 DIAG 4
ALT CHOP S2408
PARTIAL AI INTERFACE BOARD
U2402B 1/2 7474
U2402A 1/2 7474
R2401 4.7K
R2402 4.7K
R2405 10K
R2404 470
CR2404
CR2406
P2400
READY
CR2400
RESET S2400A
S2400B SINGLE SWP REPETITIVE
P2412
SWEEP DISABLE TO U2156A-2 5
SWEEP GATE FROM U2234-3
CR2409
CR2407
TO R2223 6
TO R2161, R2156 5
SINGLE SWEEP CONTROL
C2424 100µF
R2424 4.7
R2426 510
R2421 4.7K
R2422 47K
R2423 5.1K
Q2422
R2427 43
R2428 2.4K
P2420
J2422
SWP GATE OUT
DIAG 6
SWEEP RAMP FROM Q2246
R2412 13K
R2413 75K
R2414 13K
Q2412
R2415 2.7K
R2417 470
J2412
SWP RAMP OUT
R2432 20K
R2431 15K
CR2431
R2433 6.2K
R2434 220
R2437 1K
Q2432
+=BRIGHT
+=DIM
P2430
(SHOWN IN +=DIM)
Z AXIS TO R419 1
J2430
Z AXIS IN
SEE PARTS LIST FOR SEMICONDUCTOR TYPES
REVERSE PLUG TO CHANGE Z AXIS POLARITY

T922R

Diagrams 7, 8, 9, and associated circuit descriptions pertain to circuitry that is used only in the T922R and is not present in the T921 and T922 bench versions. For circuit descriptions and diagrams of circuitry common to the T921, T922, and T992R, refer to diagrams 1 through 6.

SCALE ILLUMINATION AND +32 VOLT POWER SUPPLY

The T921 and T922 bench versions use a dropping resistor R784 and Zener diode VR784 to drop the +100 volt supply to +33 volts for use in the Vertical Output Amplifier and crt circuits (see Fig. 7-4). In the T922R, the Scale Illumination circuit provides a +32 volt supply in place of the +33 volt supply.

VR818 holds the base of Q812 at +33 volts. This holds the output voltage at about +32 volts. When the SCALE ILLUM control (R812) is set fully counterclockwise, Q816 and Q818 are biased off and transistor Q812 supplies all the current drawn by the +32 volt supply. To increase Scale Illumination, R812 is adjusted to forward bias Q816 and Q818. As this forward bias increases, the current through them increases. This causes a corresponding decrease in the current through Q812. The increased current through Q816 increases the current through DS816 and DS818, which increases scale illumination.

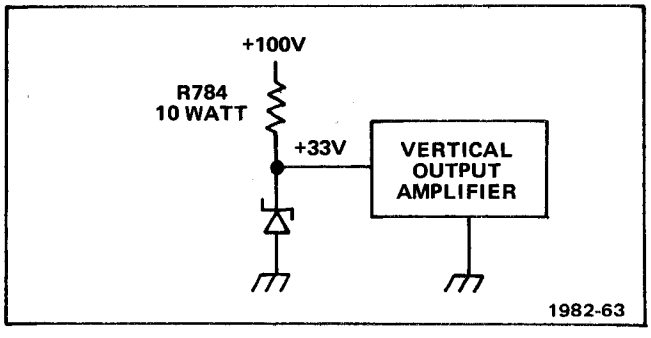


Fig. 7-4. Bench version T922 +33 volt power supply.

VERTICAL SIGNAL OUT (COMP VERT SIG OUT)

Fig. 7-5 shows a simplified block diagram of the Vertical Signal Out circuit. The Vertical Signal Out circuit supplies a sample of the signal present in the Vertical Output Amplifier to J169 (COMP VERT SIG OUT) on the rear panel.

Q160 and Q162 are connected as a differential amplifier. The paraphase signal from the emitters of Q112 and Q122 (see diagram 1) is applied to the inputs of the differential amplifier (the bases of Q160 and Q162 respectively). The output of the differential amplifier is taken from the collector of Q162 and applied to the base of Q166. Transistor Q166 amplifies the output signal and shifts its dc level. The signal from the collector of Q166 is connected (through P168) to the COMP VERT SIG OUT connector, J169.

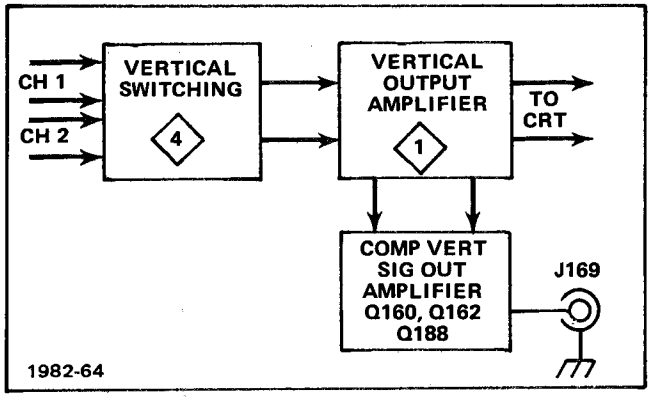
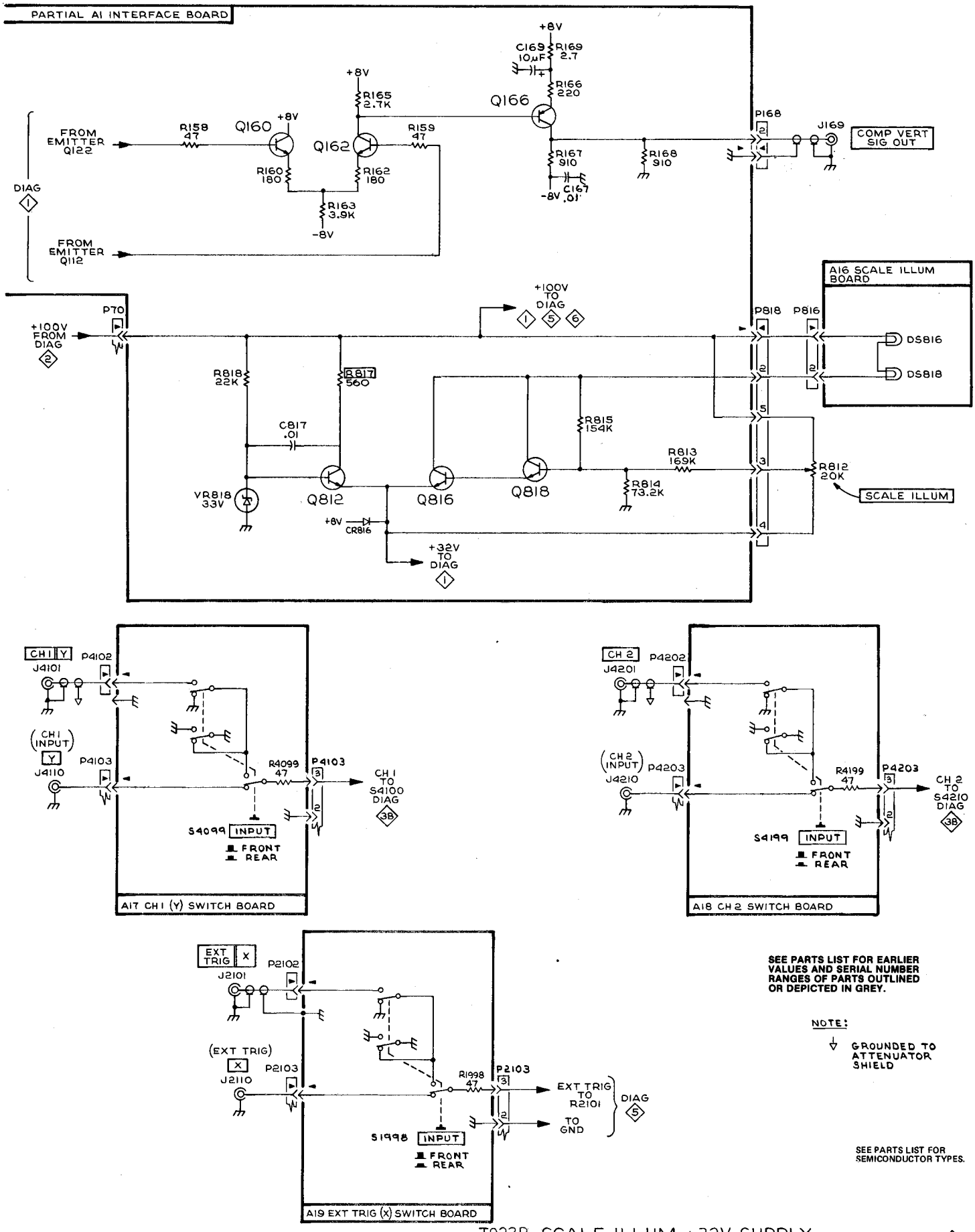


Fig. 7-5. Simplified block diagram of the vertical output amplifier circuit.



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

NOTE:

