



**PLEASE CHECK FOR CHANGE INFORMATION
AT THE REAR OF THIS MANUAL.**

5441/R5441 STORAGE OSCILLOSCOPE

INSTRUCTION MANUAL

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

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INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag,
or stamped on the chassis. The first number or letter
designates the country of manufacture. The last five digits
of the serial number are assigned sequentially and are
unique to each instrument. Those manufactured in the
United States have six unique digits. The country of
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B000000	Tektronix, Inc., Beaverton, Oregon, USA
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OPERATORS SAFETY SUMMARY

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

Terms In This Manual

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

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

Terms As Marked on Equipment

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

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

Symbols In This Manual



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

Symbols As Marked on Equipment



DANGER — High voltage.



Protective ground (earth) terminal.



ATTENTION — refer to manual.

Power Source

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

Grounding the Product

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

Danger Arising From Loss of Ground

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

Use the Proper Power Cord

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

Use only the power cord that is in good condition.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

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

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

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

Do Not Remove Covers or Panels

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

SERVICE SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

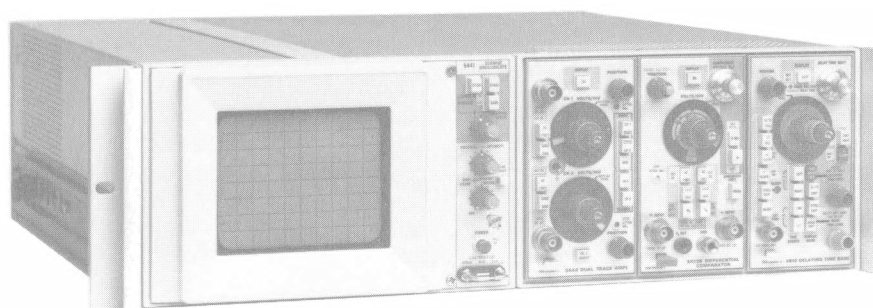
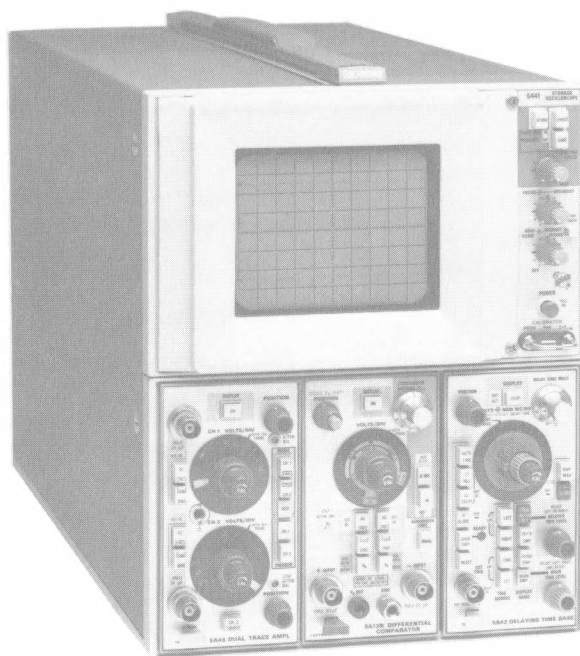
Use Care When Servicing With Power On

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

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

Power Source

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



2140-20

5441/R5441 Storage Oscilloscope.

GENERAL INFORMATION

The 5441/R5441 is a Variable Persistence Storage Oscilloscope and provides single-beam conventional operation. Provision is made for application of Z-axis signals, a front-panel calibration signal, and crt readout signals. The readout system provides plug-in control information to the crt for alphanumeric display.

The oscilloscope accepts up to three plug-ins (two verticals and one horizontal) and provides deflection preamplification. Any of the 5000-Series plug-ins are compatible in any of the three compartments. Thus, X-Y performance is

available by using an amplifier in the horizontal compartment. The system will operate with one amplifier and a time base installed; with a second amplifier optional.

The 5441/R5441 consists of two units; the acquisition unit and the display unit. The acquisition and display units are the same size and can be configured with the display unit on the top (5441 bench use) or with the display unit on the left (R5441 rackmount configuration). The units can be converted from one configuration to another with available kits.

SPECIFICATIONS

The electrical specifications are valid only if (1) the instrument has been calibrated at an ambient temperature between $+20^{\circ}\text{C}$ and $+30^{\circ}\text{C}$; (2) the instrument is operating at an ambient temperature between 0°C and $+50^{\circ}\text{C}$, unless otherwise noted; (3) each plug-in must be operating (fully installed) in a calibrated system.

Unless otherwise stated, specification are referenced to the plug-in connectors of the 5441. Any conditions that are unique to a particular specification are stated as part of that specification. Contents of Supplemental Information column are not specifications.

Table 1-1
VERTICAL AMPLIFIER

Characteristics	Performance Requirements	Supplemental Information
Input Signal Amplitude (Differential)		50 mV/div, $\pm 2\%$. Less than 0.5% difference between left and right vertical plug-in compartments.
Bandwidth (6-Division Reference)	Dc to at least 85 MHz with a 067-0680-00 Calibration Fixture. Dc to at least 50 MHz with a calibrated 5A48.	
Risetime (5-Division Reference)	4 ns or less with a 067-0680-00 Calibration Fixture. 7 ns or less with a calibrated 5A48.	
Aberrations (6-Division Reference)	5% or less measured with a 067-0680-00 Calibration Fixture. 4% or less measured with a calibrated 5A48.	
Position Effect on Aberrations (6-Division Reference with a 067-0680-00 Calibration Fixture)		Front corner aberrations of +step or –step response signal should not exceed $\pm 5\%$ when the waveform is positioned not more than 1 div beyond graticule center.
Vertical Centering		Within ± 0.5 div of graticule center.
Delay Line Length		140 ns
Modes	Chop and alt.	
Rate		
Chop		50 kHz $+50\%$ -30% ; 3 μ s on, 2 μ s off.
Alt	Once every two sweeps.	

Table 1-2
HORIZONTAL AMPLIFIER

Characteristics	Performance Requirements	Supplemental Information
Bandwidth	Dc to at least 2 MHz.	Eight-division signal used as a reference.
Horizontal Centering		Within 0.5 div of graticule center.
X-Y Operation	Less than 2° phase shift from dc to at least 20 kHz.	

**Table 1-3
Z-AXIS AMPLIFIER**

Characteristics	Performance Requirements	Supplemental Information
External Input		
Input Voltage	+5 V turns crt beam on from off condition –5 V turns crt beam off from on condition	
Usable Frequency Range	Dc to 2 MHz	
Input Impedance		Resistance: 10 k Ω Capacitance: 40 pF
Maximum Safe Input	50 V (dc + Peak ac)	

**Table 1-4
CATHODE RAY TUBE**

Characteristics	Performance Requirements	Supplemental Information
Geometry	Bowing or tilt ≤ 0.1 div	
Orthogonality	90°, $\pm 0.7^\circ$	
Stored Writing Rate	5 div/ μ s at 15 second viewing time 1 div/ μ s at 60 second viewing time	
Phosphor	P31 standard	
Deflection	Electrostatic	
Acceleration Potential	8.5 kV	

**Table 1-5
POWER SUPPLY AND CALIBRATOR**

Characteristics	Performance Requirements	Supplemental Information
Power Line Input		
Line Voltage (RMS)	Nominal 100 V, 110 V, 120 V, 200 V, 220 V, 240 V, $\pm 10\%$	
Line Frequency	50 to 400 Hz	
Input Power	100 W maximum at 120 V ac, 60 Hz	
Fuse Data	1.25 A slow blow (120 V ac) 0.7 A slow blow (240 V ac)	
Calibrator		
Voltage	400 mV, $\pm 1\%$	
Current	4 mA, $\pm 1\%$	
Frequency	Twice the power line frequency	

**Table 1-6
READOUT**

Characteristics	Performance Requirements	Supplemental Information
Intensity Range	Off to full brightness. Readout inoperative when READOUT INTENS fully counterclockwise in detent position.	
Location		Top words are displayed in top major graticule division between left and right extreme graticule lines. Bottom words are displayed in bottom major graticule division between left and right extreme graticule lines.

**Table 1-7
MISCELLANEOUS**

Characteristics	Description
Graticule	
Scale	8 x 10 div with 0.9 cm/div.
Scale Color and Type	
Normal	Orange internal graticule lines.
Beam Finder	Brings trace within viewing area and intensifies trace.
Fan Motor	Draws outside air into the mainframe for cooling and is vented out through perforated side covers. (≈ 50 cfm).

**Table 1-8
ENVIRONMENTAL**

Characteristics	Description
Temperature	
Operating	0°C to +50°C
Storage	–40°C to +70°C
Altitude	
Operating	To 15,000 feet
Storage	To 50,000 feet
Vibration	
Operating and Non-Operating	With the instrument complete and operating, vibration frequency swept from 10 to 50 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015" total displacement. Hold 3 minutes at any major response, or if none, at 50 Hz. Total time, 54 minutes.
Shock	
Operating and Non-Operating	30 g's, 1/2 sine, 11 ms duration, 2 shocks in each direction along 3 major axes for a total of 12 shocks.
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.

**Table 1-9
PHYSICAL**

Characteristics	Description
Finish	Anodized aluminum panel with gray vinyl coated frame. Blue-vinyl coated cabinet.
Net Weight of Cabinet Version with Feet and Handle	27 lbs. (12.25 kg)
Rackmount Version with/rails	28 lbs. (12.7 kg)
Overall Dimensions	See Fig. 1-1
Overall rack depth	19 inches

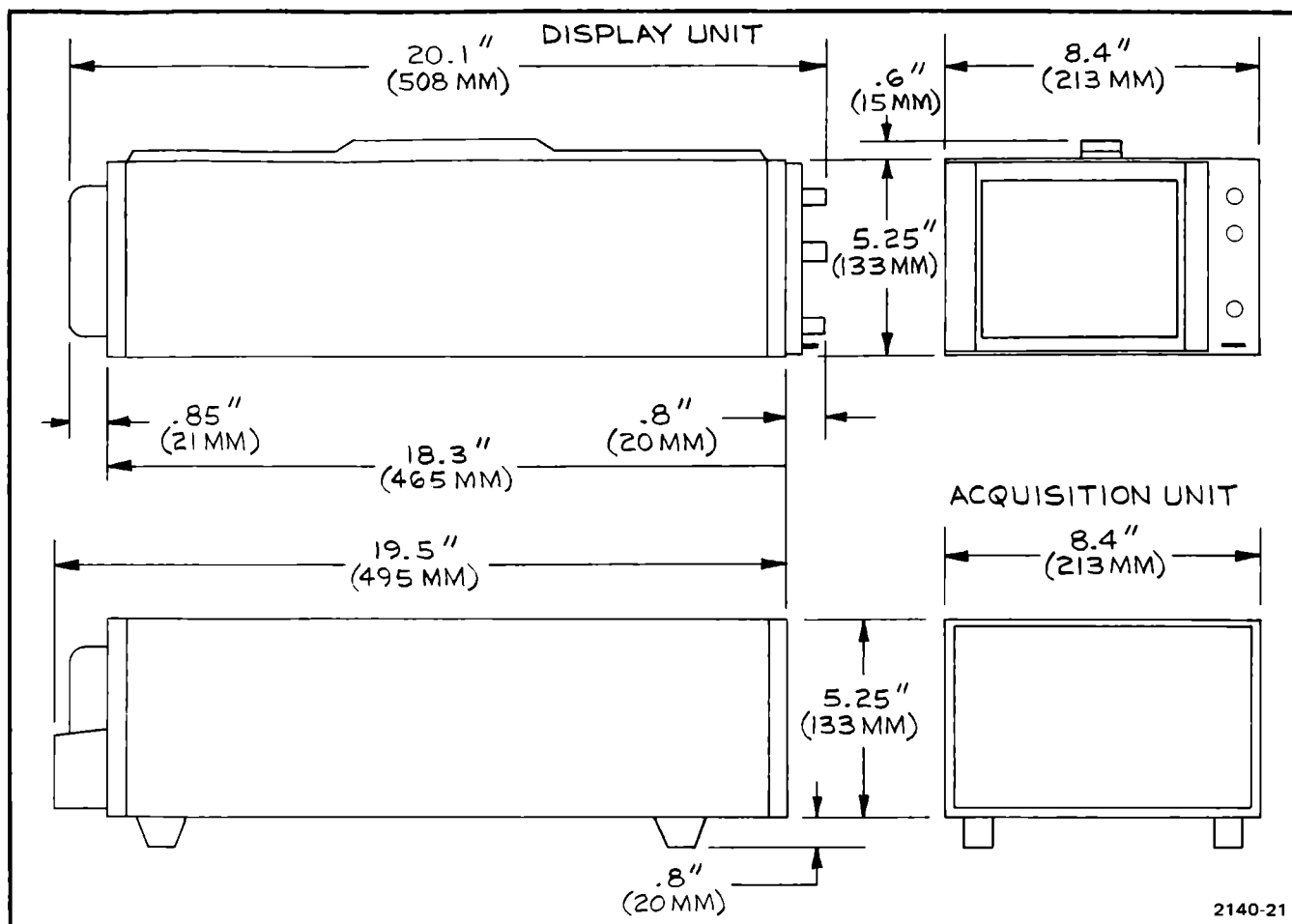


Fig. 1-1. Dimensions of the cabinet version — 5441.

OPERATING INFORMATION

This section describes front-panel control functions, giving first-time and general operating information. Information on operating voltage, instrument conversion, rackmounting, operating temperature, and plug-in installation is also included.

OPERATOR CHECKOUT PROCEDURE

Setup Information

The following steps demonstrate the use of the controls and connectors of the 5441.

1. For the following procedure, a 5A-series amplifier plug-in should be in one of the vertical (left or center) plug-in compartments and a 5B-series time-base plug-in should be in the horizontal (right) compartment.

2. See Operating Voltage in this section before proceeding. Set the POWER switch to off (pushed in) and connect the 5441 to a power source that meets the voltage and frequency requirements of this instrument.

3. Turn the INTENSITY and READOUT INTENS controls counterclockwise and pull the POWER switch out to turn the instrument on. Set the front-panel controls as follows:

STORE	Non-Store (Button out)
SAVE	Off (Button out)
WRITING SPEED	Midrange
VARIABLE PERSIST	
(and Save Time)	Midrange
INTENSITY	See text above
FOCUS	As is
READOUT INTENS	See text above
GRAT ILLUM	As desired
BEAM FINDER	Not depressed
POWER	See text above

Amplifier Plug-In

Display	On
Position	Centered
Ch 1 Volts/Div	.1
Ch 1 Variable Volts/Div	Cal (fully clockwise)
Ch 1 Input Coupling	DC
Trigger	Ch 1
Mode	Ch 1

Time-Base Plug-In

Display	Alternate (Button out)
Position	Centered
Main Sec/Div	5 ms
Variable Seconds/Div	Cal (fully clockwise)
Mag	Off (Button out)
Main Trig Level	Counterclockwise
Source	Left (or Right if the amplifier plug-in is in the center compartment)
Coupling	Auto Trig, AC
Mode	Coupl, + Slope
	Main Sweep

4. Advance the INTENSITY control until the trace is at the desired viewing level. The trace should appear near the graticule center.

5. Connect a 1X probe or test lead from the CALIBRATOR loop to the amplifier plug-in input connector.

6. Turn the Main Trig Level control clockwise until a stable display is obtained. Adjust the vertical and horizontal Position controls so that the display is centered vertically and starts at the left edge of the graticule.

7. Adjust the FOCUS control for a sharp, well-defined display over the entire trace length.

8. Disconnect the input signal and position the trace vertically so that it coincides with the center horizontal line of the graticule.

9. If the trace is not parallel with the center horizontal line, see Trace Alignment Adjustment in this section.

10. Rotate the GRAT ILLUM control throughout its range and notice that the graticule lines are illuminated as the control is turned clockwise. Set control so graticule lines are illuminated as desired.

Performance Check

11. Move the trace two divisions below graticule center and reconnect the calibrator signal to the amplifier plug-in input connector.

12. The display should be four divisions in amplitude with six complete cycles (five complete cycles for 50 Hz line frequency) shown horizontally. An incorrect display indicates that the oscilloscope mainframe or plug-ins need to be adjusted.

Readout

13. Turn the READOUT INTENS control clockwise until an alphanumeric display is visible within the top or bottom division of the crt (reset the FOCUS control if necessary for best definition of the readout). Change the Volts/Div switch of the amplifier plug-in that is selected for display. Notice that the readout portion of the display changes as the deflection factor is changed. Likewise, change the Sec/Div switch of the time-base unit that is selected for display. Notice that the readout display for the time-base unit changes also as the sweep rate is changed.

14. Set the time-base unit for magnified operation. Notice that the readout display changes to indicate the correct magnified sweep rate. If a readout-coded 10X probe is available for use with the vertical unit, install it on the input connector of the vertical plug-in. Notice that the deflection factor indicated by the readout is increased by 10 times when the probe is added. Return the time-base unit to normal sweep operation and disconnect the probe.

15. Notice that the readout for a particular plug-in occupies a specific location on the display area. If either of the vertical plug-in units is a dual-trace unit, notice that the readout for channel 2 appears within the lower division of the crt below the readout for channel 1.

Beam Finder

16. Move the display off-screen with the vertical position control.

17. Push the BEAM FINDER button and observe that the display compresses into the screen area. Reposition the display to screen center and release the BEAM FINDER button.

External Intensity Input

18. Connect a 5 V, 1 kHz sine-wave or square-wave signal to the EXT INTENSITY INPUT connector on the rear

panel. Also, use the signal to externally trigger the time-base plug-in.

19. Slowly rotate the INTENSITY control counterclockwise until the trace appears to be a series of dimmed and brightened segments. The brightened segments correspond with the tops of the square waves.

Storage Operation (Variable Persistence)

20. Disconnect the 5 V, 1 kHz sine-wave or square-wave signal from the EXT INTENSITY INPUT connector. Reset the time-base plug-in triggering controls for an internally-triggered display from the vertical plug-in.

21. After making sure the calibrator signal is still connected to the amplifier plug-in input connector, set the controls on the time-base plug-in for single-sweep operation. Press the STORE button and note that the crt will momentarily be flooded positive (becoming quite bright).

22. Press the Reset button on the time-base plug-in. One sweep will be generated, and a display should be visible, but will fade out within a few seconds. Increase the VARIABLE PERSIST control setting if a display of longer retention is required. Increase the WRITING SPEED setting to increase the background level for viewing lightly written information. If there is not display visible, increase the INTENSITY control setting and press the Reset button.

23. Press the ERASE button; the crt should turn positive and erase. Press the Reset button on the time-base plug-in to obtain another stored display on the crt. Press the SAVE button; the display is stored and no other sweep or change in position will affect the display. The SAVE button, when pushed, locks out the sweep erase circuit and cuts off the current to the flood gun cathode as long as the VARIABLE PERSIST control is turned fully clockwise (display stored at the maximum time). Turning the VARIABLE PERSIST (Save Time) control counterclockwise will decrease the time a stored display is retained on the crt. When the display is not being used, turn the VARIABLE PERSIST (Save Time) control fully clockwise; the display will not be visible on the screen, but the information has not been lost or destroyed. Turn the VARIABLE PERSIST (Save Time) control counterclockwise until a display is visible when needed.

NOTE

The 5441 Save Time control and the Variable Persistence control are combined into one control. If the VARIABLE PERSIST (Save Time) control has been adjusted to view the display in the Save mode and the 5441 is then taken out of the Save mode, the display will fade rapidly, since the persistence is now set for a shorter time.

Storage Operation (Without Variable Persistence)

24. Rotate the VARIABLE PERSIST control to its fully counterclockwise position and release the SAVE button to its off (button out) position.

25. Press the Reset button on the time-base plug-in. One sweep will be generated, and a display should be visible. Increase the WRITING SPEED setting if a brighter display is required. If there is no display visible, increase the INTENSITY control setting and press the Reset button.

26. Press the ERASE button and note that the stored waveform is erased. Another display can be stored by pressing the Reset button on the time-base plug-in.

27. Turn the READOUT INTENS control slowly clockwise to the point where the stored readout information doesn't spread.

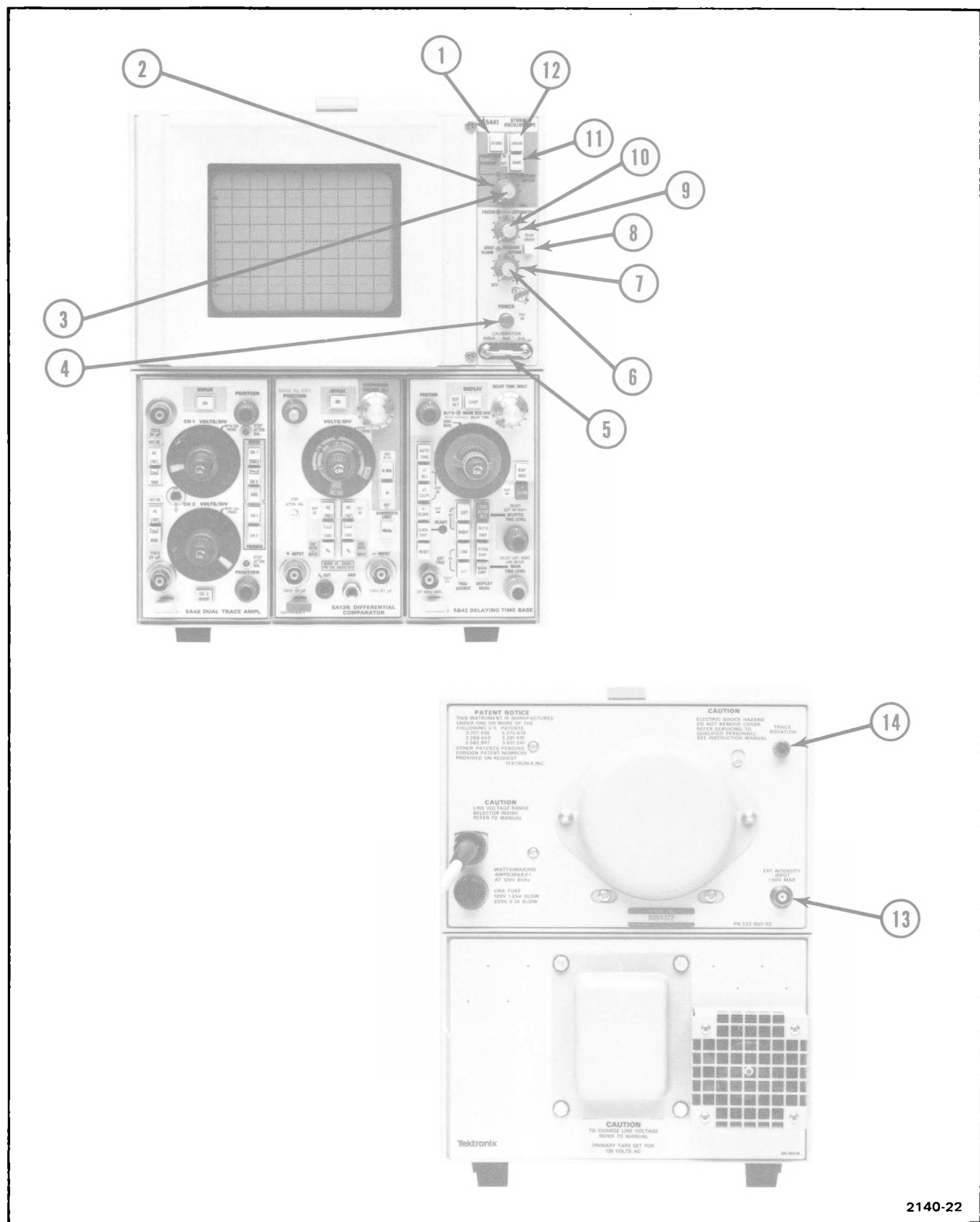


Fig. 2-1. Controls and connectors.

CONTROLS AND CONNECTORS

(See Fig 2-1)

- ① **STORE Pushbutton**—A push-push button that selects storage operation of the crt. Button out position selects normal operation without storage.
- ② **WRITING SPEED Control**—Controls the writing speed and brightness of the stored displays.
- ③ **VARIABLE PERSIST Control**—Controls the display only when the instrument is operating in the storage mode. If the SAVE pushbutton is in its out position, the control operates as a persistence control to determine the retention of the stored display. (fully counterclockwise is maximum retention). With the SAVE pushbutton pushed in, the control operates as a save-time control to extend the retention time longer than is available with the normal storage mode. The fully clockwise position (maximum retention) does not allow viewing the stored display.
- ④ **POWER Switch**—Turns instrument power on or off.
- ⑤ **CALIBRATOR Loop**—Provides positive-going accurate 400 mV and 4 mA square-wave at a frequency of twice the line frequency for calibration and compensation.
- ⑥ **GRAT ILLUM Control**—Controls graticule illumination.
- ⑦ **READOUT INTENS Control**—Controls brightness of the readout portion of the crt display. In the fully counterclockwise position, the readout system is inoperative.
- ⑧ **BEAM FINDER Pushbutton**—Brings beam on-screen; limits display to area inside graticule and intensifies beam.
- ⑨ **INTENSITY Control**—Controls display brightness.
- ⑩ **FOCUS Control**—Provides adjustment to obtain a well-defined display.
- ⑪ **SAVE Pushbutton**—A push-push button that, when pushed, prevents accidental erasure or damage to the stored information. The pushed position also allows the stored information to be retained for long periods of time.
- ⑫ **ERASE Pushbutton**—Momentary pushbutton that initiates erasure of the displayed information stored on the crt screen.
- ⑬ **EXT INTENSITY INPUT Connector**—Permits application of Z-axis signals to the crt (dc coupled). Positive-going signal increases intensity.
- ⑭ **Trace Rotation Adjustment**—Adjusts trace rotation of beam.

GENERAL OPERATING INFORMATION

Graticule

The graticule of the 5441 is internally marked on the faceplate of the crt to provide accurate, parallax-free measurements. The graticule is marked with eight vertical and ten horizontal divisions. Each division is 0.9 cm by 0.9 cm. In addition, each major division is divided into five minor divisions. The vertical gain and horizontal timing are calibrated to the graticule so that accurate measurements can be made from the graticule. The illumination of the graticule lines can be varied with the GRAT ILLUM control.

INTENSITY Control

The intensity of the display on the crt is controlled by the INTENSITY control. This control is adjusted so the display is easily visible, but not overly bright. It will probably require readjustment for different displays or sweep rates. Particular care should be exercised when only a spot is displayed. A high-intensity spot may burn the crt phosphor and cause permanent damage to the crt if allowed to remain too long.