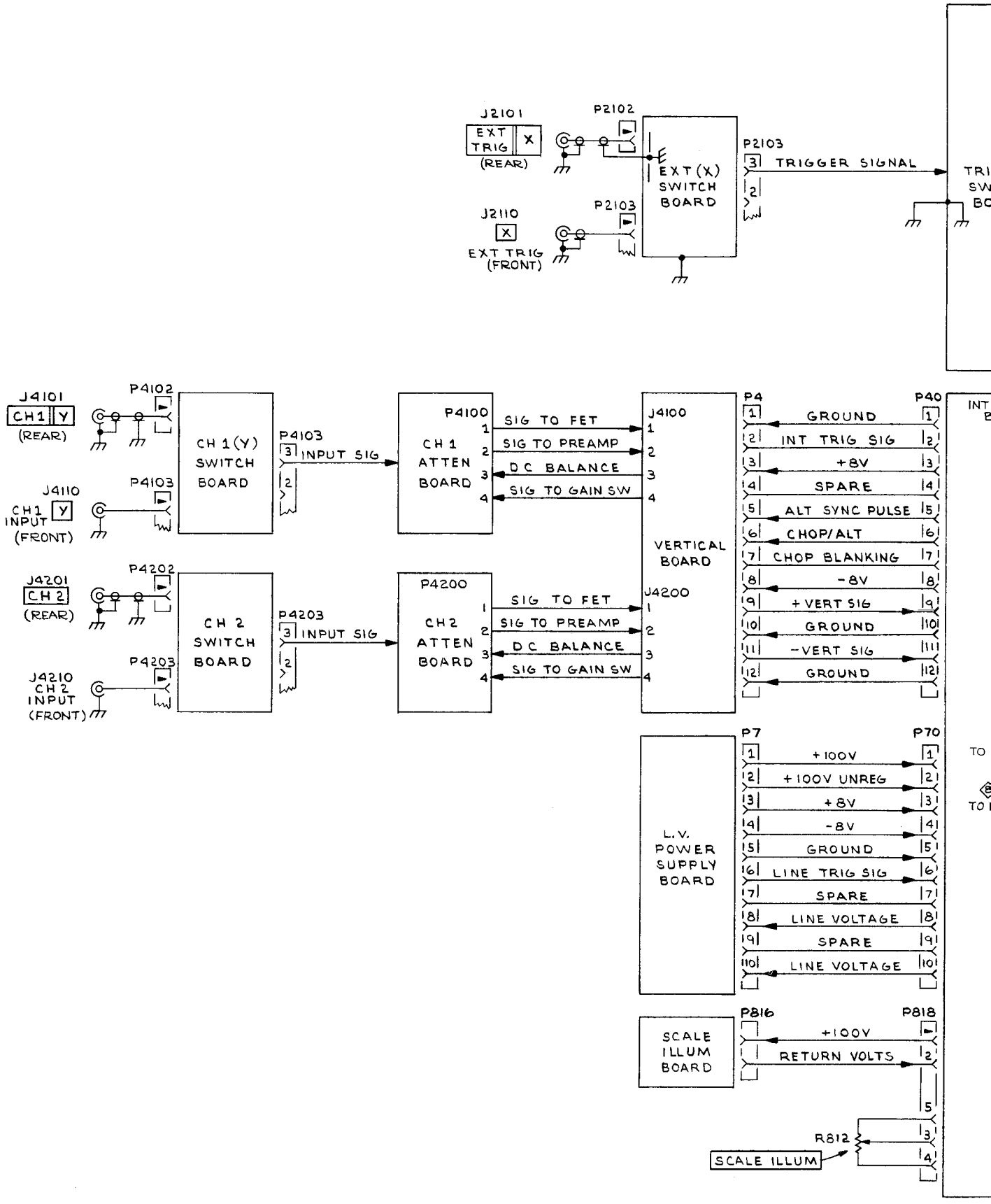
GROUNDED TO ATTENUATOR SHIELD

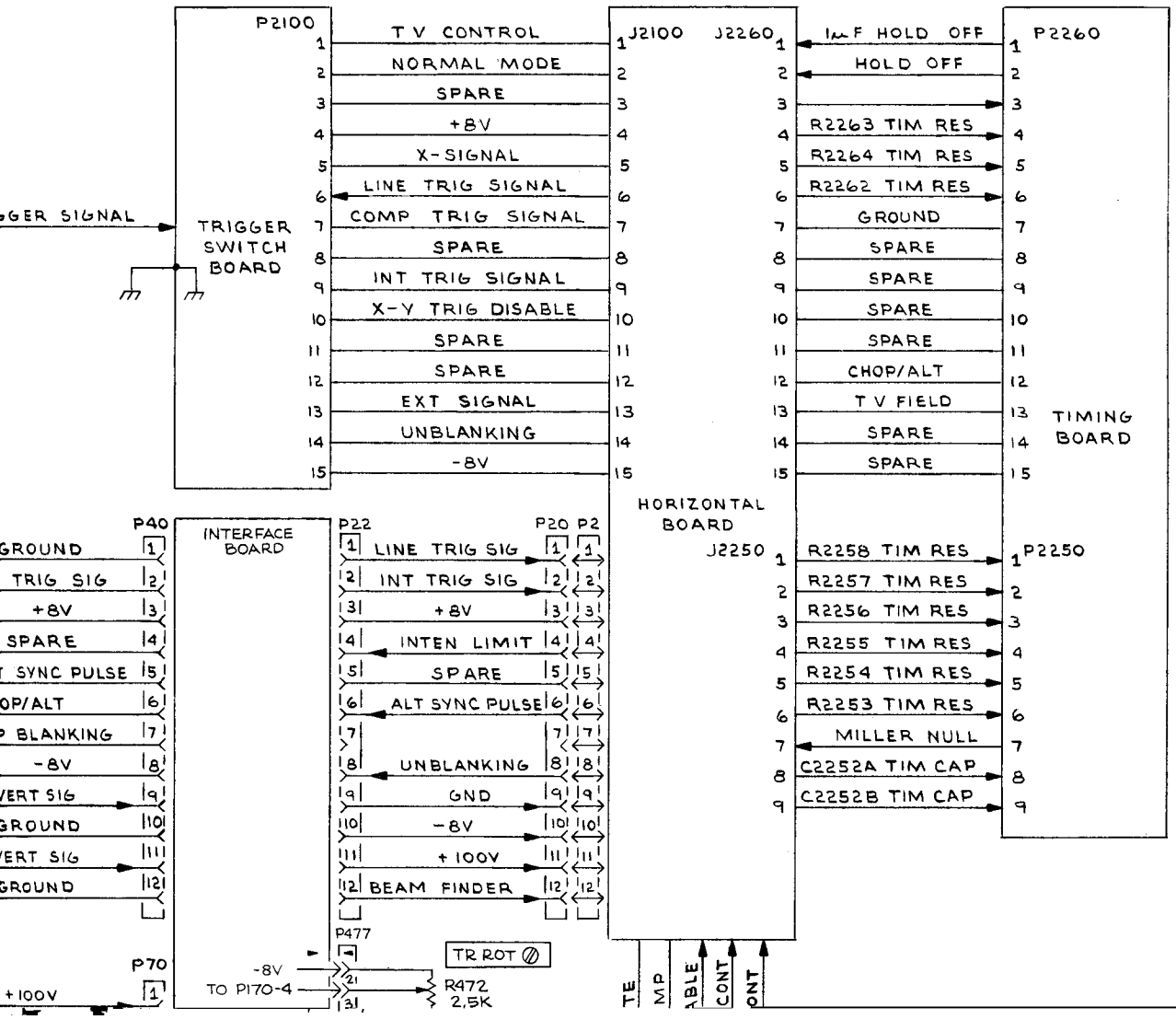
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

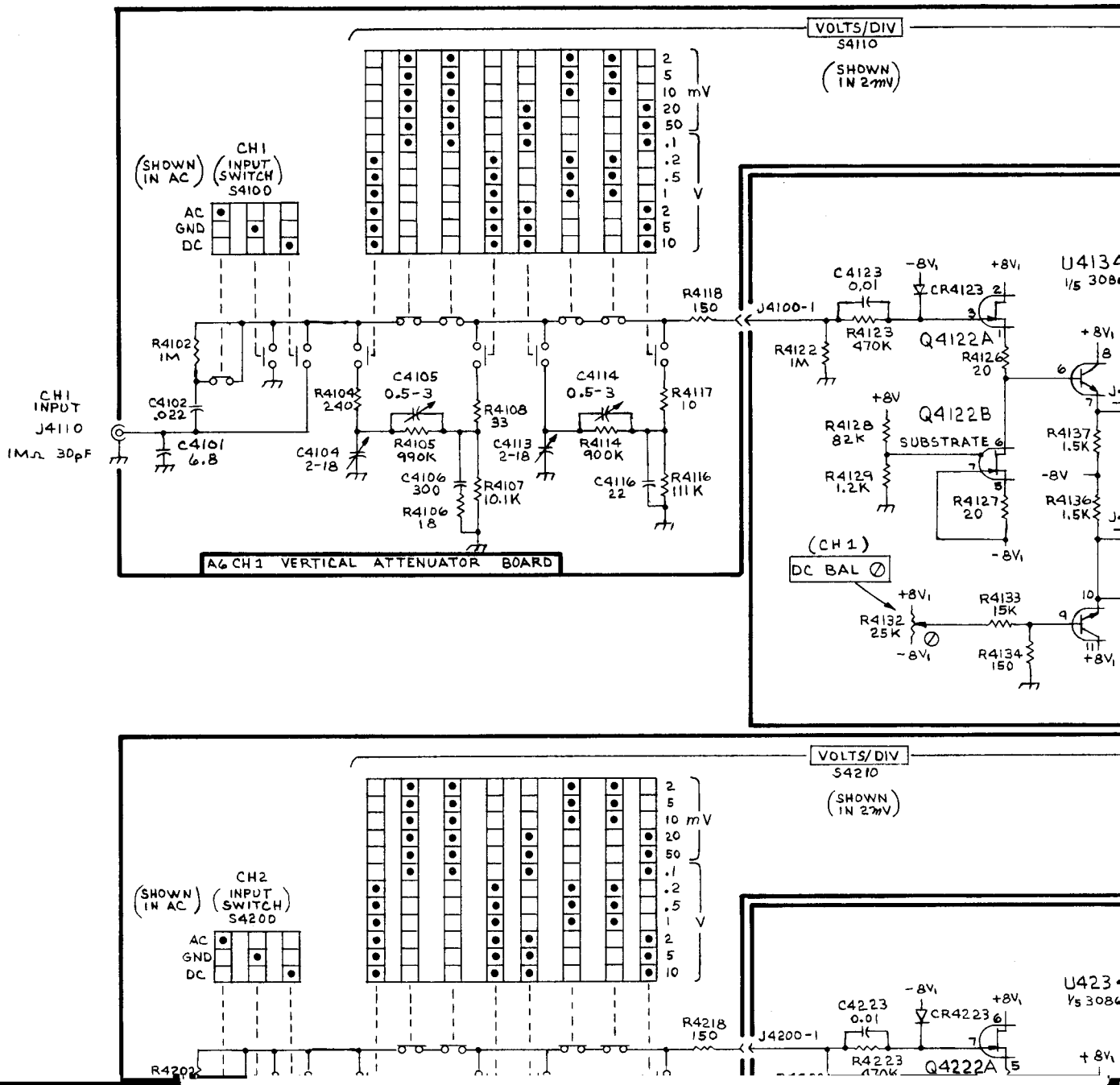
T921/T922/T922R

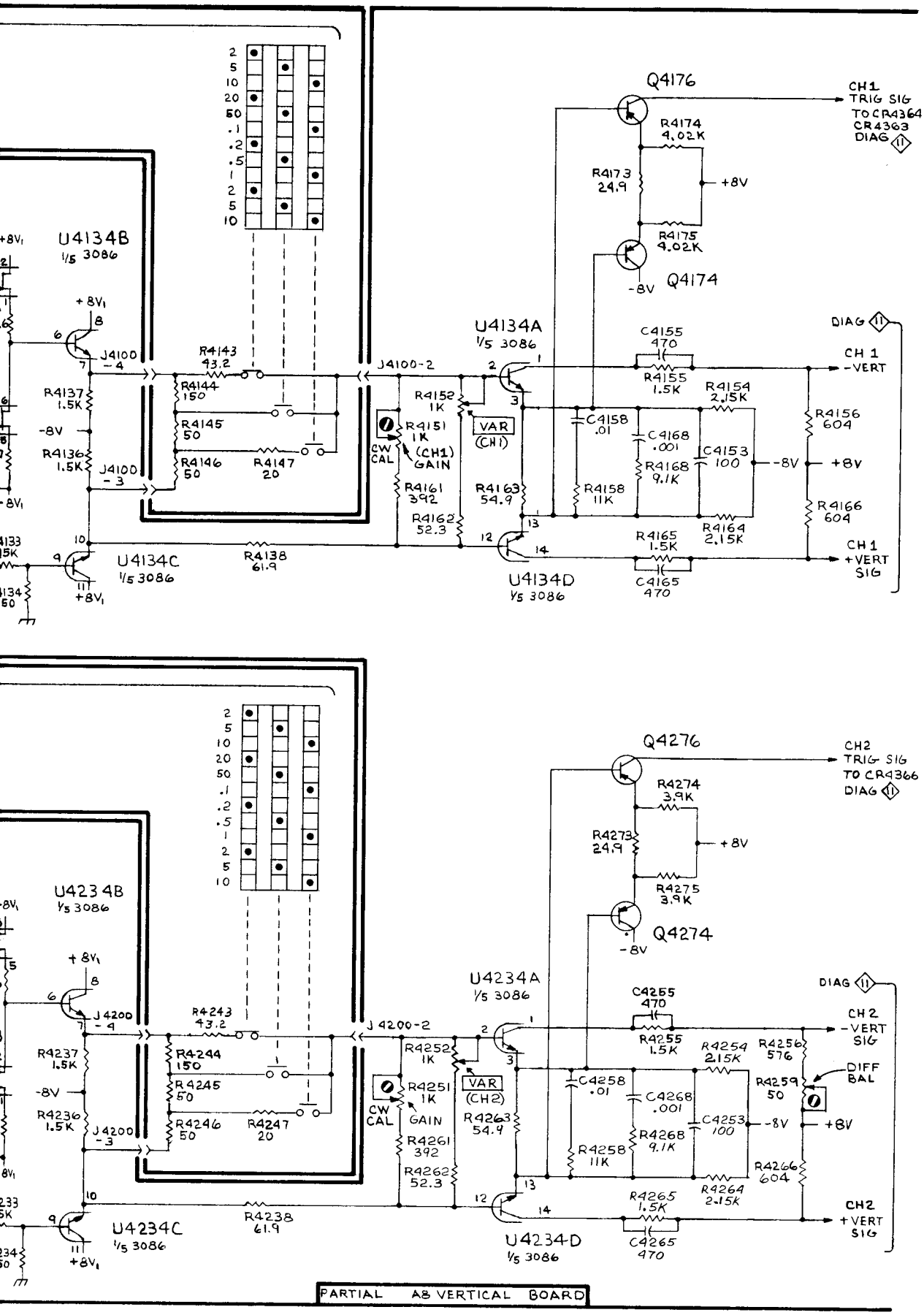
1982-66
REV. A, DEC. 1976

T922R SCALE ILLUM, +32V SUPPLY, VERTICAL SIGNAL OUT AMPLIFIER & FRONT & REAR SWITCHING 8


J2101
EXT TRIG
X
(REAR)
P2102
J2110
X
EXT TRIG (FRONT)
P2103
EXT (X) SWITCH BOARD
P2103
3 TRIGGER SIGNAL
2
J4101
CH1 Y
(REAR)
P4102
J4110
CH1 INPUT Y
(FRONT)
P4103
CH 1 (Y) SWITCH BOARD
P4103
3 INPUT SIG
2
P4100
1 SIG TO FET
2 SIG TO PREAMP
3 DC BALANCE
4 SIG TO GAIN SW
CH 1 ATTEN BOARD
J4100
1
2
3
4
VERTICAL BOARD
P4
1 GROUND
2 INT TRIG SIG
3 +8V
4 SPARE
5 ALT SYNC PULSE
6 CHOP/ALT
7 CHOP BLANKING
8 -8V
9 +VERT SIG
10 GROUND
11 -VERT SIG
12 GROUND
P40
1
J4201
CH 2
(REAR)
P4202
J4210
CH 2 INPUT
(FRONT)
P4203
CH 2 SWITCH BOARD
P4203
3 INPUT SIG
2
P4200
1 SIG TO FET
2 SIG TO PREAMP
3 DC BALANCE
4 SIG TO GAIN SW
CH2 ATTEN BOARD
J4200
1
2
3
4
P7
1 +100V
2 +100V UNREG
3 +8V
4 -8V
5 GROUND
6 LINE TRIG SIG
7 SPARE
8 LINE VOLTAGE
9 SPARE
10 LINE VOLTAGE
L.V. POWER SUPPLY BOARD
P70
1
P816
+100V
RETURN VOLTS
P818
2
5
SCALE ILLUM BOARD
R812
3
4
SCALE ILLUM
TO