Display Focus

If a well-defined display cannot be obtained with the FOCUS control, even at low intensity settings, adjustment of the internal astigmatism control may be required.

To check for proper setting of the Astig control, slowly turn the FOCUS control through the optimum setting with a signal displayed on the crt screen. If the Astig control is correctly set, the vertical and horizontal positions of the trace will come into sharpest focus at the same position of the FOCUS control.

Trace Alignment Adjustment

If a free-running trace is not parallel with the horizontal graticule lines, set the Trace Rotation adjustment (rear panel) as follows: position the trace to the center horizontal line and adjust the Trace Rotation adjustment so that the trace is parallel with the horizontal graticule lines.

BEAM FINDER

The BEAM FINDER switch provides a means of locating a display that overscans the viewing area either vertically or horizontally. When the BEAM FINDER switch is pressed, the display is compressed within the graticule area and the display intensity is increased. To locate and reposition an overscanned display, use the following procedure:

1. Press the BEAM FINDER switch, hold it in, then increase the vertical and horizontal deflection factors until the display is within the graticule area.

2. Adjust the vertical and horizontal position controls to center the display about the vertical and horizontal centerlines.

3. Release the BEAM FINDER switch; the display should remain within the viewing area.

Readout (Works Only With 5400-Series Plug-In Units)

The readout system of the power supply/amplifier and display modules allows alphanumeric display of information on the crt, along with the analog waveform displays. The information displayed by the readout system is obtained from the plug-in units that are installed in the plug-in compartments. The characters of the readout display are written by the crt beam on a time-shared basis with the signal waveforms.

The Readout System operates in a free-running mode to interrupt the waveform display to present characters. The waveform display is interrupted for only about 20 μ s for each character that is displayed.

The readout information from each plug-in is called a word. Up to six (eight with Option 03) words of readout information can be displayed (a seventh and eighth word are available when Option 03 is installed). The location at which each readout word is presented is fixed and is directly related to the plug-in unit and channel from which it originated. Figure 2-2 shows the area of the graticule where the readout from each plug-in unit channel is displayed (external readout programming is available only with Option 03). Notice that the readout from channel 1 of each plug-in unit is displayed within the top division of the graticule and the readout from channel 2 is displayed directly below within the bottom division of the graticule. Only the readout from plug-in channels that are selected by display switches, or by the mode switches of dual-channel plug-ins, appears in the readout display.

The READOUT INTENS control determines the intensity of only the readout portion of the display independent of the other traces. The readout system is inoperative in the fully counterclockwise OFF position. This may be desirable when

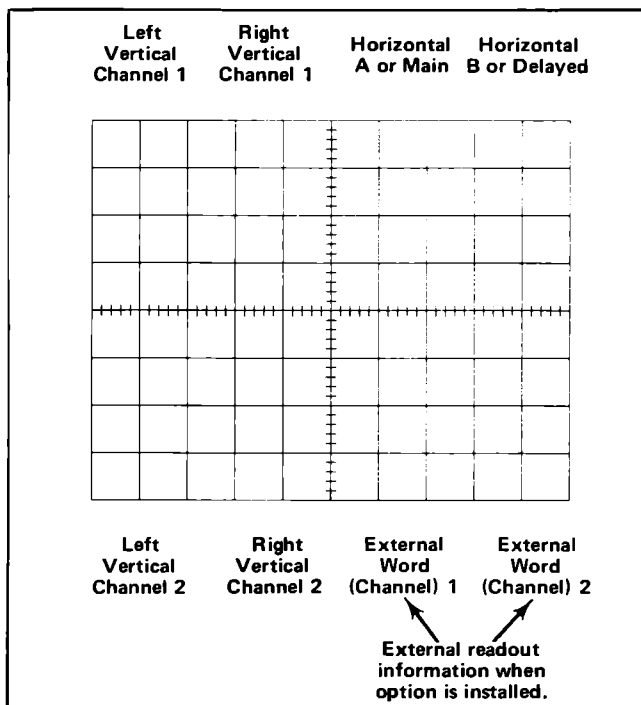


Fig. 2-2. Location of readout on the crt identifying the originating plug-in unit and channel (and external, if Option 03 is installed).

the top and bottom divisions of the graticule are to be used for waveform display, or when the trace interruptions necessary to display characters do not allow a satisfactory waveform display to be obtained.

Option 03, Externally Programmed Seventh and Eighth Readout Words

This option adds a 25-pin connector to the rear panel of the display module, through which two ten-character readout words can be displayed on the crt, see Fig. 2-2.

Care of Storage Screen

The following precautions will prolong the useful storage life of the crt screen used in this instrument.

1. Use the minimum beam intensity required to produce a clear, well-defined display. A too-high beam intensity may permanently damage the crt screen, particularly if a bright spot is allowed to remain stationary on the display area.

2. Avoid repeated use of the same area of the screen. If a particular display is being stored repeatedly, change the vertical position occasionally to use other portions of the display area.

3. Do not leave a stored display on the screen when it is no longer needed.

4. Operate the instrument in the non-store mode unless storage is required.

Storage Operation

The storage feature greatly increases the versatility of the 5441 Oscilloscope. The storage cathode-ray tube allows a display to be retained for a longer period of time. When the STORE button is out, the instrument operates as a conventional oscilloscope.

When the STORE button is pressed in, the instrument operates in a storage mode. Two modes of storage are available. They are Variable Persistence, where the persistence of the crt is electrically controlled by the VARIABLE PERSIST control; and a SAVE mode, that allows longer retention of the displayed information. When the SAVE button is pressed in, a lockout function prevents accidental erasure of the stored display.

A stored display is erased by pressing the ERASE switch. In the SAVE mode, the erase function is disabled.

Display Switching Logic

The electronic switching for time-shared displays is produced at the plug-in interface within the mainframe; however, the switching logic is selected in the plug-in units. The system allows any combination of plug-ins and Display switch settings. Refer to the individual plug-in manuals for specific capabilities and operating procedures.

NOTE

At sweep rates faster than approximately 1 μ s, the 5B10, 5B12, and 5B13 Time Base plug-in trigger circuit will not respond fast enough to allow the leading edge of the display to be observed.

Differences in wiring between the 5100-series and 5400-series oscilloscope plug-in interfaces will not allow the use of the composite trigger mode of the 5B10, 5B12, and 5B13 Time Base plug-ins when used in the 5441. If the time base units are put in this mode, they will trigger off the left vertical plug-in only.

Vertical Plug-in Compartments. When a vertical plug-in is in the active mode (Display button pushed in), a logic level is applied to the switching circuit in the mainframe and a display from this plug-in will occur. When two plug-ins are both active in the vertical compartments, a multi-trace display will occur.

play will occur (Alternate or Chopped). When no plug-in is in the active mode, the signal from the left compartment will be displayed. A time-base unit operated in one of the vertical compartments has a permanent internal connection to apply a logic level to the switching circuit; thus, a vertical trace produced by this unit will always be displayed.

Horizontal Plug-in Compartment. Alternate or Chopped display switching is selected on a time-base unit operated in the horizontal compartment. When the Display switch is out (Alt), a negative impulse is supplied at the end of the sweep to allow alternate switching between plug-ins and plug-in channels. When the Display switch is pushed in (Chop), a chopped display will appear if a multi-trace display is required by the plug-ins in the vertical compartments. A vertical plug-in unit operated in the horizontal compartment has a permanent internal connection to provide a chopped display if it is required.

Switching Sequence. Four display time slots are provided on a time-sharing basis. When two vertical plug-ins are active, each receives two time slots, so the switching sequence is: left, left, center, center, etc. The two time slots allotted to each plug-in are divided between amplifier channels in a dual-trace unit; if two dual-trace plug-ins are active, then the switching sequence is: left Channel 1, left Channel 2, center Channel 1, center Channel 2, etc. If only one vertical plug-in is active, it receives all four time slots. The switching sequence is the same for both the Alternate and Chopped display modes.

Vertical Display Mode

Display On. To display a signal, the Display button of the applicable vertical plug-in unit must be pushed in to activate the unit. If two plug-ins are installed in the vertical compartments and only the signal from one of the units is wanted, set the Display switch of the unwanted unit to Off (button out). If neither plug-in is activated, the signal from the left unit is displayed. Both plug-ins can be activated for multi-trace displays.

Alternate Mode. The alternate position of the time-base unit Display switch produces a display that alternates between activated plug-ins and amplifier channels with each sweep of the crt. The switching sequence is described under Display Switching Logic in this section. Although the Alternate mode can be used at all sweep rates, the Chop mode provides a more satisfactory display at sweep rates from approximately 1 ms/div to 5 s/div. At these slower sweep rates, alternate-mode switching becomes difficult to view.

Chopped Mode. The Chop position of the time-base unit Display switch produces a display that is electronically switched between channels at a 100 kHz rate. The switch-

ing sequence is discussed earlier. In general, the Chop mode provides the best display at sweep rates slower than approximately 1 ms/div or whenever dual-trace single-shot phenomena are to be displayed. At faster sweep rates, the chopped switching becomes apparent and may interfere with the display.

Dual-Sweep Displays. When a dual-sweep time-base unit is operated in the horizontal compartment, the alternate and chopped time-shared switching for either the A or B sweep is identical to that for a single time-base unit. However, if both the A and B sweeps are operating, the 5441 operates in the independent pairs mode. Under this condition, the left vertical unit is always displayed at the sweep rate of the A time base and the right vertical unit is displayed at the sweep rate of the B time base (non-delayed sweep only). This results in two displays that have completely independent vertical deflection and chopped or alternate sweep switching.

X-Y Operation

In some applications, it is desirable to display one signal versus another (X-Y) rather than against an internal sweep. The flexibility of the plug-in units available for use with the 5441 provides a means for applying a signal to the horizontal deflection system for this type of display. Some of the 5B-series time-base units can be operated as amplifiers, in addition to their normal use as time-base generators.

Raster Display

A raster-type display can be used to effectively increase the apparent sweep length. For this type of display, the trace is deflected both vertically and horizontally, by sawtooth signals, and is accomplished by installing a 5B-series time-base unit in the left vertical compartment, as well as one in the horizontal compartment. Normally, the unit in the vertical compartment should be set to a slower sweep rate than the one in the horizontal compartment; the number of horizontal traces in the raster depends upon the ratio between the two sweep rates. Information can be displayed on the raster using the Ext Intensity Input to provide intensity modulation of the display. This type of raster display can be used to provide a television-type display.

Intensity Modulation

Intensity (Z-Axis) modulation can be used to relate a third item of electrical phenomena to the vertical (Y-Axis) and the horizontal (X-Axis) coordinates without affecting the wave-shape of the displayed signals. The Z-Axis modulating signal, applied to the EXT INTENSITY INPUT, changes the intensity of the displayed waveform to provide this type of display. The voltage amplitude required for visible trace modulation depends on the setting of the INTENSITY control. Approximately +5 V will turn on the display to a normal

brightness level from an off level, and approximately -5 V will turn the display off from a normal brightness level. "Gray scale" intensity modulation can be obtained by applying signals between these levels. Maximum safe input voltage is ± 5 V. Usable frequency range of the Z-Axis circuit is dc to 2 MHz.

Time markers applied to the EXT INTENSITY INPUT provide a direct time reference on the display. With uncalibrated horizontal sweep or X-Y operation, the time markers provide a means of reading time directly from the display. However, if the markers are not time-related to the displayed waveform, a single-sweep display should be used (for internal sweep only) to provide a stable display.

Calibrator

The internal calibrator provides a convenient signal source for checking basic vertical gain and sweep timing. The calibrator signal is also very useful for adjusting probe compensation, as described in the probe instruction manual. The output square-wave voltage is 400 mV, within 1% and the square-wave current is 4 mA, within 1%. The frequency of the square-wave signal is twice the power-line frequency. The signal is obtained by clipping the probe to the loop.

Display Photography

A permanent record of the crt display can be obtained with an oscilloscope camera system. The crt bezel provides integral mounting for a Tektronix oscilloscope camera. The instruction manuals for the Tektronix oscilloscope cameras include complete instructions for obtaining waveform photographs.

OPERATING VOLTAGE

CAUTION

This instrument is designed for operation from a power source with its neutral at or near earth (ground) potential, and with a separate safety-earth conductor. It is not intended for operation from two phases of a multi-phase system, or across the legs of a single-phase, three-wire system.

Panel (Dust Cover) Removal

WARNING

Dangerous potentials exist at several points throughout the oscilloscope. When the instrument must be operated with the cabinet panels removed, do not touch exposed connections or components. Some transistors have voltage present on their cases. Disconnect power before cleaning the instrument or replacing parts.

The cabinet panels (dust covers) of the 5441 are held in place by slotted fasteners. To remove the panels, turn each fastener counterclockwise a quarter turn with a large screwdriver, coin, or similar device. Then the panels can be lifted away. The instrument should be operated with the panels in

place to protect the interior from dust, and to eliminate shock hazard.

Table 2-1
POWER CORD CONDUCTOR IDENTIFICATION

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

Power Transformer

The transformer permits operation from 100 V, 110 V, 120 V, 200 V, 220 V, and 240 V sources with power-line frequencies of 50 to 400 Hz. The range for which the primary taps set is marked on the rear panel of the instrument. Use the following procedure to obtain correct instrument operation from the line voltage available.

1. Disconnect the instrument from the power source.
2. Remove the bottom dust cover of the instrument to gain access to the Power Supply circuit board.