P2100
TV CONTROL
NORMAL MODE
SPARE
+8V
X-SIGNAL
LINE TRIG SIGNAL
COMP TRIG SIGNAL
SPARE
INT TRIG SIGNAL
X-Y TRIG DISABLE
SPARE
SPARE
EXT SIGNAL
UNBLANKING
-8V
GGER SIGNAL
TRIGGER SWITCH BOARD
J2100
J2260
1MF HOLD OFF
HOLD OFF
R2263 TIM RES
R2264 TIM RES
R2262 TIM RES
GROUND
SPARE
SPARE
SPARE
SPARE
CHOP/ALT
TV FIELD
SPARE
SPARE
P2260
TIMING BOARD
HORIZONTAL BOARD
J2250
R2258 TIM RES
R2257 TIM RES
R2256 TIM RES
R2255 TIM RES
R2254 TIM RES
R2253 TIM RES
MILLER NULL
C2252A TIM CAP
C2252B TIM CAP
P2250
P40
GROUND
TRIG SIG
+8V
SPARE
SYNC PULSE
OP/ALT
BLANKING
-8V
VERT SIG
GROUND
VERT SIG
GROUND
INTERFACE BOARD
P22
LINE TRIG SIG
INT TRIG SIG
+8V
INTEN LIMIT
SPARE
ALT SYNC PULSE
UNBLANKING
GND
-8V
+100V
BEAM FINDER
P20 P2
P477
TR ROT
P70
+100V
-8V
TO P170-4
R472
2,5K
TE
MP
ABLE
CONT
ONT

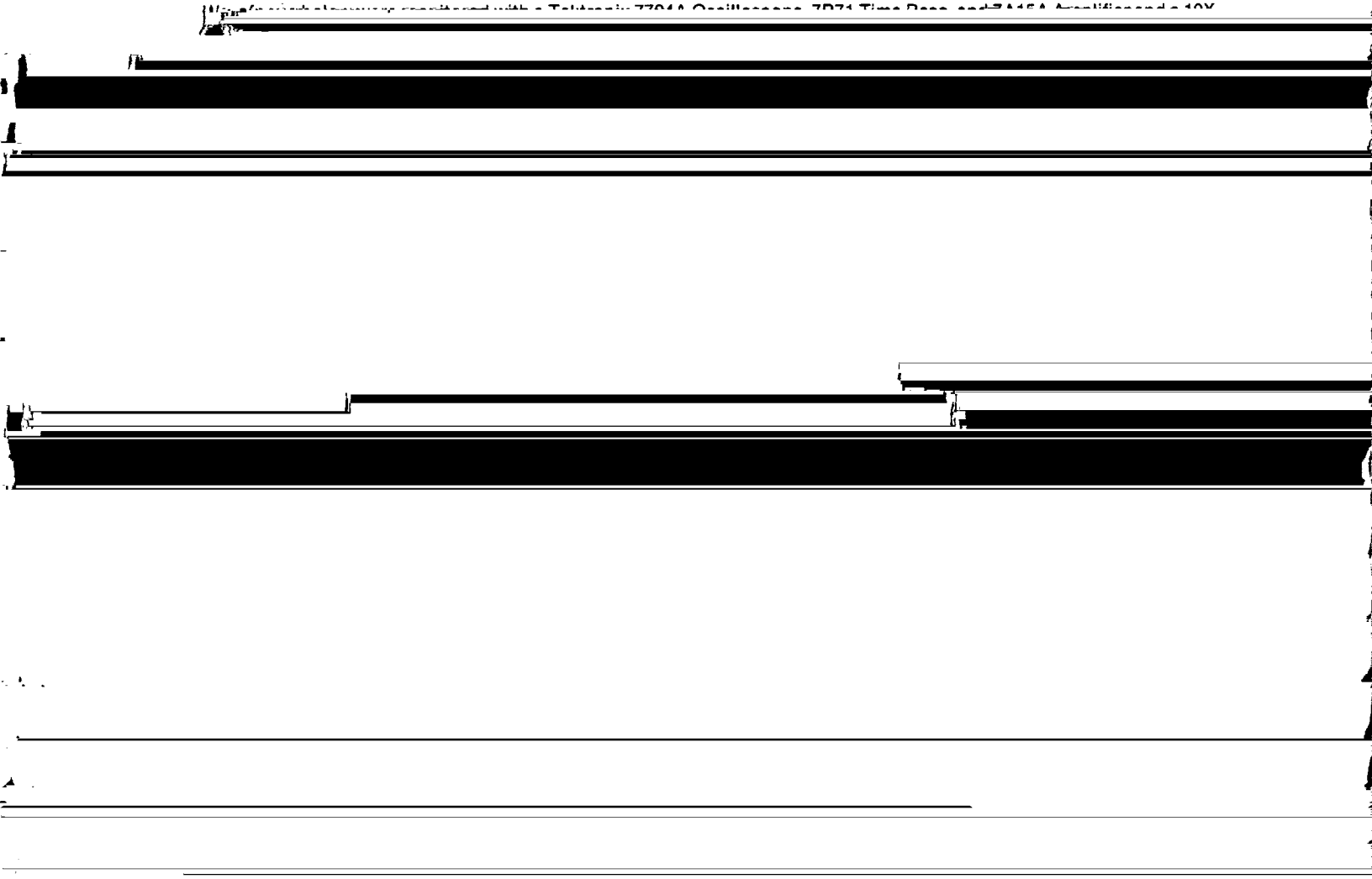

VOLTS/DIV
S4110
(SHOWN IN 2mV)
2
5
10 mV
20
50
.1
.2
.5
1 V
2
5
10
CH1 (INPUT SWITCH) S4100
(SHOWN IN AC)
AC
GND
DC
CH1 INPUT J4110
1MΩ 30pF
C4101 6.8
C4102 .022
R4102 1M
R4104 240Ω
C4104 2-18
C4105 0.5-3
R4105 990K
R4106 18
C4106 300
R4107 10.1K
R4108 33
C4113 2-18
C4114 0.5-3
R4114 900K
C4116 22
R4116 111K
R4117 10
R4118 150
J4100-1
C4123 0.01
CR4123
R4123 470K
R4122 1M
Q4122A
Q4122B
R4126 20
R4128 82K
R4129 1.2K
R4127 20
SUBSTRATE
R4137 1.5K
R4136 1.5K
(CH 1)
DC BAL
R4132 25K
R4133 15K
R4134 150
-8V1
+8V1
+8V
-8V
A6 CH 1 VERTICAL ATTENUATOR BOARD
VOLTS/DIV
S4210
(SHOWN IN 2mV)
CH2 (INPUT SWITCH) S4200
(SHOWN IN AC)
AC
GND
DC
R4218 150
J4200-1
C4223 0.01
CR4223
R4223
Q4222A
R4202


Q4176
CH1 TRIG SIG TO CR4364 CR4363 DIAG 11
R4174 4.02K
R4173 24.9
+8V
R4175 4.02K
-8V
Q4174
U4134B 1/5 3086
+8V1
J4100 -4
J4100 -3
R4143 43.2
R4144 150
R4145 50
R4146 50
R4147 20
R4137 1.5K
R4136 1.5K
-8V
U4134A 1/5 3086
J4100-2
R4152 1K
R4151 1K (CH1) GAIN
CW CAL
VAR (CH1)
R4161 392
R4162 52.3
R4163 54.9
C4155 470
R4155 1.5K
R4154 2.15K
C4158 .01
R4158 11K
C4168 .001
R4168 9.1K
C4153 100
R4156 604
R4166 604
DIAG 11
CH 1 -VERT
U4134C 1/5 3086
R4138 61.9
U4134D 1/5 3086
R4165 1.5K
C4165 470
R4164 2.15K
CH 1 +VERT SIG
Q4276
CH2 TRIG SIG TO CR4366 DIAG 11
R4274 3.9K
R4273 24.9
R4275 3.9K
Q4274
U4234B 1/5 3086
J4200 -4
J4200 -3
R4243 43.2
R4244 150
R4245 50
R4246 50
R4247 20
R4237 1.5K
R4236 1.5K
U4234A 1/5 3086
J4200-2
R4252 1K
R4251 1K (CH2) GAIN
CW CAL
VAR (CH2)
R4261 392
R4262 52.3
R4263 54.9
C4255 470
R4255 1.5K
R4254 2.15K
R4256 576
C4258 .01
R4258 11K
C4268 .001
R4268 9.1K
C4253 100
R4259 50
DIFF BAL
R4266 604
DIAG 11
CH2 -VERT SIG
U4234C 1/5 3086
R4238 61.9
U4234D 1/5 3086
R4265 1.5K
C4265 470
R4264 2.15K
CH2 +VERT SIG
PARTIAL A8 VERTICAL BOARD

VOLTAGE CONDITIONS

Voltages shown on this schematic digaram were measured with a Tektronix DM 501 Digital Multimeter. Voltage measurements can vary as much as ±20%. No signals were applied to the vertical or the X (external trigger) input. See Waveform Conditions for T922 or T922R control settings.

WAVEFORM CONDITIONS



probe. The oscilloscope input coupling was set to ac. Waveforms may vary as much as ±20%.

A 1 kHz, 50 mV sine wave was applied to Channel 1 input and a 1 kHz, 50 mV square wave was applied to Channel 2 input. A Tektronix FG 501 Function Generator provides either of the input waveforms..

The T922 or T922R controls were set as follows:

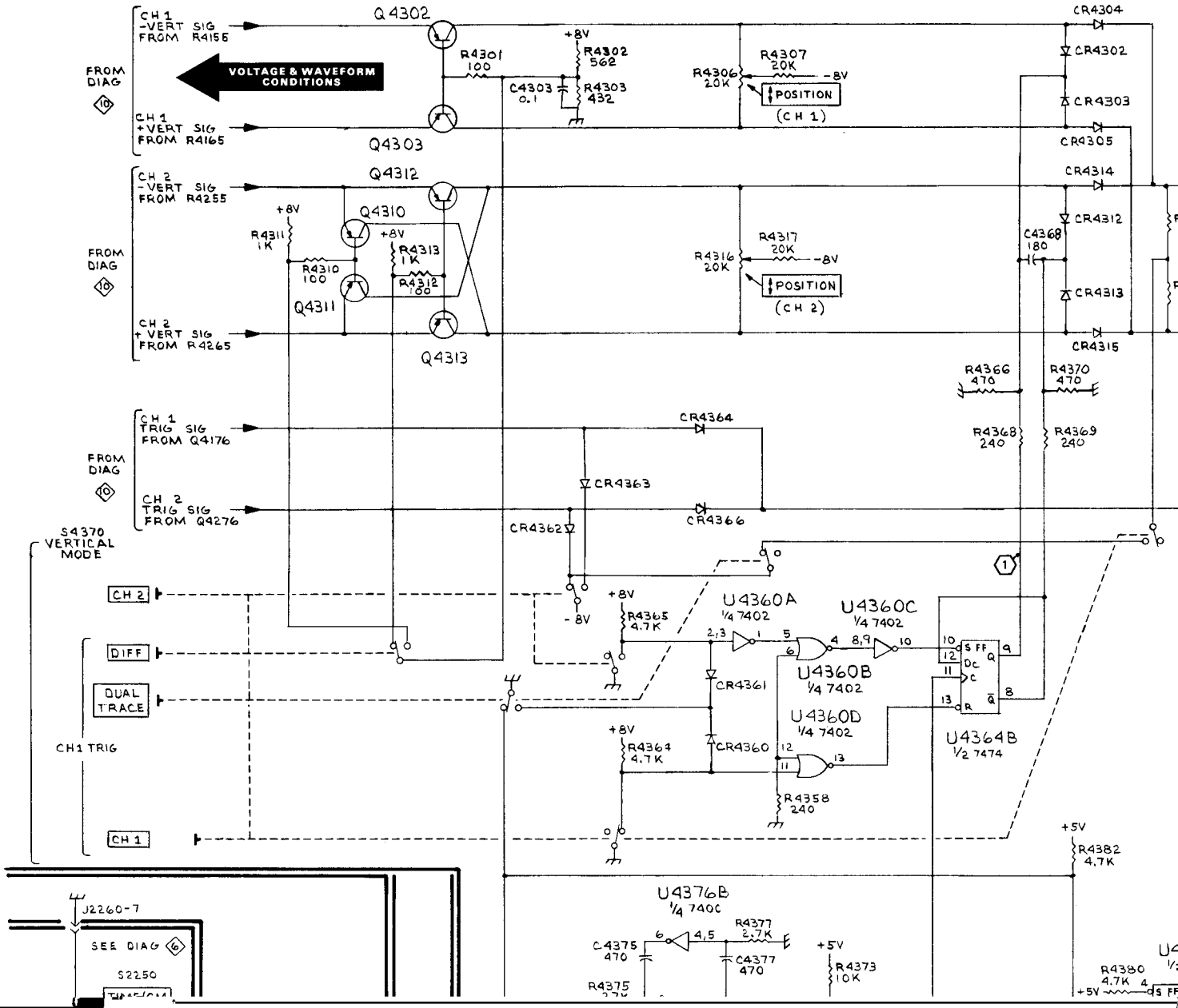
VOLTS/DIV (both)	20 mV
AC-GND-DC (both)	DC
Vertical Mode	DUAL TRACE
SOURCE	INT
MODE	AUTO
SLOPE	+OUT
SEC/DIV	.5 ms
LEVEL	As required