3. To convert from 120 V to 220 V nominal line voltage, or vice versa, remove the line-selector block from the square-pin connectors (see Fig. 2-3) and replace it with the other block. Remove the line fuse from the fuse holder located on the rear panel and replace it with one having the correct rating. The unused line-selector block and line fuse can be stored on the Power Supply circuit board. Change the line-cord power plug to match the power-source receptacle or use an adapter.

NOTE

The 120 V block is color coded brown, and it connects the transformer primary windings in parallel. The 220 V block is color coded red, and it connects the primary windings in series.

4. To change regulating ranges, place the line-selector block on the desired set of square pints. Select a range that is centered about the average line voltage to which the instrument is to be connected (see Table 2-2).

5. Change the nominal line-voltage information on the rear panel of the instrument. Use a non-abrasive eraser to remove the previous data, and mark in new data with a pencil.

6. Replace the bottom dust cover and apply power to the instrument.

CAUTION

Damage to the instrument may result from incorrect placement of the line-selector block.

Table 2-2

REGULATING RANGES FOR POWER TRANSFORMER

Line Selector Block Position	Regulating Range	
	120 V Nominal	22 V Nominal
L	90 V ac to 110 V ac	180 V ac to 220 V ac
M	99 V ac to 121 V ac	198 V ac to 242 V ac
H	108 V ac to 132 V ac	216 V ac to 264 V ac
Line Fuse	1.25 A slow-blow	0.7 A slow-blow

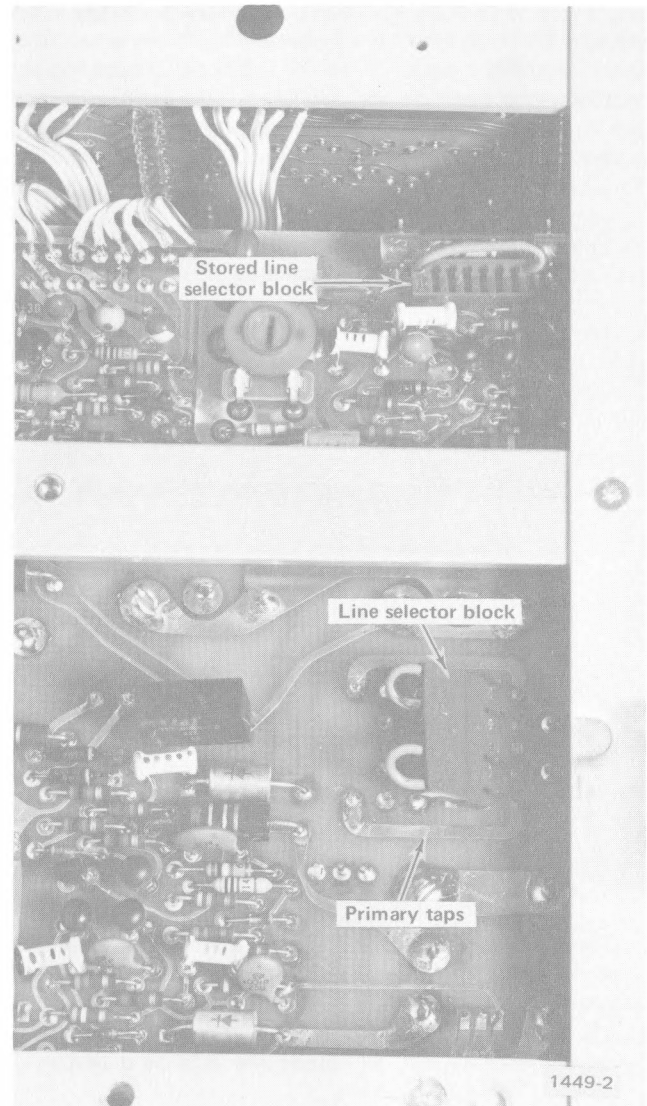


Fig. 2-3. Location of the line-selector block on the Power Supply circuit board.

INSTRUMENT CONVERSION

The acquisition unit and the display can be fastened together stacked or side by side; this permits operation as a bench oscilloscope, or in a standard 19-inch rack. The two modules can quickly be converted from a bench model to a rackmount model, or vice versa. Field conversion kits, including the necessary parts and instructions are available

from Tektronix, Inc. Order: 040-0583-02, Bench-to-rack conversion; 040-0584-03, Rack-to-bench conversion.

NOTE

Before attempting to operate the instrument, make sure the module wiring interconnections are correct.

RACKMOUNTING

The rackmount version of the 5441 is designed for operation in a standard 19-inch wide rack that has Universal, EIA, RETMA, or Western Electric hole spacing. When properly mounted, this instrument will meet all electrical and environmental specifications given in Section 1.

Mounting Method

This instrument will fit most 19-inch wide racks whose front and rear holes conform to Universal hole spacing; some drilling may be required on racks having EIA, RETMA, or Western Electric hole spacing. The slide-out tracks easily mount to the cabinet rack front and rear vertical mounting rails if the inside distance between the front and rear rails is within 10-9/16 inches to 24-3/8 inches. If the inside distance exceeds 24-3/8 inches, some means of support is required for the rear ends of the slide-out tracks. (For example, make extensions for the rear mounting brackets.)

Rack Dimensions

Height. At least 5-1/4 inches of vertical space is required to mount this instrument in a rack. If other instruments are operated in the rack, an additional 1/4 inch is required, both above and below the R5441, to allow space for proper circulation of cooling air.

Width. A standard 19-inch wide rack may be used. The dimension of the opening between the front rails must be at least 17-5/8 inches for a cabinet in which the front lip of the stationary section is mounted behind an untapped front rail as shown in Fig. 2-4A. If the front rails are tapped, and the stationary section is mounted in front of the front rail as shown in Fig. 2-4B, the dimension between the front rails should be at least 17-3/4 inches. These dimensions allow room on each side of the instrument for the slide-out tracks to operate so the instrument can move freely in and out of the rack.

Depth. For proper circulation of cooling air, allow at least two inches clearance behind the rear of the instrument and any enclosure on the rack. If it is sometimes necessary or desirable to operate the R5441 in the fully extended position, use cables that are long enough to reach from the signal source to the instrument.

WARNING

During rackmount installation, interchanging the left and right slide-out track assemblies defeats the extension stop (safety latch) feature of the tracks. Equipment could, when extended, come out of the slides and fall from the rack, possibly causing personal injury and equipment damage.

When mounting the supplied slide-out tracks, inspect both assemblies to find the LH (left hand) and RH (right hand) designations to determine correct placement. Install the LH assembly to your left side as you face the front of the rack and install the RH assembly to your right side. Refer to the rackmounting instructions in this manual for complete information.

Installing the Slide-out Tracks

The slide-out tracks for the instrument consist of two assemblies, one for the left side of the instrument and one for the right side. Each assembly consists of three sections. A stationary section attaches to the front and rear rails of the rack, the chassis section attaches to the instrument (and is installed at the factory), and the intermediate section fits between the other two sections to allow the instrument to fully extend out of the rack.

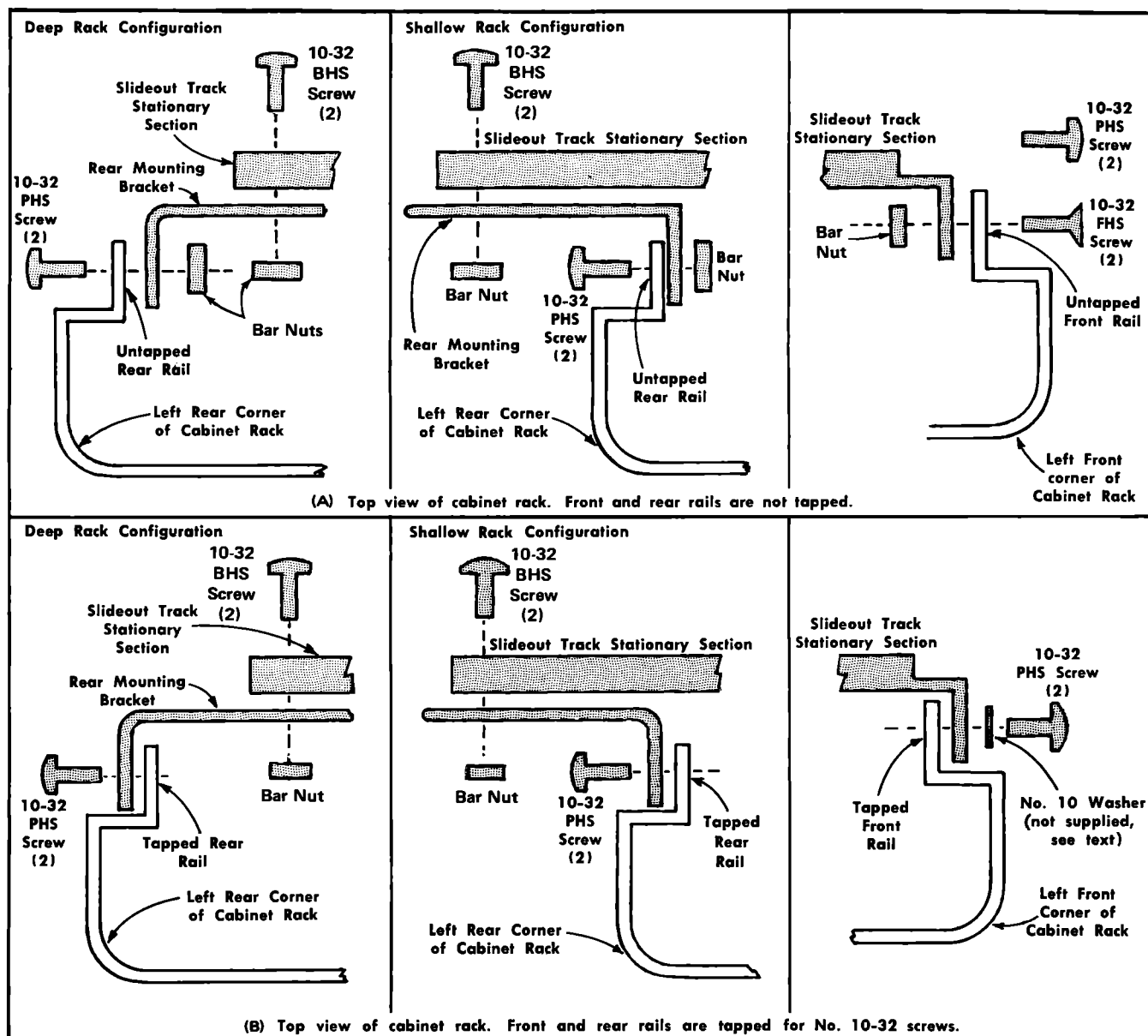


Fig. 2-4. Mounting the left stationary section (with its matched intermediate section, not shown in illustrations A and B) to the rack rails.

NOTE

The small hardware components included with the slide-out track assemblies are used to mount the tracks to most standard 19-inch vertical rack rails having this compatibility.

1. Front and rear rail holes must be large enough to allow inserting a 10-32 screw through the rail mounting hole if the rails are untapped (see Fig. 2-4A).

2. Or, front and rear rail holes must be tapped to accept a 10-32 screw if Fig. 2-4B mounting method is used. Note in the Fig. 2-4B right illustration that a No. 10 washer (not supplied) may be added to provide increased bearing surface for the slide-out track stationary section front flange.

Because of the rack compatibility, there will be some small parts left over. The stationary and intermediate sections for both sides of the rack are shipped as a matched set and should not be separated. The matched sets of both sides including hardware are marked on the package. To identify the assemblies, note that the automatic latch and intermediate section stop is located near the top of the matched set.

Mounting Procedure. Use the following procedure to mount both sides. See Fig. 2-4 for installation details.

1. To mount the instrument directly above or below another instrument in a cabinet rack, select the appropriate holes in the front rack rails for the stationary sections, using Fig. 2-5 as a guide.

2. Mount the stationary slide-out track sections to the front rack rails using either of these methods.

- a. If the front flanges of the stationary sections are to be mounted behind the front rails (rails are countersunk or not tapped), mount the stationary sections as shown in Fig. 2-4A right illustration.

- b. If the front flanges of the stationary sections are to be mounted in front of the front rails (rails are tapped for 10-32 screws), mount the stationary sections as shown in Fig. 2-4B right illustration. To provide increased bearing surface for the screw head to securely fasten the front flange to the rail, a flat washer (not supplied) may be added under the screw head. However, if this mounting method is used, the front panel will not fit flush against the front rail because of the stationary section and washer thickness. If a flush fit is preferred, method 2a should be used.

3. Mount the stationary slide-out sections to the rear rack rails using either of these methods.

- a. If the rear rack rail holes are not tapped to accept 10-32 machine screws, mount the left stationary section with hardware provided as shown in the left or center illustration of Fig. 2-4A. Note that the rear mounting bracket can be installed either way so the slide-out tracks will fit a deep or shallow cabinet rack. Use Fig. 2-4A as a guide for mounting the right stationary section. Make sure that the stationary sections are horizontally aligned so they are level and parallel with each other.

- b. If the rear rack rail holes are tapped to accept 10-32 machine screws, mount the left stationary section with hardware provided as shown in the left or center illustration of Fig. 2-4B. Note that the rear mounting bracket can be installed either way so the slide-out tracks will fit a deep or shallow cabinet rack. Use Fig. 2-4B as a guide for mounting the right stationary section.

Make sure the stationary sections are horizontally aligned so they are level and parallel with each other.

R5441 Installation And Adjustment

To insert the instrument into the rack, proceed as follows.

1. Pull the slide-out track intermediate sections out to the fully extended position.

2. Insert the instrument chassis sections into the intermediate sections.

3. Press the stop latches on the chassis sections and push the instrument toward the rack until the latches snap into their holes.

4. Again press the stop latches and push the instrument into the rack.

To adjust the slide-out tracks for smooth sliding action, loosen the screws used to join the stationary sections to the rails of the rack. Center the instrument, allowing the slide-out tracks to seek the proper width, then tighten the screws.

To secure the instrument front-panel to the rack, the rack must either have universal hole spacing, or a hole must be drilled and tapped for a 10-32 screw, see Fig. 2-5. Using the hardware (not furnished) indicated in Fig. 2-5, secure the 5441 to the front rails of the rack.

Slide-out Track Maintenance

The slide-out tracks require not lubrication. The special dark gray finish on the sliding parts is a permanent lubrication.

OPERATING TEMPERATURE

The 5441 can be operated where the ambient air temperature is between 0°C and +50°C. The instrument can be stored in ambient temperature between -40°C and +70°C. After storage at a temperature beyond the operating limits, allow the chassis temperature to come within the operating limits before power is applied.

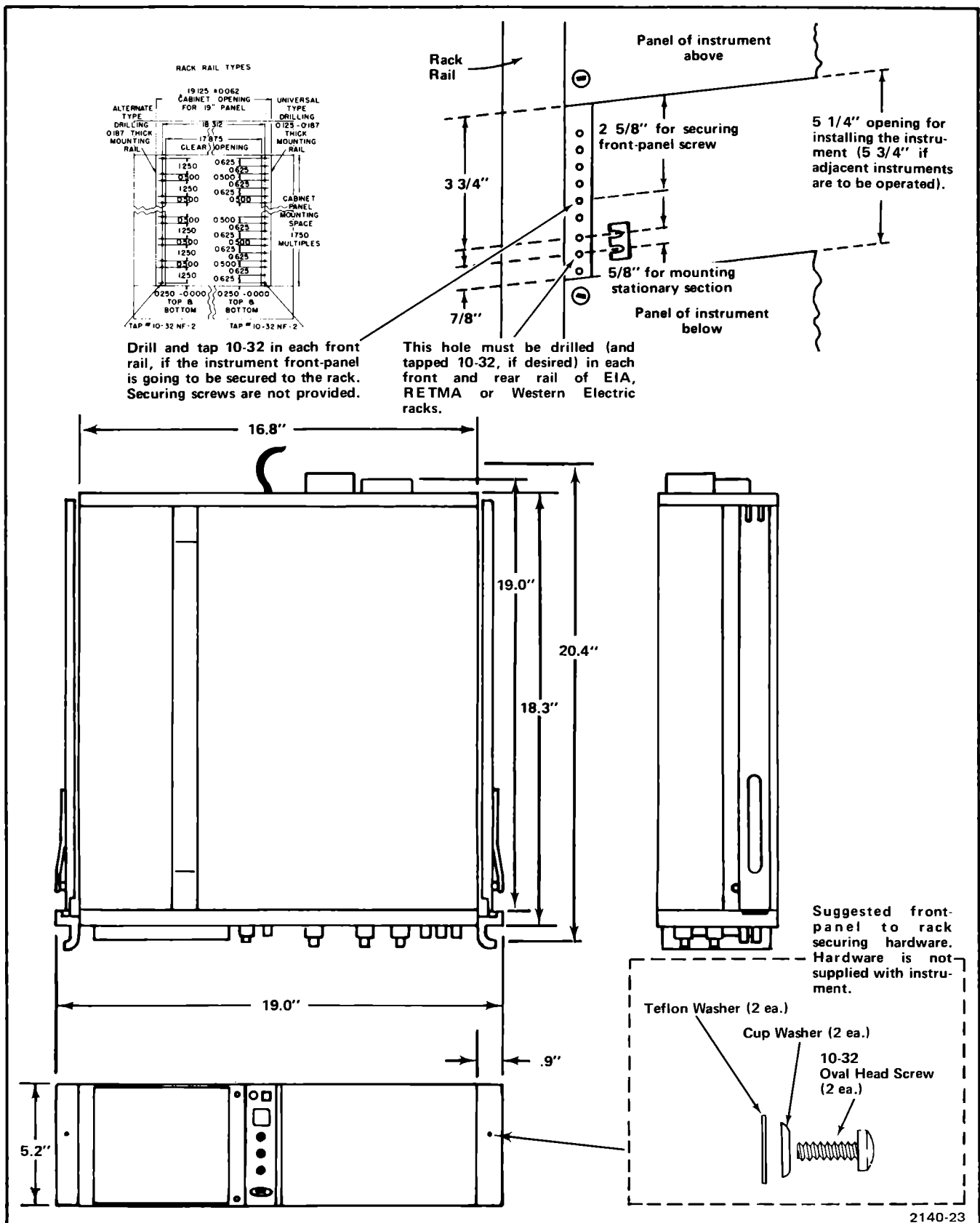


Fig. 2-5. Dimensional diagram.

A thermal cutout in the display module provides thermal protection and disconnects the power to the instrument if the internal temperature exceeds a safe operating level.

This device will automatically re-apply power when the temperature returns to a safe level.

PLUG-IN UNITS

The 5441 is designed to accept up to three Tektronix 5-series plug-in units. (Only the plug-in units without an N suffix will provide display readout.) This plug-in feature allows a variety of bandwidth, sensitivity, display mode, etc., to meet the measurement requirements. In addition, it allows the oscilloscope system to be expanded to meet future measurement requirements. The overall capabilities of the resultant system are in large part determined by the characteristics of the plug-ins selected.

Installation

To install a plug-in unit into one of the plug-in compartments, align the slots in the top and bottom of the plug-in with the associated guides in the plug-in compartment. Push the plug-in unit firmly into the plug-in compartment until it locks into place. To remove a plug-in, pull the release latch on the plug-in unit to disengage it and pull the unit out of the plug-in compartment. Plug-in units can be removed or installed without turning off the instrument power. It is not necessary that all of the plug-in compartments be filled to operate the instrument, the only plug-ins needed are those required for the measurement to be made.

When the 5441 is adjusted in accordance with the adjustment procedure, the vertical and horizontal gain are standardized. This allows adjusted plug-in units to be changed from one plug-in compartment to another without readjustment. However, the basic adjustment of the individual plug-in units should be checked when they are installed in this system to verify their measurement accuracy. See the service information section of the plug-in unit manual for verification procedure.

Selection

The plug-in versatility of the 5441 allows a variety of display modes with many different plug-ins. The following information is provided here to aid in plug-in selection.

To produce a single-trace display, install a single-channel vertical unit (or dual-channel unit set for single-channel operation) in either of the vertical (left or center) compartments and a time-base unit in the horizontal (right) compartment. For dual-trace displays, either install a dual-channel vertical unit in one of the vertical compartments or install a single-channel vertical unit in each vertical compartment. A combination of a single-channel and a dual-channel vertical unit allows a three-trace display; likewise, a combination of two dual-channel vertical units allows a four-trace display.

To obtain a vertical sweep with the input signal displayed horizontally, insert the time-base unit into one of the vertical compartments and the amplifier unit in the horizontal compartment. If a vertical sweep is used, there is no retrace blanking and the time-base unit triggering must be accomplished externally.

For X-Y displays, either a 5A-series amplifier unit or a 5B-series time-base unit having an amplifier channel can be installed in the horizontal compartment to accept the X signal. The Y signal is connected to a 5A-series amplifier unit installed in a vertical compartment.

Special purpose plug-in units may have specific restrictions regarding the compartments in which they can be installed. This information will be given in the instruction manuals for these plug-ins.

BASIC OSCILLOSCOPE APPLICATIONS

The 5441 and its associated plug-in units provide a very flexible measurement system. The capabilities of the overall system depend mainly upon the plug-ins that are chosen. The following information describes the techniques for making basic measurements. These applications are not described in detail, since each application must be adapted to the requirements of the individual measurement. Specific applications for the individual plug-in units are described in the manuals for these units. Contact your local Tektronix Field Office or representative for additional assistance.

The following books describe oscilloscope measurement techniques which can be adapted for use with this instrument.

Harley Carter, *An Introduction to the Cathode Ray Oscilloscope*, Philips Technical Library, Cleaver-Hume Press Ltd., London, 1960

J. Czeck, *Oscilloscope Measuring Techniques*, Philips Technical Library, Springer-Verlag, New York, 1965.

Robert G. Middleton, *Scope Waveform Analysis*, Howard W. Sams & Co. Incl, The Bobbs-Merrill Company Inc., Indianapolis, 1963.

Robert G. Middleton and L. Donald Payne, *Using the Oscilloscope in Industrial Electronics*, Howard W. Sams & Co., Inc., The Bobbs-Merrill Company Inc., Indianapolis, 1961.

John F. Rider and Seymour D. Uslan, *Encyclopedia of Cathode-Ray Oscilloscopes and Their Uses*, John F. Rider Publisher Inc., New York, 1959.

John F. Rider, *Obtaining and Interpreting Test Scope Traces*, John F. Rider Publisher Inc., New York, 1959.

Rufus P. Turner, *Practical Oscilloscope Handbook*, Volumes 1 and 2, John F. Rider Publisher, Inc., New York, 1964.

Peak-to-peak Voltage Measurements—AC

To make peak-to-peak voltage measurements, use the following procedure.

1. Set the input coupling on the vertical plug-in unit to Gnd and connect the signal to the input connector.

2. Set the input coupling to ac and set the Volts/Div switch to display about 5 or 6 vertical divisions of the wave-

form. Check that the variable Volts/Div control (red knob) is in the Cal position.

3. Adjust the time-base triggering controls for a stable display and set the Sec/Div switch to display several cycles of the waveform.

4. Turn the vertical Position control so that the lower portion of the waveform coincides with one of the graticule lines below the center horizontal line, and the top of the waveform is in the viewing area. Move the display with the horizontal Position control so that one of the upper peaks is aligned with the center vertical reference line (see Fig. 2-6).

5. Measure the vertical deflection from peak to peak (divisions).

NOTE

This technique may also be used to make measurements between two points on the waveform rather than peak to peak.

6. Multiply the distance (in divisions) measured in step 5 by the Volts/Div switch setting. Also include the attenuation factor of the probe, if applicable.

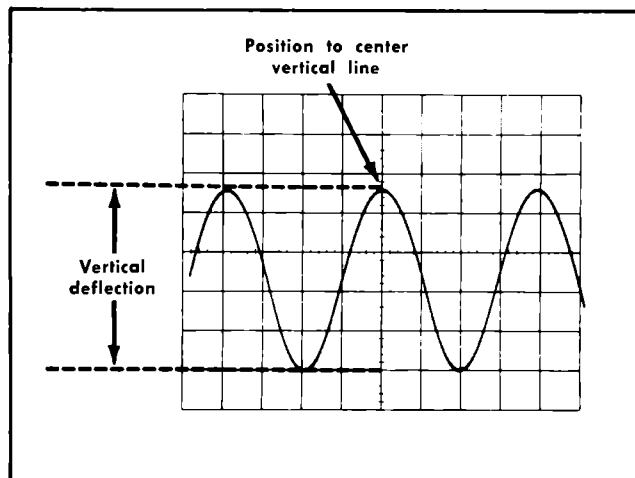


Fig. 2-6. Measuring peak-to-peak voltage of a waveform.

EXAMPLE: Assume a peak-to-peak vertical deflection of 4.6 div and a Volts/Div switch setting of 5 V.

$$\text{Peak-to-peak volts} = \frac{4.6}{(\text{div})} \times 5 (\text{Volts/Div setting}) = 23 \text{ V}$$

NOTE

If an attenuator probe is used that cannot change the scale factor readout (Volts/Div), multiply the right side of the previous equation by the attenuation factor.

Instantaneous Voltage Measurement—DC

To measure the dc level at a given point on the waveform use the following procedure.

1. Set the input coupling of the vertical plug-in unit to Gnd and position the trace to the bottom line of the graticule (or other selected reference line). If the voltage to be measured is negative with respect to ground, position the trace to the top line of the graticule. Do not move the vertical Position control after this reference has been established.

NOTE

To measure a voltage level with respect to a voltage other than ground, make the following changes to step 1: Set the input coupling switch to dc and apply the reference voltage to the input connector, then position the trace to the reference line.

2. Connect the signal to the input connector. Set the input coupling to dc (the ground reference can be checked at any time by setting the input coupling to Gnd).

3. Set the Volts/Div switch to display about 5 or 6 vertical divisions of the waveform. Check that the variable Volts/Div control (red knob) is in the Cal position. Adjust the time-base triggering controls for a stable display.

4. Measure the distance in divisions between the reference line and the point on the waveform at which the dc level is to be measured. For example, in Fig. 2-7 the measurement is made between the reference line and point A.

5. Establish the polarity. The voltage is positive if the signal is applied to the + input connector and the waveform is above the reference line.