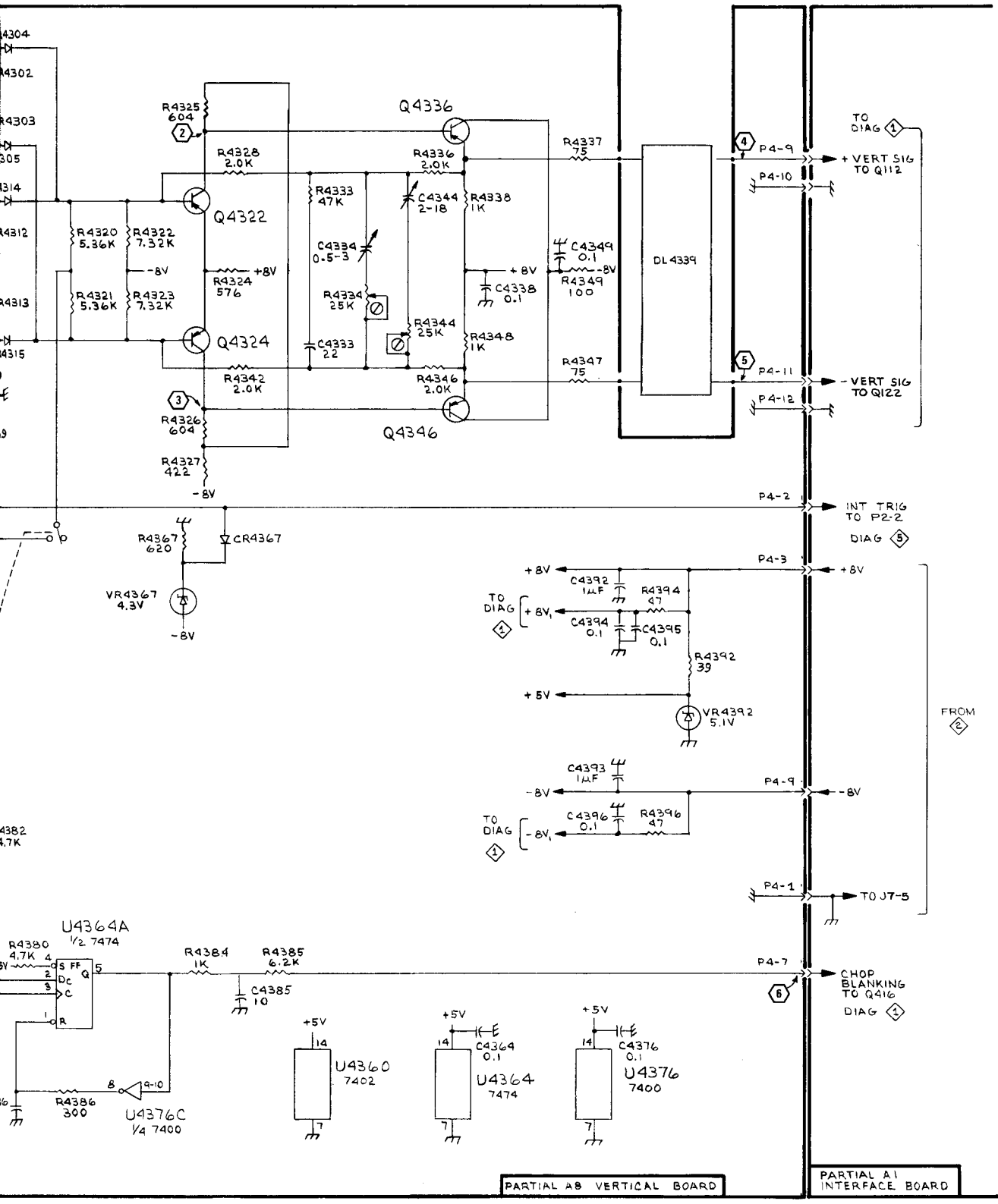
The other controls were set as needed to obtain a display.

The CH 1 POSITION control was adjusted so that the bottom of the sine wave was on the first horizontal graticule line above the center and the CH 2 POSITION control was adjusted so that the top of the square wave was on the first horizontal graticule line below the center.

***Screen positions for waveforms 2, 3, 4, and 5 are affected by settings of the T922 or T922R POSITION controls.**

(1) (2)* (3)*


CH 1 -VERT SIG FROM R4156
CH 1 +VERT SIG FROM R4165
FROM DIAG 10
VOLTAGE & WAVEFORM CONDITIONS
Q4302
Q4303
R4301 100
+8V
R4302 562
C4303 0.1
R4303 432
R4306 20K
R4307 20K
-8V
POSITION (CH 1)
CR4304
CR4302
CR4303
CR4305
CH 2 -VERT SIG FROM R4255
CH 2 +VERT SIG FROM R4265
Q4312
Q4310
Q4311
Q4313
R4311 1K
R4310 100
R4313 1K
R4312 100
R4316 20K
R4317 20K
POSITION (CH 2)
CR4314
CR4312
CR4313
CR4315
C4368 180
R4366 470
R4370 470
R4368 240
R4369 240
CH 1 TRIG SIG FROM Q4176
CH 2 TRIG SIG FROM Q4276
CR4364
CR4363
CR4362
CR4366
S4370 VERTICAL MODE
CH 2
DIFF
DUAL TRACE
CH 1
CH1 TRIG
R4365 4.7K
U4360A 1/4 7402
U4360B 1/4 7402
U4360C 1/4 7402
U4360D 1/4 7402
CR4361
CR4360
R4364 4.7K
R4358 240
U4364B 1/2 7474
+5V
R4382 4.7K
J2260-7
SEE DIAG 6
S2250
U4376B 1/4 74C0
R4377 2.7K
C4375 470
C4377 470
R4373 10K
R4375
R4380 4.7K



(1981) 1982-69
@

T922 OR T922R OPTION 1 VERTICAL SWITCHING 11

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 *Name & Description*

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

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

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000BE	EDAC, INC.	36 MOBILE DRIVE	TORONTO, ONTARIO M4AHP
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
05091	TRI-ORDINATE CORPORATION	343 SNYDER AVENUE	BERKELEY HEIGHTS, NJ 07922
11897	PLASTIGLIDE MFG. CORPORATION	P O BOX 867, 1757 STANFORD ST.	SANTA MONICA, CA 90406
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
12360	ALBANY PRODUCTS CO., DIV. OF PNEUMO DYNAMICS CORPORATION	145 WOODWARD AVENUE	SOUTH NORWALK, CT 06586
12697	CLAROSTAT MFG. CO., INC.	LOWER WASHINGTON STREET	DOVER, NH 03820
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
23499	GAVITT WIRE AND CABLE, DIVISION OF RSC INDUSTRIES, INC.	455 N. QUINCE ST.	ESCONDIDO, CA 92025
26365	GRIES REPRODUCER CO., DIV. OF COATS AND CLARK, INC.	125 BEECHWOOD AVE.	NEW ROCHELLE, NY 10802
27264	MOLEX PRODUCTS CO.	5224 KATRINE AVE.	DOWNERS GROVE, IL 60515
28520	HEYMAN MFG. CO.	147 N. MICHIGAN AVE.	KENILWORTH, NJ 07033
55210	GETTIG ENG. AND MFG. COMPANY	PO BOX 85, OFF ROUTE 45	SPRING MILLS, PA 16875
59730	THOMAS AND BETTS COMPANY	36 BUTLER ST.	ELIZABETH, NJ 07207
70485	ATLANTIC INDIA RUBBER WORKS, INC.	571 W. POLK ST.	CHICAGO, IL 60607
71279	CAMBRIDGE THERMIONIC CORP.	445 CONCORD AVE.	CAMBRIDGE, MA 02138
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P. O BOX 858	FORT DODGE, IA 50501
72228	CONTINENTAL SCREW CO., DIV. OF AMTEL, INC.	459 MT. PLEASANT	NEW BEDFORD, MA 02742
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
74445	HOLO-KROME CO.	31 BROOK ST. WEST	HARTFORD, CT 06110
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-1	348-0443-00			1	STAND,ELEC EQPT:0.156" DIA,SST,PASSIVATE	80009	348-0443-00
-2	437-0200-00			1	CABINET,SCOPE:ASSEMBLY(T921 & T922)	80009	437-0200-00
					(ATTACHING PARTS)		
-3	211-0648-00			6	SCR,ASSEM WSHR:6-32 X 0.625 INCH,PNH STL	83385	OBD
-4	210-0408-00			6	NUT,PLAIN,HEX.:6-32 X 0.312 INCH,BRS	73743	3040-402
					- - - * - - -		
	----- -----			-	. CABINET ASSY INCLUDES:		
-5	348-0441-00			4	. FOOT,CABINET:POLYURETHANE,BLACK	80009	348-0441-00
-6	348-0447-00			2	. FOOT,CABINET:LEFT FRONT,RIGHT REAR	80009	348-0447-00
	348-0447-01			2	. FOOT,CABINET:RIGHT FRONT,LEFT REAR	80009	348-0447-01
					(ATTACHING PARTS FOR EACH)		
-7	213-0731-00			1	. SCR,TPG,THD FOR:6-19 X 0.5 INCH,PNH STL	72228	OBD
					- - - * - - -		
-8	334-2682-00			2	. PLATE,IDENT:2.50" LONG-TEKTRONIX	80009	334-2682-00
-9	334-2624-00			1	. PLATE,IDENT:MARKED--DC BAL,CH1 AND CH2	80009	334-2624-00
	351-0458-00			1	. GUIDE,LINE ADJ:HI-LO	80009	351-0458-00
	351-0458-01			1	. GUIDE,LINE ADJ:115V-230V	80009	351-0458-01
-10	384-1371-01			1	EXTENSION SHAFT:5.2" LONG W/KNOB	80009	384-1371-01
-11	384-1371-03			1	EXTENSION SHAFT:10.7" LONG W/KNOB	80009	384-1371-03
-12	366-1559-00			2	PUSH BUTTON:GRAY	80009	366-1559-00
-13	214-2309-00			1	CONDUCTOR,LIGHT:5.265" LONG	80009	214-2309-00
-14	358-0550-00			2	BUSHING,SHAFT:0.15 ID X 0.3INCH OD,PLSTC	80009	358-0550-00
-15	426-1072-00			1	FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
	334-2755-00			1	LABEL,IDENT:--PRESS TO RELEASE	80009	334-2755-00
-16	333-2078-00			1	PANEL,FRONT:	80009	333-2078-00
-17	337-2185-00			1	SHLD,IMPLOSION:BLUE	80009	337-2185-00
-18	136-0387-01			1	JACK,TIP:BLACK	71279	450-4352-01-0310
-19	386-3287-00			1	SUBPANEL,FRONT:CRT,PLASTIC	80009	386-3287-00
					(ATTACHING PARTS)		
-20	213-0146-00			1	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	OBD
					- - - * - - -		
-21	384-1370-00			1	EXTENSION SHAFT:4.68" L,MOLDED PLSTC	80009	384-1370-00
-22	384-1364-00			1	EXTENSION SHAFT:10.818" L,NYLON,BLK	80009	384-1364-00
-23	351-0456-00			2	GUIDE,RES ADJ:PLASTIC	80009	351-0456-00
-24	352-0425-00			1	FUSEHOLDER:PLASTIC	80009	352-0425-00
-25	352-0331-00			1	LAMPHOLDER:	80009	352-0331-00
-26	337-2227-00			1	SHIELD,ELEC:HIGH VOLTAGE POWER SUPPLY	80009	337-2227-00
					(ATTACHING PARTS)		
-27	211-0007-00			2	SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
					- - - * - - -		
-28	342-0293-00			1	INSULATOR,SHLD:HIGH VOLTAGE	80009	342-0293-00
-29	343-0213-00			2	CLAMP,LOOP:PRESS MT,PLASTIC	80009	343-0213-00
-30	----- -----			1	TRANSISTOR:CHASSIS MTG(SEE Q458 EPL)		
					(ATTACHING PARTS)		
-31	344-0236-01			1	CLIP,SPR TNSN:TRANSISTOR MOUNTING	80009	344-0236-01
	342-0202-00			1	INSULATOR,PLATE:TRANSISTOR	01295	10-21-023-106
-32	253-0202-00			FT	INSUL TAPE,ELEC:POLYMIDE,0.875" W X 1.0" LONG	99742	221
-33	----- -----			1	CRT BOARD ASSY:INTERFACE(SEE A1 EPL)		
					(ATTACHING PARTS)		
-34	211-0008-00			6	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
-40	----- -----			1		. TRANSFORMER:H.V.(SEE T460 EPL)		
	361-0007-00			3		. SPACER,SLEEVE:0.250 INCH DIA,PLASTIC	80009	361-0007-00
-41	----- -----			2		. RES.,VAR:INTEN AND FOCUS(SEE R412,R468 EPL)		
-42	----- -----			1		. SWITCH,PUSH:BEAMFINDER(SEE S100 EPL)		
-43	361-0608-00			2		. SPACER,PUSH SW:PLASTIC	80009	361-0608-00
-44	----- -----			1		. SWITCH,PUSH:POWER ON(SEE S700 EPL)		
-45	344-0154-00			2		. CLIP,ELECTRICAL:FOR 0.25 INCH DIA FUSE	80009	344-0154-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-	342-0202-00			3		INSULATOR,PLATE:TRANSISTOR	01295	10-21-023-106
-83	253-0202-00			FT		INSUL TAPE,ELEC:POLYMIDE,0.875" W X 3.5" L	99742	221
-84	214-2265-00			1		HEAT SINK,XSTR:6.0" L X 0.72" H,AL	80009	214-2265-00
						(ATTACHING PARTS)		
-85	211-0507-00			2		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-86	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-87	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-88	352-0425-00			1		FUSEHOLDER:PLASTIC	80009	352-0425-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-120	131-0955-00			1		. CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
						(ATTACHING PARTS)		
-121	210-1000-00			1		. WASHER,FLAT:0.384 ID X 0.50" OD,AL	80009	210-1000-00
	210-0978-00[1]			1		. WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
	210-0978-00[2]	XB010400		1		. WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - - -		
-122	105-0678-00[1]	B010100	B010549	1		. DRUM,CAM SWITCH:W/LEVER	80009	105-0678-00
	105-0678-01[1]	B010550		1		. DRUM,CAM SWITCH:AC-DC GND,CHANNEL 1	80009	105-0678-01
	105-0678-00[2]	B010100	B013440	1		. DRUM,CAM SWITCH:W/LEVER	80009	105-0678-00
	105-0678-02[2]	B013441		1		. DRUM,CAM SWITCH:AC-DC GND,CHANNEL 2	80009	105-0678-02
-123	214-1126-01			4		. SPRING,FLAT:GREEN COLORED	80009	214-1126-01
-124	214-1752-00			4		. ROLLER,DETENT:	80009	214-1752-00
-125	401-0338-00			1		. BEARING,CAM SW:FRONT	80009	401-0338-00
						(ATTACHING PARTS)		
-126	211-0116-00[1]	B010100	B010339	2		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	211-0244-00[1]	B010340		2		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	78189	OBD
	211-0116-00[2]	B010100	B011674	2		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	211-0244-00[2]	B010675		2		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	78189	OBD
-127	210-0406-00			2		. NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
						- - - * - - -		
-128	376-0174-00			1		. CPLG,SHAFT,RGD:0.19 ID X 0.325 OD X 0.2" H	80009	376-0174-00
-129	105-0679-00			1		. DRUM,CAM SWITCH:	80009	105-0679-00
-130	343-0564-00			1		. RTNR BAR,CONT:ATTENUATOR,LEFT CH1	80009	343-0564-00
	343-0565-00			1		. RTNR BAR,CONT:ATTENUATOR,RIGHT CH2	80009	343-0565-00
						(ATTACHING PARTS)		
-131	211-0116-00[1]	B010100	B010339	1		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	211-0244-00[1]	B010340		1		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	78189	OBD
	211-0116-00[2]	B010100	B011674	1		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	OBD
	211-0244-00[2]	B011675		1		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	78189	OBD
-132	211-0152-00[1]	B010100	B010339	1		. SCR,ASSEM WSHR:4-40 X 0.625 INCH,PNH BRS	83385	OBD
	211-0246-00[1]	B010340		1		. SCR,ASSEM WSHR:4-40 X 0.625 INCH,PNH,STL	78189	OBD
	211-0152-00[2]	B010100	B011674	1		. SCR,ASSEM WSHR:4-40 X 0.625 INCH,PNH BRS	83385	OBD
	211-0246-00[2]	B011675		1		. SCR,ASSEM WSHR:4-40 X 0.625 INCH,PNH,STL	78189	OBD
-133	210-0406-00			1		. NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
						- - - * - - -		
-134	131-1779-03			1		. CONT ASSY,ELEC:CAM SW,1 CONTACT,LEFT,CH1	80009	131-1779-03
	131-1779-04			1		. CONT ASSY,ELEC:CAM SW,1 CONTACT,RIGHT,CH2	80009	131-1779-04
-135	131-1779-01			1		. CONT ASSY,ELEC:CAM SW,13 CONTACT,LEFT,CH1	80009	131-1779-01
	131-1779-02			1		. CONT ASSY,ELEC:CAM SW,13 CONTACT,RIGHT,CH2	80009	131-1779-02
-136	----- -----			1		. CKT BOARD ASSY:CH1 OR CH2(SEE A6,A7 EPL)		
-137	136-0263-04			5		. . SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	22526	75377-001
-138	361-0735-00			2		SPACER,CKT BD:0.25"OD X 0.093" H,PLSTC	80009	361-0735-00
	361-0735-00			1		SPACER,CKT BD:0.25"OD X 0.093" H,PLSTC	80009	361-0735-00
-139	384-1136-00			3		EXTENSION SHAFT:0.95 INCH LONG	80009	384-1136-00
-140	----- -----			1		CKT BOARD ASSY:VERTICAL(SEE A8 EPL)		
						(ATTACHING PARTS)		
-141	211-0014-00			3		SCREW,MACHINE:4-40 X 0.50 INCH,PNH STL	83385	OBD
	211-0008-00			1		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-142	131-1817-00[1]	B010100	B010633	72		. LINK,TERM CONNE:22 AWG,2.25" LONG	80009	131-1817-00
	131-1817-00[1]	B010634		77		. LINK,TERM CONNE:22 AWG,2.25" LONG	80009	131-1817-00
	131-1817-00[2]			72		. LINK,TERM.CONN:22 AWG,2.25 INCH LONG	80009	131-1817-00
	131-0566-00[1]	B010100	B010107	4		. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	ERD-18T0
	131-0566-00[1]	B010108	B010633X	4		. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	55210	ERD-18T0
	131-0566-00[2]			5		. LINK,TERM.CONN:0.086 DIA X 2.375 INCH L	55210	ERD-18T0
-143	131-0589-00			10		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
	131-0589-00			5		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-144	131-1792-00			1		. CONTACT ASSY,EL:12 MALE CONTACT,FLAT WAFER	27264	09-70-2121
-145	----- -----			1		. SWITCH,PUSH:CH1,CH2(SEE S4370 EPL)		
-146	361-0542-00			4		. SPACER,SWITCH:PLASTIC	71590	J-64281
-147	----- -----			2		. RES.,VAR:CH1,CH2 VAR GAIN(SEE R4152,R4252 EPL)		
	----- -----			1		. RES.,VAR,CH1 VAR GAIN(SEE R4152 EPL)		