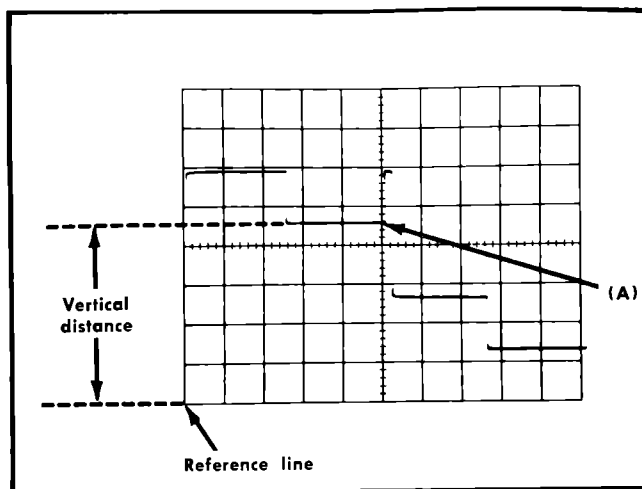


Fig. 2-7. Measuring instantaneous DC voltage with respect to a reference voltage.

6. Multiply the distance measured in step 4 by the Volts/Div switch setting. Include the attenuation factor of the probe, if applicable (see the note following the Peak-to-Peak Voltage Measurement example).

EXAMPLE: Assume that the vertical distance measured in 4.6 div, the polarity is positive, and the Volts/Div switch setting is 2 V.

$$\text{Instantaneous voltage} = \frac{4.6}{(\text{div})} \times 2 (\text{Volts/Div}) = + 9.2 \text{ V}$$

Comparison Measurements

In some applications, it may be necessary to establish a set of deflection factors other than those indicated by the Volts/Div or Sec/Div switches. This is useful for comparing signals to a reference voltage amplitude or period. To establish a new set of deflection factors based upon a specific reference amplitude or period, proceed as follows.

Vertical Deflection Factor

1. Apply a reference signal of known amplitude to the vertical input connector. Using the Volts/Div switch and variable Volts/Div control, adjust the display for an exact number of divisions. Do not move the variable Volts/Div control after obtaining the desired deflection.

2. Divide the amplitude of the reference signal (volts) by the product of the deflection in divisions (established in step 1) and the Volts/Div switch setting. This is the Deflection Conversion Factor.

$$\text{Deflection Conversion Factor} = \frac{\text{reference signal amplitude (volts)}}{\text{deflection (divisions) X Volts/Div setting}}$$

4. Set the Volts/Div switch to a setting that provides sufficient deflection to make the measurement. Do not readjust the variable Volts/Div control.

5. To establish a Modified Deflection Factor at any setting of the Volts/Div switch, multiply the Volts/Div switch setting by the Deflection Conversion Factor established in step 2.

$$\text{Modified Deflection Factor} = \text{Volts/Div setting} \times \text{Deflection Conversion Factor}$$

6. Measure the vertical deflection in divisions and determine the amplitude by the following formula.

$$\text{Signal Amplitude} = \text{Modified Factor} \times \text{Deflection (divisions)}$$

EXAMPLE: Assume a reference signal amplitude of 30 V, a Volts/Div switch setting of 5 V and a deflection of four divisions. Substituting these values in the Deflection Conversion Factor formula (step 2):

$$\frac{30 \text{ V}}{(4) (5 \text{ V})} = 1.5$$

Then, with a Volts/Div switch setting of 2 V, the Modified Deflection Factor (step 5) is:

$$(2 \text{ V}) (1.5) = 3 \text{ V/div}$$

To determine the peak-to-peak amplitude of an applied signal that produces a vertical deflection of five divisions with the above conditions, use the Signal Amplitude formula (step 6):

$$(3 \text{ V}) (5) = 15 \text{ V}$$

Sweep Rate

1. Apply a reference signal of known frequency to the vertical input connector. Using the Sec/Div switch and variable Sec/Div control, adjust the display so that one cycle of the signal covers an exact number of horizontal divisions. Do not change the variable Sec/Div control after obtaining the desired deflection.

2. Divide the period of the reference signal (seconds) by the product of the horizontal deflection in divisions (estab-

lished in step 1) and the setting of the Sec/Div switch. This is the Deflection Conversion Factor.

$$\text{Deflection Conversion Factor} = \frac{\text{reference signal period (seconds)}}{\text{horizontal deflection (divisions) X Sec/Div switch setting}}$$

3. To determine the period of an unknown signal, disconnect the reference and apply the unknown signal.

4. Set the Sec/Div switch to a setting that provides sufficient horizontal deflection to make an accurate measurement. Do not readjust the variable Sec/Div control.

5. To establish a Modified Deflection Factor at any setting of the Sec/Div switch, multiply the Sec/Div switch setting by the Deflection Conversion Factor established in step 2.

$$\text{Modified Deflection Factor} = \text{switch setting} \times \text{Deflection Conversion Factor}$$

6. Measure the horizontal deflection in divisions and determine the period by the following formula.

$$\text{Period} = \text{Modified Deflection Factor} \times \text{horizontal deflection (divisions)}$$

EXAMPLE: Assume a reference signal frequency of 455 Hz (period 2.2 ms), a Sec/Div switch setting of .2 ms, and a horizontal deflection of 8 div. Substituting these values in the Deflection Conversion Factor formula (step 2):

$$\frac{2.2 \text{ ms}}{(8) (0.2 \text{ ms})} = 1.375$$

Then with a Sec/Div switch setting of 50 μ s, the Modified Deflection Factor (step 5) is:

$$(50 \mu\text{s}) (1.375) = 68.75 \text{ ms/div}$$

To determine the time period of an applied signal that completes one cycle in seven horizontal divisions, use the Period formula (step 6):

$$(68.75 \mu\text{s}) (7) = 481 \mu\text{s}$$

This product can be converted to frequency by taking the reciprocal of the period (see application of Determining Frequency).

Time Period Measurement

To measure the time (period) between two points on a waveform, use the following procedure.

1. Connect the signal to the vertical input connector, select either ac or dc input coupling, and set the Volts/Div switch to display about four divisions of the waveform.

2. Set the time-base triggering controls to obtain a stable display. Set the Sec/Div switch to the fastest sweep rate that will permit displaying one cycle of the waveform in less than eight divisions (some non-linearity may occur in the first and last graticule divisions of display). Refer to Fig. 2-8.

3. Adjust the vertical Position control to move the points between which the time measurement is made to the center horizontal line. Adjust the horizontal Position control to center the time-measurement points within the center eight divisions of the graticule.

4. Measure the horizontal distance between the time measurement points. Be sure the variable Sec/Div control is in the Cal position.

5. Multiply the distance measured in step 4 by the setting of the Sec/Div switch.

EXAMPLE: Assume that the horizontal distance between the time-measurement points is five divisions and the Sec/Div switch is set to .1 ms. Use the following formula.

$$\text{Period} = \begin{array}{c} \text{horizontal} \\ \text{distance} \\ \text{(divisions)} \end{array} \times \begin{array}{c} \text{Sec/Div} \\ \text{switch} \\ \text{setting} \end{array} = (5) (0.1 \text{ ms}) = 0.5 \text{ ms}$$

The period is 0.5 ms.

Determining Frequency

The time measurement technique can also be used to determine the frequency of a signal. The frequency of a periodically recurrent signal is the reciprocal of the time duration (period) of one cycle. Use the following procedure.

1. Measure the period of one cycle of the waveform as described in the previous application.

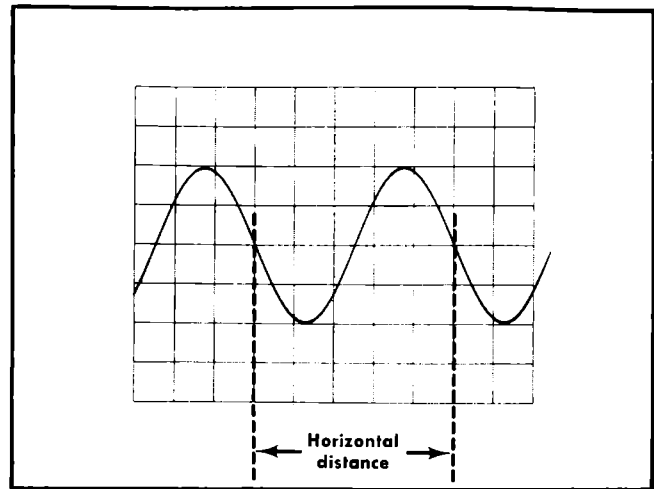


Fig. 2-8. Measuring time duration (period) between points on a waveform.

2. Take the reciprocal of the period to determine the frequency.

EXAMPLE: The frequency of the signal shown in Fig. 2-8, which has a period of 0.5 ms, is:

$$\text{Frequency} = \frac{1}{\text{period}} = \frac{1}{0.5 \text{ ms}} = 2 \text{ kHz}$$

Risetime Measurement

Risetime measurements employ basically the same techniques as the time-period measurements. The main difference is the points between which the measurements is made. The following procedure gives the basic method of measuring risetime between the 10% and 90% points of the waveform.

1. Connect the signal to the input connector.
2. Set the Volts/Div switch and variable Volts/Div control to produce a display exactly five divisions in amplitude.
3. Center the display about the center horizontal line with the vertical Position control.
4. Set the time-base triggering controls to obtain a stable display. Set the Sec/Div switch to the fastest sweep rate that will display less than eight divisions between the 10% and 90% points on the waveform (see Fig. 2-9).

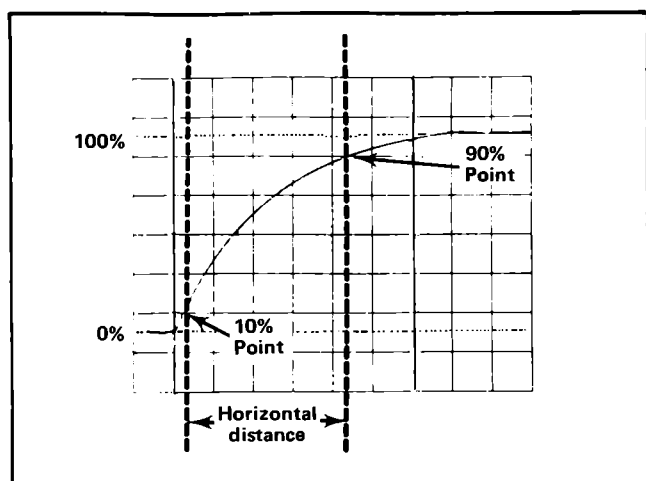


Fig. 2-9. Measuring risetime.

5. Adjust the horizontal Position control to move the 10% point of the waveform to the second vertical line of the graticule.

6. Measure the horizontal distance between the 10% and 90% points. Be sure the variable Sec/Div control is in the Cal position.

7. Multiply the distance measured in step 6 by the setting of the Sec/Div switch.

EXAMPLE: Assume that the horizontal distance between the 10% and 90% points is four divisions and the Sec/Div switch is set to 1 μ s.

Use the period formula to find risetime.

$$\text{Risetime} = \frac{\text{horizontal distance}}{\text{period}} \times \frac{\text{Sec/Div}}{\text{switch setting}} = (4) (1 \mu\text{s}) = 4 \mu\text{s}$$

The risetime is 4 μ s.

Time Difference Measurements

When used in conjunction with a calibrated time-base plug-in unit, the multi-trace feature of the 5441 permits measurement of time difference between two or more separate events. To measure time difference, use the following procedure.

1. Set the input coupling switches of the amplifier channels to either ac or dc.

2. Set the Display switch on the time-base unit to either Chop or Alt. In general, Chop is more suitable for low-frequency signals. More information on determining the mode is given under Vertical Display Mode in this section.

3. Set the vertical plug-in triggering switches to trigger the display on channel 1 (or left plug-in) and channel 2 (or center plug-in).

4. Connect the reference signal to the channel 1 input connector and the comparison signal to the channel 2 (or center plug-in) input connector. The reference signal should precede the comparison signal in time. Use coaxial cables or probes that have similar time-delay characteristics to connect the signal to the input connectors.

5. If the signals are of opposite polarity, invert the channel 2 (or center plug-in) display. (Signals may be of opposite polarity due to 180° phase difference; if so, take this into account in the final calculation.)

6. Set the Volts/Div switches to produce about four divisions of display waveform.

7. Set the time-base triggering controls for a stable display. Set the Sec/Div switch for a sweep rate that shows three or more divisions between the measurement points, if possible.

8. Adjust the vertical Position controls to bring the measurement points to the center horizontal reference line.

9. Adjust the horizontal Position control so the channel 1 (or left plug-in) waveform (reference) crosses the center horizontal line at a vertical graticule line.

10. Measure the horizontal distance between the two measurement points (see Fig. 2-10).

11. Multiply the measured distance by the setting of the Sec/Div switch.

EXAMPLE: Assume that the Sec/Div switch is set to 50 μ s and the horizontal distance between measurement points is four divisions. Use the following formula.

$$\text{Time Delay} = \frac{\text{Sec/Div}}{\text{switch setting}} \times \frac{\text{horizontal distance}}{\text{divisions}} = (50 \mu\text{s}) (4) = 200 \mu\text{s}$$

The time delay is 200 μ s.

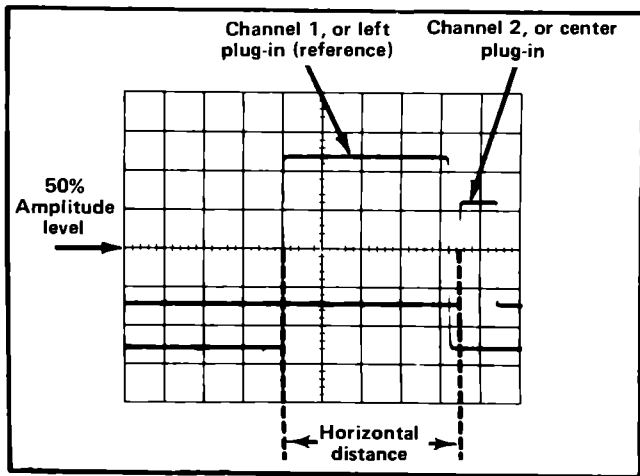


Fig. 2-10. Measuring time difference between two pulses.

Multi-trace Phase Difference Measurement

Phase comparison between two or more signals of the same frequency can be made using a dual-trace plug-in or two single-trace plug-ins. This method of phase difference measurement can be used up to the frequency limit of the vertical system. To make the comparison, use the following procedure.

1. Set the input coupling switches of the amplifier channels to either ac or dc.

2. Set the Display switch on the time-base unit to either Chop or Alt. In general, Chop is more suitable for low-frequency signals and the Alt position is more suitable for high-frequency signals. More information on determining the mode is given under Vertical Display Mode in this section.

3. Set the vertical plug-in triggering switches to trigger the display on channel 1 (or left plug-in) and channel 2 (or center plug-in).

4. Connect the reference signal to the channel 1 input connector and comparison signal to the channel 2 (or center plug-in) input connector. The reference signal should precede the comparison signal in time. Use coaxial cables or probes that have similar time-delay characteristics to connect the signals to the input connectors.

5. If the signals are of opposite polarity invert the channel 2 (or center plug-in). (Signals may be of opposite polarity due to 180° phase difference; if so, take this into account in the final calculation.)

6. Set the Volts/Div switches and the variable Volts/Div controls so the displays are equal and about five divisions in amplitude.

7. Set the time-base triggering controls to obtain a stable display. Set the Sec/Div switch to a sweep rate that displays about one cycle of the waveform.

8. Move the waveforms to the center of the graticule with the vertical Position controls.

9. Turn the variable Sec/Div control until one cycle of the reference signal (channel 1, or left plug-in) occupies exactly eight divisions between the second and tenth vertical lines of the graticule (see Fig. 2-11). Each division of the graticule represents 45° of the cycle ($360^\circ \div 8 \text{ div} = 45^\circ/\text{division}$). The sweep rate can be stated in terms of degrees as 45°/div.

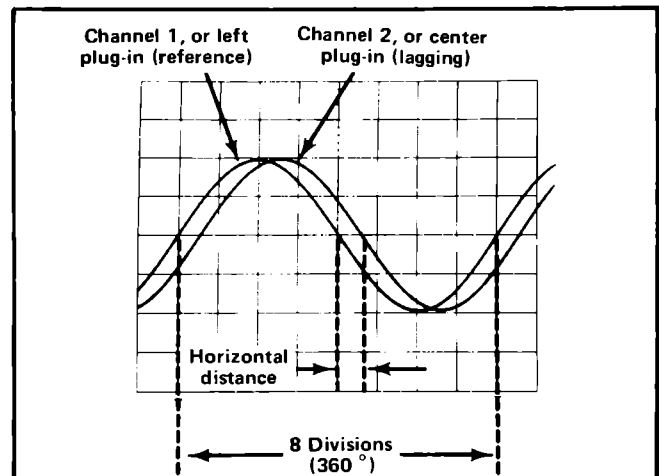


Fig. 2-11. Measuring phase difference.

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

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

EXAMPLE: Assume a horizontal difference of 0.6 div with a sweep rate of 45°/div as shown in Fig. 2-11. Use the following formula.

$$\text{Phase Difference} = \frac{\text{horizontal difference (divisions)}}{\text{sweep rate (degrees/division)}} = (0.6) (45^\circ) = 27^\circ$$

The phase difference is 27°.

High Resolution Phase Measurement

More accurate dual-trace phase measurements can be made by increasing the sweep rate (without changing the variable Sec/Div control setting). One of the easiest ways to increase the sweep rate is with the Swp Mag (10X) button on the time-base unit. The magnified sweep rate is automatically indicated by the crt readout and knob-skirt scale-factor readout.

EXAMPLE: If the sweep rate were increased 10 times with the magnifier, the magnifier sweep rate should be $45^\circ/\text{div} \div 10 = 4.5^\circ/\text{div}$. Figure 2-12 shows the same signals as used in Fig. 2-11 but with the Swp Mag button pushed in. With a horizontal difference of six divisions the phase difference is:

$$\text{Phase Difference} = \frac{\text{horizontal difference}}{\text{(divisions)}} \times \frac{\text{sweep rate}}{\text{(degrees/division)}} = (6) (4.5^\circ) = 27^\circ$$

The phase difference is 27° .

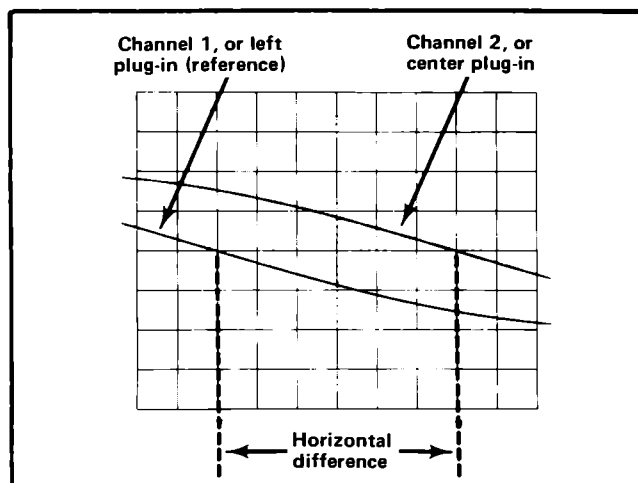


Fig. 2-12. High-resolution phase difference measurement with increased sweep rate.

THEORY OF OPERATION

INTRODUCTION

This section of the manual contains a description of the circuitry used in the 5441/R5441 oscilloscope. Individual descriptions are separated into the following parts: Main Interface, Vertical Amplifier, Horizontal Amplifier, Z-Axis Amplifier & CRT Circuit, Storage Circuit, Low Voltage Power Supply, Calibrator, and Readout System.

Refer to the appropriate diagrams in the Diagrams and Circuit Board Illustrations section of this manual while reading the circuit descriptions.

INTERFACE

The interface circuit provides an interconnection of signals, logic levels, and power-supply voltages between plug-in units and the oscilloscope mainframe. It incorporates circuits that determine the vertical display mode and amplify the vertical and horizontal display signals. Functions of interconnections not discussed are labeled on the interface diagram.

Chop Oscillator

The chop oscillator produces a 200 kHz square-wave signal for chopping between vertical plug-ins and amplifier channels within the plug-ins. This multivibrator circuit consists of U770A, U770B, and associated passive components. When the multivibrator receives a chop actuate level (+5 V), it free-runs at a 100 kHz rate. (The chop actuate level is routed through the vertical plug-ins to the time-base unit, and is present at contact A20 of J630 when a multi-trace display is required and the time-base Display switch is set to Chop.) The chop actuate level also disables Q770, locking out alternate-drive pulses. The multivibrator has two outputs; one is sent through buffers to the divider circuit as a timing signal, and the other is sent to the U770D and U770C circuit to blank the chop-switching transients.

Divider Circuit

The divider circuit produces the display switching signal for both the Alternate and Chopped switching modes. This circuit is composed of U780, and its discrete passive components, which is connected as a pair of JK flip-flops. Each flip-flop is a divide-by-two counter; the first one driving the second. The divider circuit is activated by a negative-going

transition, which can come from either the chop oscillator or from the time-base plug-in unit via grounded-base amplifier Q770. The chop oscillator input results in chopped-mode vertical switching. The input from the time-base unit coincides with the end of each sweep, and results in alternate-mode vertical switching. The output from the divide-by-two portion of the divider circuit, U780A, is sent via contacts B21 of J610 and J620 to the channel-switching circuits incorporated within multi-trace vertical plug-in units. The outputs from the divide-by-four portion of the divider circuit, U780B, are used for plug-in switching; one output is sent to pin 4 of the vertical integrated switching circuit to produce plug-in switching, and the other output is sent via contact B21 of J630 to produce dual-sweep switching in dual-time-base units. The vertical mode switching sequence and some of the display combination possibilities are fully discussed in the Operating Information section of this manual.

Vertical Amplifier and Vertical Integrated Switching Circuit

Emitter followers Q600, Q604, Q610, and Q614 provide a high-impedance input to the vertical amplifier and vertical integrated switching circuit, U620. The vertical amplifier input resistance for the oscilloscope mainframe is determined by R601, R605, R611, and R615.

The vertical integrated switching circuit permits only one of the two vertical plug-in signals to pass to the vertical output amplifier, the level at pin 4 of U620 determines the plug-in signal that is passed to the vertical amplifier. When the Display On pushbutton on the right-hand vertical plug-in

is pressed, -30 V is connected to contact B18 of J620, turning Q680 on. This increases the voltage level on pin 4 of U620, allowing the signal from the right-hand vertical plug-in to pass. If the left-hand vertical plug-in is to be displayed, the voltage on pin 4 of U620 is decreased by applying -30 V through contact B18 of J610 to R688. The signal from the left-hand plug-in now passes through U620. If, however, both plug-ins have an "on" logic level, the two logic levels applied to Q680 cancel each other and the signal from the divider circuit controls the plug-in signal passed. In the chopped switching mode, the switching between pairs of amplifiers occurs at a 50 kHz rate (switching occurs on both the negative- and positive-going transition), and in the alternate mode, switching occurs at the end of every second sweep. If neither plug-in has an "on" logic level, the level at pin 4 of U620 is such that the left plug-in signal passes to the vertical amplifier.

The gain of the vertical amplifier portion of U620 is set by resistors R620 (left plug-in amplifier) and R626 (center plug-in amplifier). The vertical output signal at pins 12 and 13 of U620 goes to a grounded-base stage consisting of Q640 and Q660. Q640 and Q660 change the dc level of the vertical signal so that it is compatible with the vertical amplifier in the display module. Q630 and Q650 act as both a current source for the grounded base stage and an insertion point for the vertical readout and trace separation information.

Trace separation information from contact B16 of J630 is supplied to the emitter of Q650 via Q674. Trace separation information is only available when a dual time base plug-in is used.

The vertical Ch switch Off signal is supplied to Q670 where it causes Q674 to be reverse biased during readout time, thus blocking the trace separation information. The signal also goes to pin 6 of U620 where it is used to prevent any vertical signal output from U620 during readout time. During the time of the vertical Ch switch Off signal, vertical readout signal information is supplied to the emitter of Q630.

Horizontal Amplifier

The horizontal amplifier consists of an emitter follower stage (Q740, Q744) and a gain stage (Q748, Q752). The gain setting resistor is R750. Thermistor RT754 and resistor R756 provide a temperature compensation network for the amplifier.

Trigger Amplifiers

Left Vertical Plug-in. A nominal 250 mV/div, single-ended, input signal is applied to the input stage of a two stage amplifier from contact A4 of J610. The first stage, a paraphase amplifier consisting of Q700-Q708, amplifies the signal by 1/4. The second gain stage consists of Q710 and Q715; R713 sets the stage gain. The output signal amplitude of the trigger amplifier depends upon the input impedance of the time-base trigger circuit at contacts A3 and B4 of J630. Time-base plug-ins designed for 5100-series oscilloscopes have a high input impedance, which results in a signal amplitude of 240 mV/div. Time-base plug-ins designed for 5400-series oscilloscopes have a low impedance, which results in a signal amplitude of 50 mV/div.

Right Vertical Plug-in. The right vertical plug-in trigger amplifier operates the same as described above.

Z-Axis Signal

The gate signal from the A and B sweeps is added on the interface circuit board. The combined A and B gate signal is also summed with the trace intensification and chopped blanking signals before being supplied, via contact 4 of P755, to the display module as the Z-Axis signal. Diode CR761 limits the combined signals on the Z-Axis signal line. C766 and R766, which are in parallel with the input to the Z-Axis amplifier, serve to increase the rise time of the Z-Axis signal.

VERTICAL AMPLIFIER

The vertical amplifier provides the final amplification for the vertical signal before it is applied to the vertical deflection plates of the crt. The vertical amplifier circuitry includes the delay line and part of the beam finder circuit, which reduces the final drive to compress an over-scanned display to within the viewing area of the crt.

Delay Line

Delay line DL100 provides approximately 140 ns of delay for the vertical signal. This allows the time-base circuits time to initiate a sweep before the vertical signal reaches the crt deflection plates. This delay of the vertical signal allows the leading edge of the signal originating the trigger pulse to be displayed when using internal triggering.

The delay line has a characteristic input impedance of approximately 75 Ω from side-to-side.

Amplifier

The vertical amplifier consists of a high bandpass three-stage paraphase amplifier having an input sensitivity of approximately 35 mV/div and a voltage gain of about 115. The amplifier is differentially driven at the bases of Q100 and Q125 by the input signal from the delay line. R100 and R125 terminate the delay line.

The first amplifier stage consists of Q100, Q106, Q125, and Q130. The gain of this stage is determined by the ratio

of feedback resistor R104-R103 or R128-R129 and emitter resistor R111. The networks parallel to the emitter resistor compensate for the signal losses in the delay line. R135 acts as a dc centering control, which compensates for resistive tolerance errors and crt electrical center error in the vertical amplifier, and allows the mainframe input to be standardized.