[1] T921
[2] T922

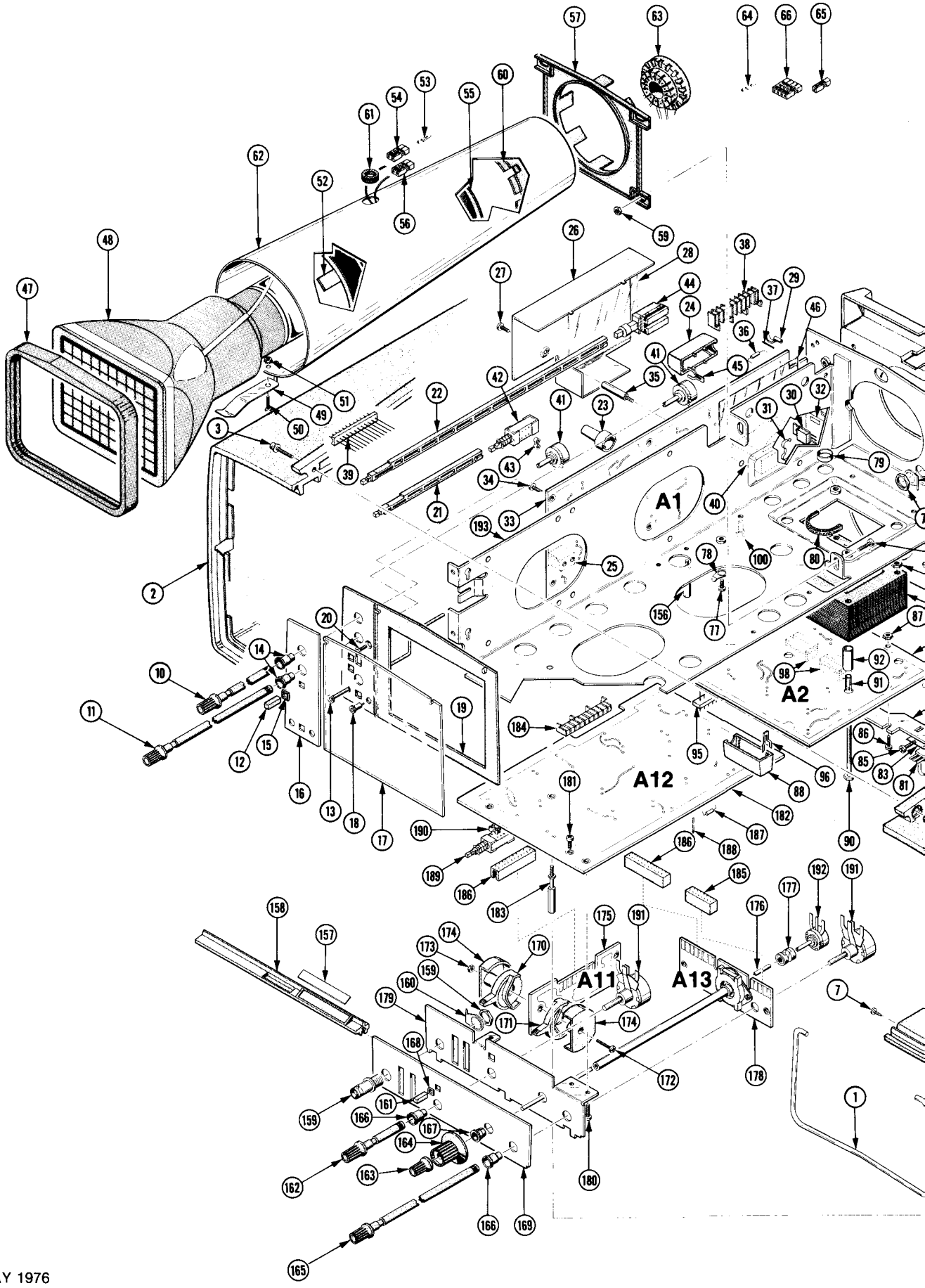
Fig. &

No.	Part No.	Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Code	Mfr Part Number
1-148	----- -----			2		. RES.,VAR:CH1,CH2 POSITION(SEE R4306,R4316 EPL)		
	----- -----			1		. RES.,VAR:CH1 POSITION(SEE R4306 EPL)		
-149	----- -----			1		DELAY LINE:W/HDWR(SEE DL4339 EPL)		
						(ATTACHING PARTS)		
-150	211-0007-00			2		SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
-151	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
-152	210-0458-00			3		NUT,PLAIN,EXT W:8-32 X 0.344 INCH,STL	83385	OBD
						- - - * - - -		
	----- -----			-		. DELAY LINE ASSY INCLUDES:		
-153	131-1798-00			2		. CONTACT,ELEC:DELAY LINE	80009	131-1798-00
-154	346-0121-00			3		. STRAP,ELEC COMP:TIE DOWN,5.0 LONG	59730	T4-34M
-155	386-3292-00			1		SUBPANEL,FRONT:VERTICAL	80009	386-3292-00
-156	129-0577-00			1		SPACER,POST:0.188 HEX X 1.442"L,BRS	80009	129-0577-00
-157	334-2536-00			1		PLATE,IDENT:MARKED T922	80009	334-2536-00
	334-2607-00			1		PLATE,IDENT:MARKED T921	80009	334-2607-00
-158	124-0315-00			1		STRIP,TRIM:FRONT,PLASTIC	80009	124-0315-00
-159	131-0106-02			1		CONNECTOR,RCPT,:BNC	80009	131-0106-02
						(ATTACHING PARTS)		
-160	210-0255-00			1		TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
						- - - * - - -		

-162	384-1371-00			1		EXTENSION SHAFT:2.0" LONG,W/KNOB,PLASTIC	80009	384-1371-00
-163	366-1647-00			1		KNOB:0.127" ID X 0.5" OD X 0.531"	80009	366-1647-00
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-164	366-1281-02			1		KNOB:GRAY,FCTN TIME/DIV	80009	366-1281-02
	213-0153-00			2		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-165	384-1371-02			1		EXTENSION SHAFT:6.8" LONG,W/KNOB	80009	384-1371-02
-166	358-0550-00			2		BUSHING,SHAFT:0.15 ID X 0.3INCH OD,PLSTC	80009	358-0550-00
-167	358-0216-00			1		BUSHING,PLASTIC:0.257 ID X 0.412 INCH OD	80009	358-0216-00
-168	426-1072-00			1		FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-169	333-2039-00			1		PANEL,FRONT:HORIZONTAL	80009	333-2039-00
	672-0517-00[1]	B010100	B010129	1		CKT BOARD ASSY:TRIGGER,W/LEVER SWITCH	80009	672-0517-00
	672-0549-00[1]	B010130		1		CKT BOARD ASSY:TRIGGER,W/LEVER SWITCH	80009	672-0549-00
	672-0517-00[2]	B010100	B010169	1		CKT BOARD ASSY:TRIGGER,W/LEVER SWITCH	80009	672-0517-00
	672-0549-00[2]	B010170		1		CKT BOARD ASSY:TRIGGER,W/LEVER SWITCH	80009	672-0549-00
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-170	----- -----			1		. LEVER,SWITCH:MODE(SEE S2150 EPL)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-184	131-1795-00			1		. CONNECTOR,RCPT,:12 FEMALE CONTACT,RT-ANGLE	27264	09-62-3121
-185	131-1801-00			1		. CONNECTOR,RCPT,:9 CONTACTS	80009	131-1801-00
-186	131-1802-00			2		. CONNECTOR,RCPT,:15 CONTACTS	80009	131-1802-00
-187	131-1817-00[1]	B010100	B010633	33		. LINK,TERM CONNE:22 AWG,2.25" LONG	80009	131-1817-00
	131-1817-00[1]	B010634		36		. LINK,TERM CONN:22 AWG,2.25 INCH LONG	80009	131-1817-00
	131-1817-00[2]	B010100	B014318	33		. LINK,TERM CONN:22 AWG,2.25 INCH LONG	80009	131-1817-00
	131-1817-00[2]	B014319		36		. LINK,TERM CONN:22 AWG,2.25 INCH LONG	80009	131-1817-00
-188	131-0608-00			2		. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-189	----- -----			1		. SWITCH,PUSH:SLOPE(SEE S2140 EPL)		
-190	361-0542-00			2		. SPACER,SWITCH:PLASTIC	71590	J-64281
-191	----- -----			2		. RES.,VAR:LEVEL,POSITION(SEE R2138,R2316 EPL)		
-192	----- -----			1		. RES.,VAR:POS(SEE R2322 EPL)		
-193	441-1278-00			1		CHASSIS,SCOPE:MAIN	80009	441-1278-00
-194	131-1538-00			4		CONTACT,ELEC:CRIMP-ON,22-26 AWG WIRE	22526	75369-002
-195	131-0707-00			4		CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	47439
-196	352-0171-00			1		CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00

[1] T921
[2] T922



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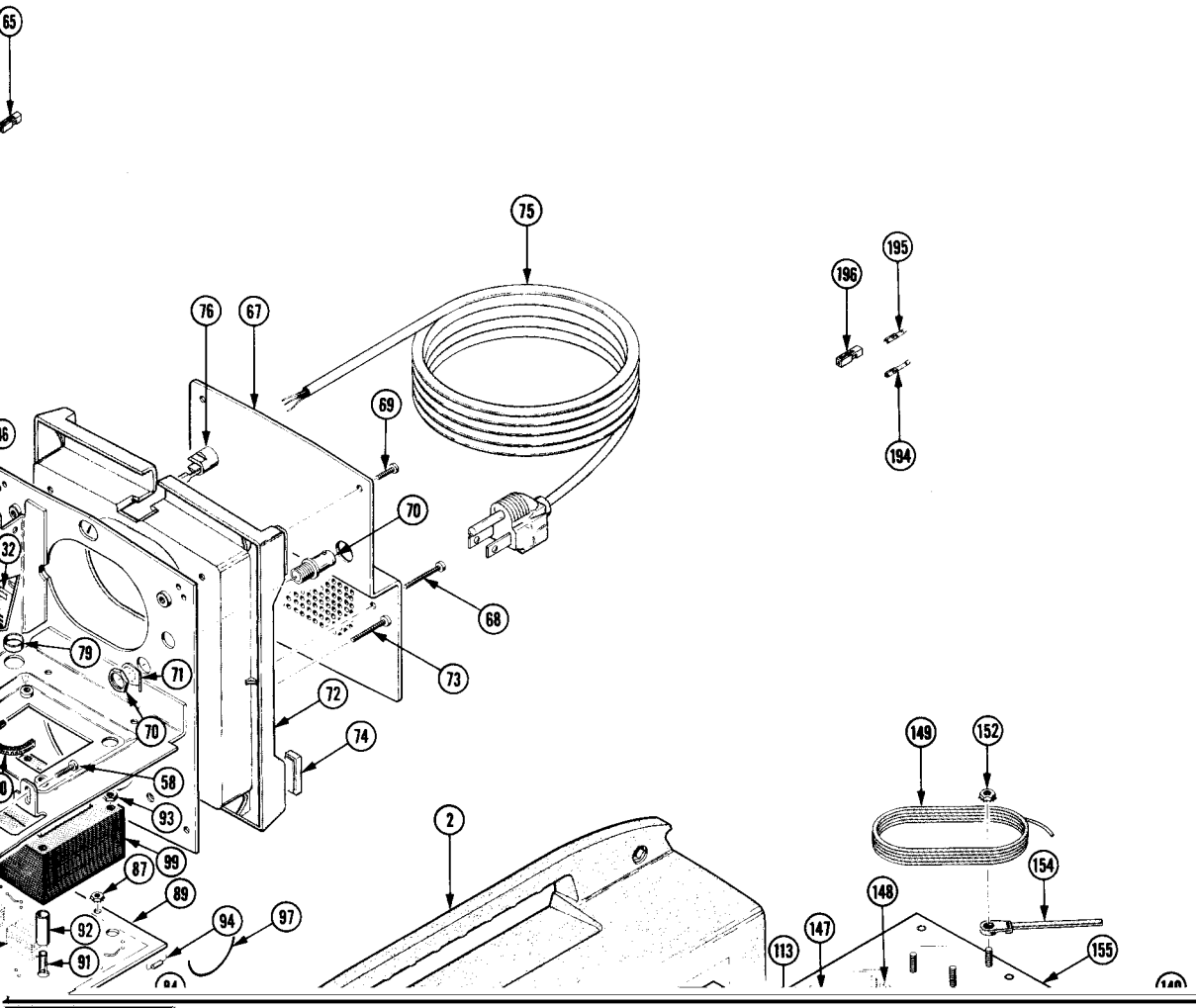
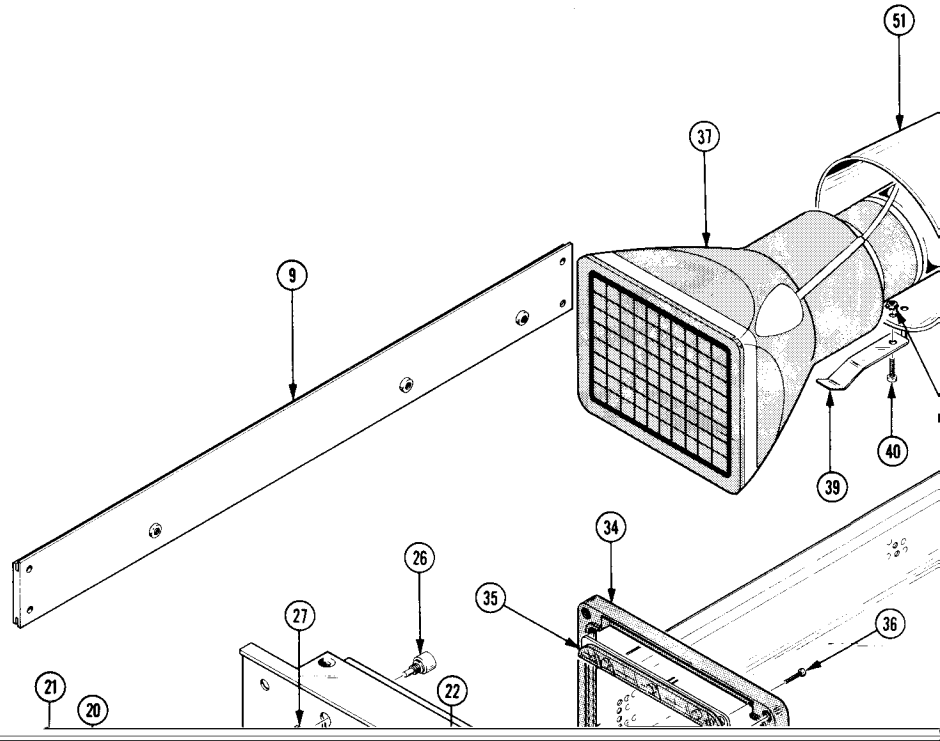


FIG. 1 T921/T922

FIG. 2 T922R FRAME



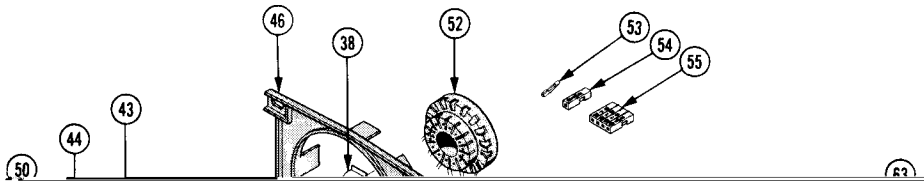

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Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-1	390-0530-00			2		CABINET,SCOPE:TOP AND BOTTOM(T922R)	80009	390-0530-00
-2	386-1151-00			6		. PLATE,LATCH LKG:	80009	386-1151-00
-3	386-0227-04			6		. PLATE,LCH INDEX:MOLD SI GY PLSTC	80009	386-0227-04
-4	214-0603-01			6		. PIN,SECURING:0.27 INCH LONG	80009	214-0603-01
-5	214-0604-00			6		. WASH.,SPG TNSN:0.26 ID X 0.47 INCH OD	80009	214-0604-00
-6	426-1325-00			1		FRAME SECT,CAB.:RIGHT	80009	426-1325-00
						(ATTACHING PARTS)		
-7	212-0004-00			4		SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
-8	211-0504-00			3		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-9	426-1326-00			1		FRAME SECT,CAB.:LEFT	80009	426-1326-00
						(ATTACHING PARTS)		
	212-0004-00			4		SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-10	367-0228-00			2		HANDLE,BOW:4.0 INCH LONG,ALUM	80009	367-0228-00
						(ATTACHING PARTS FOR EACH)		
-11	212-0574-00			2		SCREW,MACHINE:10-32 X 0.438"100 DEG FLH STL	83385	OBD
						- - - * - - -		
-12	333-2188-00			1		PANEL,FRONT:	80009	333-2188-00
-13	384-1371-01			1		EXTENSION SHAFT:5.2" LONG W/KNOB	80009	384-1371-01
-14	384-1371-03			1		EXTENSION SHAFT:10.7" LONG W/KNOB	80009	384-1371-03
-15	136-0387-01			1		JACK,TIP:BLACK	71279	450-4352-01-0310
-16	214-2309-00			1		CONDUCTOR,LIGHT:5.265" LONG	80009	214-2309-00
-17	358-0378-01			1		BUSHING,SLEEVE:0.250 OD X 0.131 ID,PRESS MT	80009	358-0378-01
-18	358-0550-00			2		BUSHING,SHAFT:0.15 ID X 0.3 INCH OD,PLSTC	80009	358-0550-00
-19	426-1072-00			2		FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-20	366-1660-00			1		KNOB:GRAY	80009	366-1660-00
	213-0153-00			2		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-21	333-2190-00			1		PANEL,FRONT:CRT	80009	333-2190-00
-22	----- -----			2		RES.,VAR:ASTIG/TRACE ROTATE(SEE R472,R477 EPL)		
						(ATTACHING PARTS FOR EACH)		
-24	210-0046-00			2		WASHER,LOCK:INTL,0.26 ID X 0.40" OD,STL	78189	1214-05-00-0541C
-25	210-0471-00			1		NUT,SLEEVE:HEX.,0.312 X 0.594 INCH LONG	80009	210-0471-00
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-42	----- -----			1		COIL,TUBE DEFL:(SEE L472 EPL)		
-43	131-0707-00			2		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	75691-005
-44	352-0169-01			1		. CONN BODY,PL,EL:2 WIRE BROWN	80009	352-0169-01
-45	----- -----			1		COIL,TUBE DEFL:(SEE L470 EPL)		
	131-0707-00			2		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	75691-005
	352-0169-00			1		. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
-46	386-3288-00			1		SPRT,CRT SHIELD:REAR	80009	386-3288-00
						(ATTACHING PARTS)		
-47	211-0507-00			4		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-48	220-0419-00			4		NUT,PLAIN,SQ:6-32 X 0.312 INCH,STL	83385	OBD
						- - - * - - -		
-49	386-3305-00			1		SUPPORT,CRT:REAR	80009	386-3305-00
-50	348-0004-00			1		GROMMET,RUBBER:0.281 ID X 0.563 INCH OD	70485	763
-51	337-2223-00			1		SHIELD,ELEC:CRT	80009	337-2223-00
	136-0652-00			1		SOCKET ASSY:CRT	80009	136-0652-00
-52	136-0202-01			1		. SOCKET,PLUG-IN:14 PIN	80009	136-0202-01
-53	131-0707-00			9		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	75691-005
-54	352-0171-00			1		. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0171-00
-55	352-0162-00			2		. CONN BODY,PL,EL:4 WIRE BLACK	80009	352-0162-00
-56	407-1828-00			1		BRKT,ELEC CONN:ALUMINUM	80009	407-1828-00
						(ATTACHING PARTS)		
-57	211-0504-00			3		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
-58	211-0504-00			3		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-59	131-0955-00			7		CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
						(ATTACHING PARTS FOR EACH)		
-60	210-0255-00			1		TERMINAL,LUG:0.391" ID INT TOOTH	80009	210-0255-00
						- - - * - - -		
-61	333-2189-00			1		PANEL,REAR:	80009	333-2189-00
						(ATTACHING PARTS)		
-62	211-0504-00			6		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-63	161-0107-02			1		CABLE ASSY,PWR,:3,18 AWG,115V,93.0" L	80009	161-0107-02
						(ATTACHING PARTS)		
-64	358-0506-00			1		BUSHING,HANDLE:0.500 INCH DIAMETER	80009	358-0506-00
						- - - * - - -		
	----- -----			-		. POWER CORD ASSEMBLY INCLUDES:		
-65	210-0287-00			1		. TERMINAL,LUG:	00779	34142
						(ATTACHING PARTS)		
	210-0586-00			1		. NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
						- - - * - - -		
-66	386-3580-00			1		SUBPANEL,FRONT:	80009	386-3580-00
						(ATTACHING PARTS)		
-67	211-0541-00	B010100	B010145	4		SCREW,MACHINE:6-32 X 0.25"100 DEG,FLH STL	83385	OBD
	211-0504-00	B010146		4		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-68	407-1848-00			2		BRACKET CAB.COR:ALUMINUM	80009	407-1848-00
						(ATTACHING PARTS FOR EACH)		
-69	211-0541-00	B010100	B010145	2		SCREW,MACHINE:6-32 X 0.25"100 DEG,FLH STL	83385	OBD
	211-0504-00	B010146		2		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
-70	101-0036-00			1		TRIM,FRONT PNL:	80009	101-0036-00

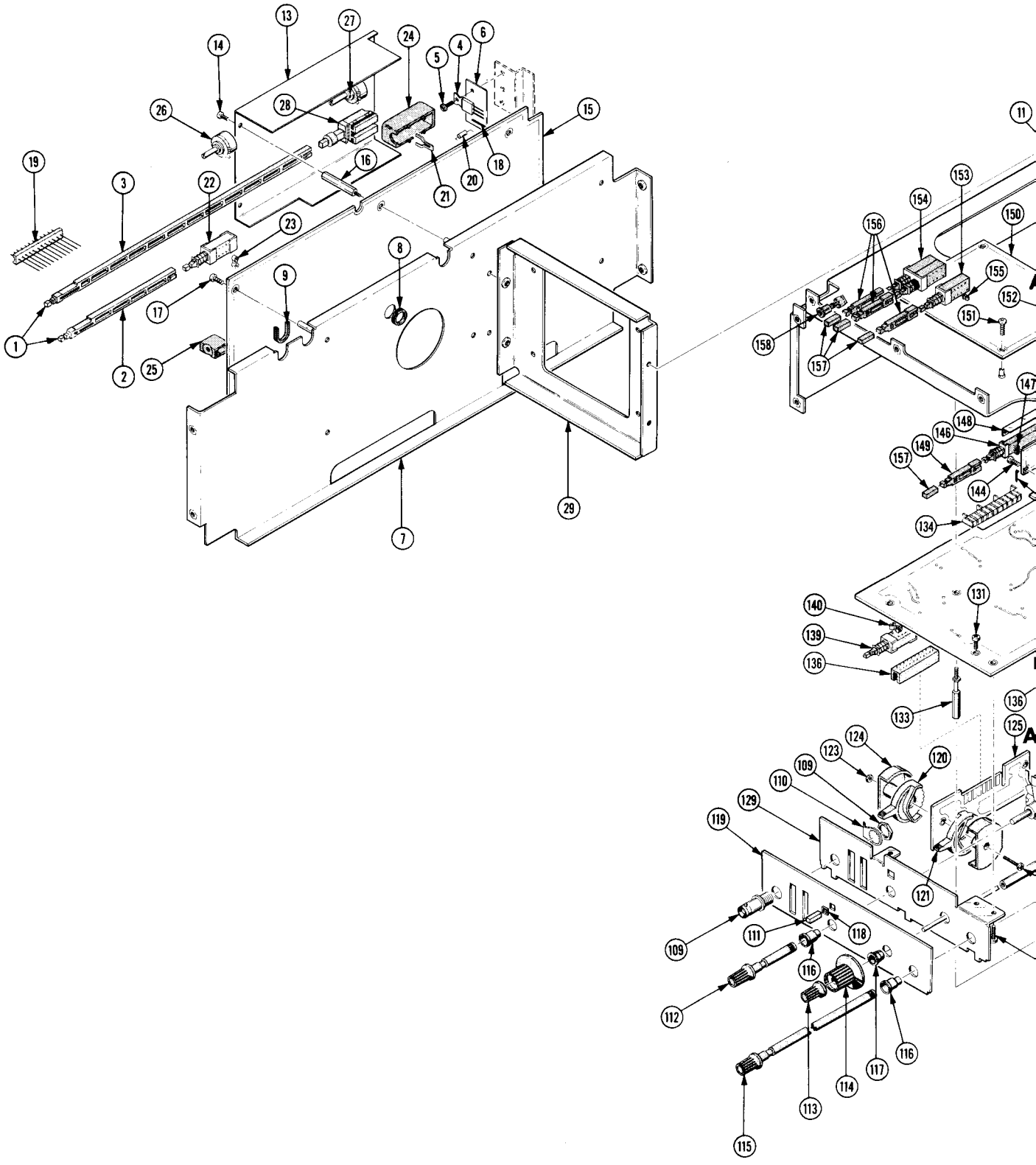
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	Name & Description	Mfr Code	Mfr Part Number
-2	384-1370-00			1	EXTENSION SHAFT:4.68" L,MOLDED PLSTC	80009	384-1370-00
-3	384-1364-00			1	EXTENSION SHAFT:10.818" L,NYLON,BLK	80009	384-1364-00
-4	----- -----			3	TRANSISTOR:(SEE Q458,Q816,Q818 EPL)		
					(ATTACHING PARTS FOR EACH)		
-5	211-0040-00			1	SCREW,MACHINE:4-40 X 0.25",BDGH PLSTC	26365	OBD
-6	342-0202-00			1	INSULATOR,PLATE:TRANSISTOR	01295	10-21-023-106
					- - - * - - -		
-7	441-1341-00			1	CHASSIS,SCOPE:INTERFACE	80009	441-1341-00
					(ATTACHING PARTS)		
	211-0541-00	B010100 B010145		4	SCREW,MACHINE:6-32 X 0.25"100 DEG,FLH STL	83385	OBD
	211-0504-00	B010146		4	SCREW.MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-8	348-0003-00			1	GROMMET,RUBBER:0.312 INCH DIAMETER	70485	1411B6040
-9	348-0171-00			2	GROMMET,PLASTIC:U-SHAPED	80009	348-0171-00
-10	255-0334-00			FT	PLASTIC CHANNEL:0.667 FT LONG	11897	122-37-2500
-11	343-0089-00			3	CLAMP,LOOP:LARGE	80009	343-0089-00
-12	343-0213-00			4	CLAMP,LOOP:PRESS MT,PLASTIC	80009	343-0213-00
	342-0293-00			1	INSULATOR,SHLD:HIGH VOLTAGE	80009	342-0293-00
-13	337-2351-00			1	SHIELD,ELEC:HIGH VOLTAGE	80009	337-2351-00
					(ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-42	----- -----			1		CKT BOARD ASSY:L.V. POWER(SEE A2 EPL)		
						(ATTACHING PARTS)		
-43	212-0516-00			4		SCREW,MACHINE:10-32 X 2 INCH,HEX HD STL	77250	OBD
-44	166-0227-00			4		INS SLV,ELEC:0.187 ID X 1.50 INCH LONG	80009	166-0227-00
-45	361-0741-00			4		SPACER,SLEEVE:0.245" ID X 0.75" L,AL	80009	361-0741-00
-46	220-0572-00			2		NUT,PLAIN,HEX.:10-32 X 0.25 INCH,PL BRS	73743	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-47	131-1817-00			9		. LINK,TERM CONNE:22 AWG,2.25" LONG	80009	131-1817-00
-48	131-1750-00			1		. TERM.,FEED THRU:10 PIN INSULATED	27264	09-64-1103
-49	----- -----			2		. SWITCH:(SEE S701,S705 EPL)		
-50	344-0154-00			2		. CLIP,ELECTRICAL:FOR 0.25 INCH DIA FUSE	80009	344-0154-00
-51	346-0032-00			3		. STRAP,RETAINING:	98159	2829-75-4
-52	----- -----			1		TRANSFORMER:(SEE T700 EPL)		
	343-0213-00			4		CLAMP,LOOP:PRESS MT,PLASTIC	80009	343-0213-00
	343-0089-00			2		CLAMP,LOOP:LARGE	80009	343-0089-00
-53	366-1031-02			1		KNOB:RED-VAR	80009	366-1031-02
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-54	366-1646-00			1		KNOB:GRAY,W/SHAFT	80009	366-1646-00
-55	384-1371-02			1		EXTENSION SHAFT:6.8" LONG,W/KNOB	80009	384-1371-02
-56	358-0550-00			1		BUSHING,SHAFT:0.15 ID X 0.3INCH OD,PLSTC	80009	358-0550-00
-57	366-1559-00			3		PUSH BUTTON:GRAY	80009	366-1559-00
-58	384-1371-02			1		EXTENSION SHAFT:6.8" LONG,W/KNOB	80009	384-1371-02
-59	366-1031-02			1		KNOB:RED-VAR	80009	366-1031-02
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-60	366-1646-00			1		KNOB:GRAY,W/SHAFT	80009	366-1646-00
-61	426-1072-00			3		FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-62	358-0550-00			1		BUSHING,SHAFT:0.15 ID X 0.3INCH OD,PLSTC	80009	358-0550-00
-63	333-2040-00			1		PANEL,FRONT:VERTICAL	80009	333-2040-00
-64	384-1393-00			2		EXTENSION SHAFT:0.123 DIA X 6.3" L,PLSTC	80009	384-1393-00
-65	376-0051-00			2		CPLG,SHAFT,FLEX:FOR 0.125 INCH DIA SHAFTS	80009	376-0051-00
	213-0022-00			4		. SETSCREW:4-40 X 0.188 INCH,HEX SOC STL	74445	OBD
-66	351-0456-00			2		. GUIDE,RES ADJ:PLASTIC	80009	351-0456-00
	672-0518-00			1		CKT BOARD ASSY:ATTEN CH1 W/CAM SW	80009	672-0518-00
	672-0519-00			1		CKT BOARD ASSY:ATTEN CH2 W/CAM SW	80009	672-0519-00
						(ATTACHING PARTS FOR EACH)		
-67	211-0144-00			2		SCREW,MACHINE:4-40 X 1.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-68	211-0018-00			2		SCREW,MACHINE:4-40 X 0.875 PNH,STL	83385	OBD
-69	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
	----- -----			-		. EACH ATTENUATOR INCLUDES:		
-70	337-2214-00			1		. SHIELD,ELEC:ATTENUATOR LEFT,CH1	80009	337-2214-00
	337-2215-00			1		. SHIELD,ELEC:ATTENUATOR,RIGHT,CH2	80009	337-2215-00
						(ATTACHING PARTS)		
-71	211-0244-00			2		. SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	78189	OBD
						- - - * - - -		
-72	131-0955-00			1		. CONNECTOR,RCPT,:BNC,FEMALE,W/HARDWARE	05091	31-279
						(ATTACHING PARTS)		
-73	210-1000-00			1		. WASHER,FLAT:0.384 ID X 0.50" OD,AL	80009	210-1000-00
	210-0978-00			1		. WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	OBD
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-82	343-0564-00			1		. RTNR BAR,CONT:ATTENUATOR,LEFT CH1	80009	343-0564-00
	343-0565-00			1		. RTNR BAR,CONT:ATTENUATOR,RIGHT CH2	80009	343-0565-00
-83	211-0244-00			1		. .SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH STL	78189	OBD
-84	211-0246-00			1		. SCR,ASSEM WSHR:4-40 X 0.625 INCH,PNH,STL	78189	OBD
-85	210-0406-00			1		. NUT,PLAIN,HEX.:4-40 X 0.188 INCH,BRS	73743	2X12161-402
						- - - * - - -		
-86	131-1779-03			1		. CONT ASSY,ELEC:CAM SW,1 CONTACT,LEFT,CH1	80009	131-1779-03
	131-1779-04			1		. CONT ASSY,ELEC:CAM SW,1 CONTACT,RIGHT,CH2	80009	131-1779-04
-87	131-1779-01			1		. CONT ASSY,ELEC:CAM SW,13 CONTACT,LEFT,CH1	80009	131-1779-01
	131-1779-02			1		. CONT ASSY,ELEC:CAM SW,13 CONTACT,RIGHT,CH2	80009	131-1779-02
-88	----- -----			1		. CKT BOARD ASSY:(SEE A6,A7 EPL)		
-89	136-0263-04			5		. . SOCKET,PIN TERM:FOR 0.025 INCH SQUARE PIN	22526	75377-001
-90	361-0735-00			2		SPACER,CKT BD:0.25"OD X 0.093" H,PLSTC	80009	361-0735-00
-91	384-1136-00			3		EXTENSION SHAFT:0.95 INCH LONG	80009	384-1136-00
-92	----- -----			1		CKT BOARD ASSY:(SEE A8 EPL)		
						(ATTACHING PARTS)		
-93	211-0014-00			3		SCREW,MACHINE:4-40 X 0.50 INCH,PNH STL	83385	OBD
	211-0008-00			1		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
	131-0566-00			3		. LINK,TERM.CONNE:0.086 DIA X 2.375 INCH L	0000L	ERD-18T0
-94	131-0589-00			10		. CONTACT,ELEC:0.46 INCH LONG	22526	47350
-95	131-1817-00			51		. LINK,TERM CONNE:22 AWG,2.25" LONG	80009	131-1817-00
-96	131-1792-00			1		. CONTACT ASSY,EL:12 MALE CONTACT,FLAT WAFER	27264	09-70-2121
-97	----- -----			1		. SWITCH:(SEE S4370 EPL)		
-98	361-0542-00			4		. SPACER,SWITCH:PLASTIC	71590	J-64281
-99	----- -----			2		. RES.,VAR:CH1,CH2 VAR.GAIN(SEE R4152,4252 EPL)		
-100	----- -----			2		. RES.,VAR:CH1,CH2 POSITION(SEE R4306,4316 EPL)		
-101	----- -----			1		DELAY LINE:(SEE DL4339 EPL)		
						(ATTACHING PARTS)		
-102	211-0007-00			2		SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
-103	210-0586-00			2		NUT,PLAIN,EXT W:4-40 X 0.25 INCH,STL	78189	OBD
-104	210-0458-00			3		NUT,PLAIN,EXT W:8-32 X 0.344 INCH,STL	83385	OBD
						- - - * - - -		
	----- -----			-		. DELAY LINE ASSEMBLY INCLUDES:		
-105	131-1798-00			2		. CONTACT,ELEC:DELAY LINE	80009	131-1798-00
-106	346-0121-00			3		. STRAP,ELEC COMP:TIE DOWN,5.0 LONG	59730	T4-34M
-107	386-3292-00			1		SUBPANEL,FRONT:VERTICAL	80009	386-3292-00
-108	129-0577-00			1		SPACER,POST:0.188 HEX X 1.442"L,BRS	80009	129-0577-00
-109	131-0106-02			1		CONNECTOR,RCPT,:BNC	80009	131-0106-02
						(ATTACHING PARTS)		
-110	210-0207-00			1		TERMINAL,LUG:0.375 INCH DIAMETER	12697	01136902
						- - - * - - -		
-111	366-1559-00			1		PUSH BUTTON:GRAY	80009	366-1559-00
-112	384-1371-00			1		EXTENSION SHAFT:2.0" LONG,W/KNOB,PLASTIC	80009	384-1371-00
-113	366-1647-00			1		KNOB:0.127" ID X 0.5" OD X 0.531"	80009	366-1647-00
	213-0153-00			1		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-114	366-1281-02			1		KNOB:GRAY,FCTN TIME/DIV	80009	366-1281-02
	213-0153-00			2		. SETSCREW:5-40 X 0.125 INCH,HEX SOC STL	74445	OBD
-115	384-1371-02			1		EXTENSION SHAFT:6.8" LONG,W/KNOB	80009	384-1371-02
-116	358-0550-00			2		BUSHING,SHAFT:0.15 ID X 0.3INCH OD.PLSTC	80009	358-0550-00
-117	358-0216-00			1		BUSHING,PLASTIC:0.257 ID X 0.412 INCH OD	80009	358-0216-00
-118	426-1072-00			1		FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-119	333-2039-00			1		PANEL,FRONT:HORIZONTAL	80009	333-2039-00
	672-0549-00			1		CKT BOARD ASSY:TRIGGER W/LEVER SWITCH	80009	672-0549-00
-120	----- -----			1		. LEVER,SWITCH:MODE(SEE S2150 EPL)		
-121	----- -----			1		. LEVER,SWITCH:SOURCE(SEE S2100 EPL)		
						(ATTACHING PARTS FOR EACH)		
-122	211-0240-00			1		. SCR,ASSEM WSHR:4-40 X 0.688"PNH,STL	78189	OBD
-123	210-0551-00			1		. NUT,PLAIN,HEX.:4-40 X 0.25 INCH,STL	83385	OBD
-124	351-0448-01			2		. GUIDE ,SWITCH:W/SPRING AND ROLLER	80009	351-0448-01
						- - - * - - -		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-125	----- -----			1		. CKT BOARD ASSY:TRIGGER(SEE A11 EPL)		
-126	384-1399-00			1		EXTENSION SHAFT:0.123" ID X 7.65" L,PLSTC	80009	384-1399-00
-127	376-0051-00			1		CPLG,SHAFT,FLEX:FOR 0.125 INCH DIA SHAFTS	80009	376-0051-00
	213-0022-00			4		. SETSCREW:4-40 X 0.188 INCH,HEX SOC STL	74445	OBD
-128	----- -----			1		CKT BOARD ASSY:TIMING(SEE A13 EPL)		
-129	386-3293-00			1		SUBPANEL,FRONT:HORIZONTAL	80009	386-3293-00
						(ATTACHING PARTS)		
-130	211-0008-00			1		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-131	211-0007-00			2		SCREW,MACHINE:4-40 X 0.188 INCH,PNH STL	83385	OBD
	214-0614-00			1		THUMBSCREW:	80009	214-0614-00
	214-0276-00			1		CONTACT,ELEC:	80009	214-0276-00
	129-0457-00			1		SPACER,POST:	80009	129-0457-00
						- - - * - - -		
-132	----- -----			1		CKT BOARD ASSY:HORIZONTAL(SEE A12 EPL)		
						(ATTACHING PARTS)		
-133	129-0573-00			2		SPACER,POST:0.188" HEX 1.627" L,AL	80009	129-0573-00
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-134	131-1795-00			1		. CONNECTOR,RCPT,:12 FEMALE CONTACT,RT-ANGLE	27264	09-62-3121
-135	131-1801-00			1		. CONNECTOR,RCPT,:9 CONTACTS	80009	131-1801-00
-136	131-1802-00			2		. CONNECTOR,RCPT,:15 CONTACTS	80009	131-1802-00
-137	131-1817-00			33		. LINK,TERM CONNE:22 AWG,2.25" LONG	80009	131-1817-00
-138	131-0608-00			2		. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-139	----- -----			1		. SWITCH:SLOPE(SEE S2140 EPL)		
-140	361-0542-00			2		. SPACER,SWITCH:PLASTIC	71590	J-64281
-141	----- -----			2		. RES.,VAR:LEVEL,POSITION(SEE R2138,R2316 EPL)		
-142	----- -----			1		. RES.,VAR:POS(SEE R2322 EPL)		
-143	----- -----			3		CKT BOARD ASSY:SWITCH(SEE A17,A18,A19 EPL)		
						(ATTACHING PARTS FOR EACH)		
-144	211-0008-00			2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
	210-0283-00			1		TERMINAL,LUG:#6,SPADE,SOLDERLESS,CU TIN	000BI	A-234-06X
						- - - * - - -		
	----- -----			-		. EACH CKT BOARD ASSY INCLUDES:		
-145	131-0787-00			4		. CONTACT,ELEC:0.64 INCH LONG	22526	47359
-146	----- -----			1		. SWITCH:(SEE S4099,S4199,S1998 EPL)		
-147	361-0542-00			2		. SPACER,SWITCH:PLASTIC	71590	J-64281
-148	337-2372-00			1		. SHLD,PB SWITCH:	80009	337-2372-00
-149	384-1099-00			3		EXTENSION SHAFT:PUSH BUTTON,1.54 INCH LONG	80009	384-1099-00
	366-1559-00			1		PUSH BUTTON:GRAY	80009	366-1559-00
-150	----- -----			1		CKT BOARD ASSY:BUFFER(SEE A15 EPL)		
						(ATTACHING PARTS)		
-151	211-0008-00			4		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
						- - - * - - -		
	----- -----			-		. CKT BOARD ASSY INCLUDES:		
-152	131-0608-00			19		. CONTACT,ELEC:0.365 INCH LONG	22526	47357
-153	----- -----			1		. SWITCH:(SEE S2408 EPL)		
-154	----- -----			1		. SWITCH:(SEE S2400A,B EPL)		
-155	361-0382-00			6		. SPACER,PB SW:BROWN,0.275 INCH LONG	80009	361-0382-00
-156	384-1099-00			3		EXTENSION SHAFT:PUSH BUTTON,1.54 INCH LONG	80009	384-1099-00
-157	366-1559-00			3		PUSH BUTTON:GRAY	80009	366-1559-00
-158	----- -----			1		BULB ASSY:(SEE CR2400 EPL)		
	200-0935-00			1		. BASE,LAMPHOLDER:0.29 OD X 0.19 CASE	80009	200-0935-00
	352-0157-00			1		. LAMPHOLDER:WHITE PLASTIC	80009	352-0157-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-	131-0707-00			6		. CONTACT,ELEC:0.48"L,22-26 AWG WIRE	22526	75691-005
	352-0161-00			2		. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
	131-1790-00			12		. CONTACT,ELEC:18-24 AWG,FEMALE,BRASS	27264	08-56-0105
	352-0462-00			2		. HLDR,TERM. CONN:10 FEMALE,NYLON	27264	09-50-7101
	175-0860-00			FT		. WIRE,ELECTRICAL:5 WIRE RIBBON	23499	TEK-175-0860-00
	175-0859-00			FT		. WIRE,ELECTRICAL:6 WIRE RIBBON	23499	TEK-175-0859-00
	131-1790-00			22		. CONTACT,ELEC:18-24 AWG,FEMALE,BRASS	27264	08-56-0105
	352-0461-00			2		. HLDR,TERM. CONN:12 FEMALE,NYLON	27264	09-50-7121
	175-0859-00			FT		. WIRE,ELECTRICAL:6 WIRE RIBBON	23499	TEK-175-0859-00
	131-1790-00			24		. CONTACT,ELEC:18-24 AWG,FEMALE,BRASS	27264	08-56-0105
	352-0461-00			2		. HLDR,TERM. CONN:12 FEMALE,NYLON	27264	09-50-7121
	352-0197-00			2		. CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0197-00
	352-0164-02			1		. CONN BODY,PL,EL:6 WIRE RED	80009	352-0164-02
	352-0169-00			2		. CONN BODY,PL,EL:2 WIRE BLACK	80009	352-0169-00
	352-0162-02			1		. CONN BODY,PL,EL:4 WIRE RED	80009	352-0162-02
	352-0161-00			4		. CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0161-00
	198-3071-00			1		. WIRE SET,ELEC:	80009	198-3071-00
	198-3213-00			1		. WIRE SET,ELEC:	80009	198-3213-00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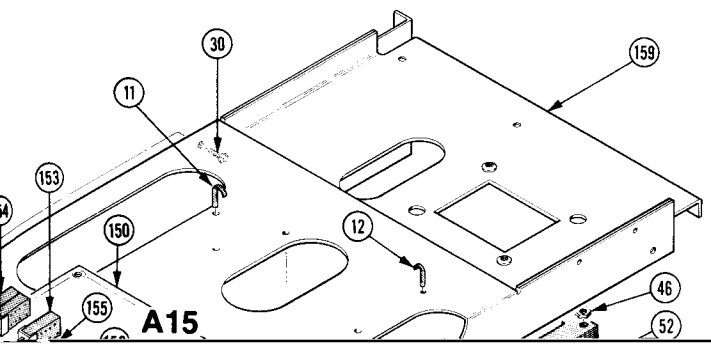
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MANUAL CHANGE INFORMATION

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

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

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

SERVICE NOTE

Because of the universal parts procurement problem, some electrical parts in your instrument may be different from those described in the Replaceable Electrical Parts List. The parts used will in no way alter or

CALIBRATION TEST EQUIPMENT REPLACEMENT

Calibration Test Equipment Chart

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

Comparison of Main Characteristics

DM 501 replaces 7D13	

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MANUAL CHANGE INFORMATION

PRODUCT T921/T922/T922R
070-1982-01

CHANGE REFERENCE M30436
DATE 9-21-77

CHANGE:	DESCRIPTION

EFF SN B011555 (T921)

EFF SN B018319 (T922)

EFF SN B010670 (T922R)

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO:

C465	283-0404-00	CAP.,FXD,CER DI:0.01UF,20%,4000V
C466	283-0404-00	CAP.,FXD,CER DI:0.01UF,20%,4000V
R458	308-0218-00	RES.,FXD,CMPSN:150 OHM,5%,3W

The above parts are located on the INTERFACE circuit board and shown on diagram 1 CRT & VERT AMPL.

Diagram 1

TEKTRONIX®

MANUAL CHANGE INFORMATION

PRODUCT T921/T922/T922R

CHANGE REFERENCE M31736

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MANUAL CHANGE INFORMATION

PRODUCT T921/T922/T922R
070-1982-01

CHANGE REFERENCE M32553

DATE 1-24-78

CHANGE:	DESCRIPTION

EFF SN B011626 (T921)

EFF SN B019271 (T922)

EFF SN B010873 (T922R)

ELECTRICAL PARTS LIST AND

MANUAL CHANGE INFORMATION

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MANUAL CHANGE INFORMATION

PRODUCT ALL T900 SERIES
EFF ALL SN

CHANGE REFERENCE M32883
DATE 12-21-77

CHANGE:	DESCRIPTION

Affects Manuals: 070-1981-01
070-1982-01
070-1983-01
070-2492-00

Oscilloscope Light Filter and Graticule Illumination Photography Effects

Some oscilloscopes contain a factory installed colored (usually blue or green) plastic light filter in front of the crt faceplate to improve general purpose viewing contrast in ambient lighting conditions (in some applications this device also functions as an implosion safety shield).

In order for the oscilloscope graticule to be photographed along with a crt display, oscilloscopes that do not provide internal graticule (scale) illumination must be used with a camera such as the C5A or C5A Option 3, which provide external flash illumination of the graticule. An exception to this is some storage oscilloscopes operated in the store mode, where the target illumination may also illuminate the graticule lines.

Effectiveness of the graticule illumination flash is severly degraded when used with most colored crt light filters. If a clear light filter was provided as an accessory with your oscilloscope, the colored filter should be removed and the clear filter installed in its place when taking oscilloscope display photographs. The clear filter may also provide improved photograph definition and contrast with reduced oscilloscope display intensity settings (some colored filters reduce effective display intensity as much as 75%). Under no circumstances should the oscilloscope be operated without either a clear or colored light filter when no other implosion shield is provided (optional accessory mesh filters are not intended for implosion protection and must be removed when using an oscilloscope camera).

If your oscilloscope was not provided with a clear light filter accessory,