The next stage of amplification consists of Q148, Q170, Q165, and Q172. Thermistor RT157, resistor R157, varicap CR146, and capacitor C160 between the emitters of Q148 and Q165 comprise a thermal compensation network to correct for frequency loss with temperature changes. The two RC networks (R151-C156 and R155-C153-C155) in the emitters of Q148 and Q165, and the RCL network in the collectors of Q148 and Q165 provide high-frequency compensation.

The final amplifier stage consists of Q180, Q188, Q182, and Q190. R175 provides a means of adjusting the vertical amplifier gain within a $\pm 20\%$ range.

Pushing the BEAM FINDER switch compresses an off-screen display to determine its location. This is accomplished by turning off Q140, when the BEAM FINDER switch is pushed, which reduces the standing current in the second amplifier stage. This lowers the voltage drop across R172 and R176, which lowers the standing current in the final amplifier stage. The lower final amplifier stage standing current reduces the possible scan on the crt.

HORIZONTAL AMPLIFIER

The horizontal amplifier amplifies the push-pull horizontal deflection signal from the interface circuit board and applies it to the horizontal deflection plates of the crt.

Input Amplifier

The horizontal signal from the interface circuit board is connected to the bases of Q200 and Q215. Under no-signal conditions, the bases of Q200 and Q215 are within 150 mV of ground. Resistive network R205-R207-R210-R212-R213, between the emitters of Q200 and Q215, controls the emitter degeneration of this stage. R212 provides a means of adjusting the emitter degeneration of the input amplifier and thereby controls the gain of the horizontal amplifier, within $\pm 10\%$.

To compress an off-screen display so that it may be viewed on the crt, the BEAM FINDER switch reduces the dynamic range of the input amplifier. This is done by disconnecting CR208 in the emitter circuitry of Q200-Q215, and supplying a reduced current through current setting resistors R205, R208, and R213.

Resistors R202 and R217 provide thermal compensation for the input amplifier, while R222 provides a means of correcting for differential unbalance in the amplifier or crt.

Output Amplifier

Transistors Q240-Q244-Q250 and Q270-Q274-Q280 are connected as two separate current-driven feedback amplifiers. Input transistor Q240 (in the left output amplifier) is an NPN transistor for better response to positive-going signals, while input transistor Q270 (in the right output amplifier) is a PNP transistor for better negative-going signal response.

Negative feedback is provided from the collectors of output transistors Q244-Q250-Q274-Q280 to the base of input transistors Q240 and Q270 through feedback networks C242-R242 and C272-R272. Variable capacitors C242 and C272 adjust the transient response of the feedback networks to provide good linearity at fast sweep rates. The Zener diode-fast switching series diode, VR245 and CR242, turn on when the sweep passes the right edge of the crt. This action stops the collectors of the output transistors, thus current limiting the output amplifier. Capacitors C240, C250, and C280 are speed-up capacitors to improve the amplifier response to fast changes. Diodes CR246 and CR274 prevent Q244 and Q274 from going into saturation.

Z-AXIS AMPLIFIER AND CRT CIRCUIT

The crt circuit produces the high voltage potentials and provides the control circuits necessary for operation of the cathode-ray tube (crt). The Z-Axis amplifier circuit is included with the crt circuit discussion, since it sets the intensity of the crt display.

Z-Axis Amplifier

The Z-Axis amplifier is a current-driven, shunt-feedback operational amplifier with a voltage output. The amplifier consists of Q345, Q352, and Q356. The feedback path is from the Q352-Q356 collectors through C350-R349-R350 to the summing point at the base of Q345. Q352 and Q356 are connected as a collector-coupled complementary amplifier that provides a fast linear output signal while consuming minimum quiescent power. Q356 acts as the pull-up transistor and Q352 acts as the pull-down transistor for the amplifier. The output voltage from the amplifier provides the drive signal to control the crt intensity level through the control-grid supply.

The output voltage level of the Z-Axis amplifier is determined by the voltage drop across R349 and R350 in reference to the voltage level at the summing point for the amplifier (base of Q345). The current through R349-R350 is determined by the input current from any combination of several sources, such as the INTENSITY control, plug-in interface (unblanking, readout unblanking) and from Q320 and Q335. Q320 is an operational amplifier that sets the EXT INTENSITY INPUT connector signal to a level suitable for proper Z-Axis amplifier response. Q335 acts as an electronic switch to cause the crt display intensity to increase when the BEAM FINDER switch is pushed. Q340 acts as an impedance-matching and bias-setting transistor for the Z-Axis amplifier. CR352 and current limiting resistor R352 act as a protection circuit for the Z-Axis amplifier in case of a high-voltage short.

High-Voltage Regulator

High-Voltage Primary. A repetitive, sinusoidal signal is produced by a regenerative feedback oscillator in the primary of T410 and induced into the secondary. Current drive for the primary winding is furnished by Q410.

The conduction of Q410 is controlled by the collector voltage of Q400.

High-Voltage Regulation. Regulation is accomplished by sampling the -1.5 kV across voltage divider R395A-R395B. If the output level of the cathode supply goes above the nominal -1.5 kV (goes more negative), the input base

of Darlington transistor Q390 goes negative from its quiescent 0 V. The output of Q390 goes more positive, reducing the conduction of Q400 and Q410. This reduces the peak-to-peak sinusoidal signal amplitude, resulting in a reduced voltage in the secondary of T410. Conversely, if the output decreases below -1.5 kV (goes more positive), Q410 will conduct more, i.e., have a larger sinusoidal signal amplitude. CR395 and C395 form a delay turn-on circuit to prevent the crt beam from coming on immediately at instrument turn-on. The delay time is controlled by the time it takes the (+) end of C395 to charge to $+30.6$ V through R392 from the $+200$ V power supply. At the moment the top of C395 reaches $+30.6$ V, diode CR395 will turn on and clamp the CR395-C395-R397-R395A junction at $+30.6$ V. R402 and C402 limit the bandwidth of the regulator to prevent oscillations.

High-Voltage Outputs

The secondary winding of T410 provides the negative and positive accelerating potentials for the crt and the bias voltage for the control grid.

Positive accelerating voltage for the crt screen is supplied by voltage doubler U410. The applied voltage to the input of U410 from the T410 secondary winding is approximately $+1.5$ kV peak-to-peak. The output voltage of U410 is approximately $+7$ kV at the crt anode. The negative accelerating voltage for the crt cathode is also obtained from the T410 secondary winding. CR412 half-wave rectifies the transformer output and supplies the -1.5 kV to the crt cathode. R419 connects the crt cathode voltage to the crt filament to prevent cathode-to-filament breakdown.

Diodes CR420 and CR422 provide the rectified negative control voltage for the crt control grid. The output level of this supply is set by Intens Range adjustment R435. Diodes CR428 and CR430 clip the crt grid bias voltage from the T410 secondary, to determine the operating level at the control grid. CR428 limits the negative excursion of the bias voltage, depending upon the output voltage of the Z-Axis amplifier. The positive clipping level at the cathode of CR430 is set by the Intens Range adjustment. CR420 acts as a dc restorer and CR422 as a rectifier. This results in a dc level across R422 equal to the peak-to-peak excursion at the anode of CR430.

CRT Control Circuits

The focus of the display is determined by the Focus control R332B. This control and the Auto Focus amplifier maintain a well-defined display for fast changes in intensity. The network consisting of CR457, CR456, CR454, CR452, and

VR452 provide the negative voltage for the focus grid of the crt. Approximately 700 V peak to peak from the secondary of T410 is connected to the focus grid supply through C450 and R450. The positive clipping level at the anode of CR452 is set by the Focus control setting. This determines the operating level at the focus grid. Under normal operating conditions, the voltage applied to the focus grid is more positive (less negative) than the control grid or the cathode of the crt. The signal developed by the Auto Focus amplifier is coupled to the focus grid by C460. When there is a sudden change in intensity levels, the focus grid will change to maintain a well-defined display. Astigmatism adjustment R370, which is used in conjunction with the Focus control to obtain a well-defined display, varies the positive level on the astigmatism grid. Geometry adjustment R365 varies the positive level on

the horizontal deflection-plate shield to control the overall geometry of the display.

Auto Focus Amplifier

A sample of the unblanking signal is taken from the collector of Q340. This signal is inverted and amplified nonlinearly by Q300 and Q302 to conform to the requirements of the crt focus electrode. As the base of Q300 is driven negative, CR303 is forward biased, producing a knee in the amplifier response. The level where the knee occurs is determined by adjustment R306, auto focus bias. The operation of the remaining amplifier is identical to that of the Z-Axis amplifier.

STORAGE CIRCUIT

The cathode-ray tube is a transmission halftone storage tube. The collector mesh is a coarse mesh, which accelerates electrons toward the target area. The target (storage mesh) is a fine mesh with a highly insulative dielectric layer deposited on it. It is in the dielectric layer that storage occurs. The flood guns cover the entire storage target with a continuous stream of low velocity electrons; these electrons are prevented from reaching the phosphor screen unless a display has been written on the storage area.

The collimation bands (electrodes) are used as a lens that uniformly distributes flood-gun electrons over the storage target area. In the non-store mode, the collimation bands have no control over the crt.

Switching from the non-store mode to the store mode is done by pushing in the STORE pushbutton. When changing modes from non-storage to storage operation, an erase cycle is generated automatically.

Flood-Gun Filaments

The flood-gun filament supply for the crt consists of VR690-VR691 and emitter follower Q690. The power to heat the filaments is derived from the —20 V power supply. VR690-VR691 sets the base voltage of Q690 and provides regulation.

Flood-Gun Cathode

The flood-gun cathode is switched either on or off by switching transistors Q675, Q680, and Q685. Two signals

control whether the flood-gun cathode is turned on; they are:

- a. The STORE switch pushed in signal turns on the flood-gun cathode.
- b. The SAVE pushbutton, S675, when pressed, either turns the flood-gun cathode completely off (VARIABLE PERSIST control fully clockwise) or, if the VARIABLE PERSIST control is turned away from its fully clockwise position, allows the flood-gun cathode to be pulsed at a low duty factor.

When the 5441 power is turned off, in less than a micro-second Q700 turns off. This eliminates the negative voltage that would result from the slow decay of the power supply filter capacitors, leaving only the positive voltage present at the base of Q675. Q675 is turned on, causing Q680 and Q685 to be off. This prevents damage to any stored information if the save mode is being utilized, since there is not any flood-gun cathode current available.

Flood-Gun Anode

The flood-gun anode circuit consists of operational amplifier Q670-Q672. The operational amplifier is used as a current-to-voltage conversion amplifier. A composite erase pulse is supplied to the base of Q670 to hold the flood-gun anode high during the erase cycle.

Collimation Electrodes (CE)

The CE 1 and 2, and the CE 3 circuits consist of an emitter follower, Q655 and Q600, with base-emitter reverse voltage protection furnished by CR655 or CR600. R655, CE 1 and R600, CE 3 adjustments control the voltage level of the CE 1 and 2, and CE 3, respectively. CE 1 and 2 voltage varies between store and non-store modes of operation. R655, CE 1 adjustment, sets the CE 1 and 2 level in the store mode, while R654 and VR655 sets the CE 1 and CE 2 level in the non-store mode. R655-R657 divider is allowed to float in the non-store mode.

Collector Mesh

Emitter follower Q595, base-emitter reverse voltage protection diode CR595 and Zener diode VR595 make up the collector mesh circuitry. VR595 sets the base voltage for Q595.

Storage Mesh

Q580, Q575, and Q585 form an operational amplifier that is used as a current-to-voltage conversion amplifier. Internal adjustments R572, Prep Level, and R590, Op Level, set the quiescent operating levels for the crt in the storage mode. R585, WRITING SPEED control, allows a small adjustment to be made in the operate level, which increases the crt's ability to store a fast waveform. During the erase cycle the storage mesh is made a high positive for 50 ms, returned to its operate level for 10 ms, then made a slightly positive level for 440 ms. The two positive-going erase signals (see Fig. 3-1) are supplied to the storage mesh by the collectors of Q515 (50 ms) and Q555 (440 ms).

Erase Generator

Pushing the ERASE pushbutton creates a negative pulse at the base of Q510. R665-R500-C500 is a contact bounce remover network for the ERASE pushbutton with R500 used to dampen any ringing. Q510 and Q515 form a 50 ms monostable multivibrator; C514 and R501 are the timing components. Coupling capacitor C528 couples the 50 ms multivibrator to the input of the 10 ms monostable multivibrator consisting of Q530-Q535. The timing components for Q530-Q535 are C534 and R530. The output from the 10 ms multivibrator is coupled to the input of the 440 ms monostable multivibrator by C538. Q550-Q555, along with timing components C554 and R545 form the 440 ms monostable multivibrator. The monostable multivibrators are cascaded to provide a sequential pulse train. Diodes CR560, CR562 and CR564 make up an OR gate to supply a composite erase signal to the flood-gun anode circuit.

The signal available from the collector of Q550 is used to retrigger the erase generator when the ERASE pushbutton is held in.

Variable Persistence and Save

Q625 and Q640 form a monostable multivibrator that is triggered by the output of the 10 ms pulse generator consisting of programmable unijunction transistor Q610. The timing components for the monostable multivibrator are C625, R622, R620, VARIABLE PERSIST control. The 10 ms pulse generator timing components are C610, R608, and R609. Q635 acts as a switch for R620, VARIABLE PERSIST control.

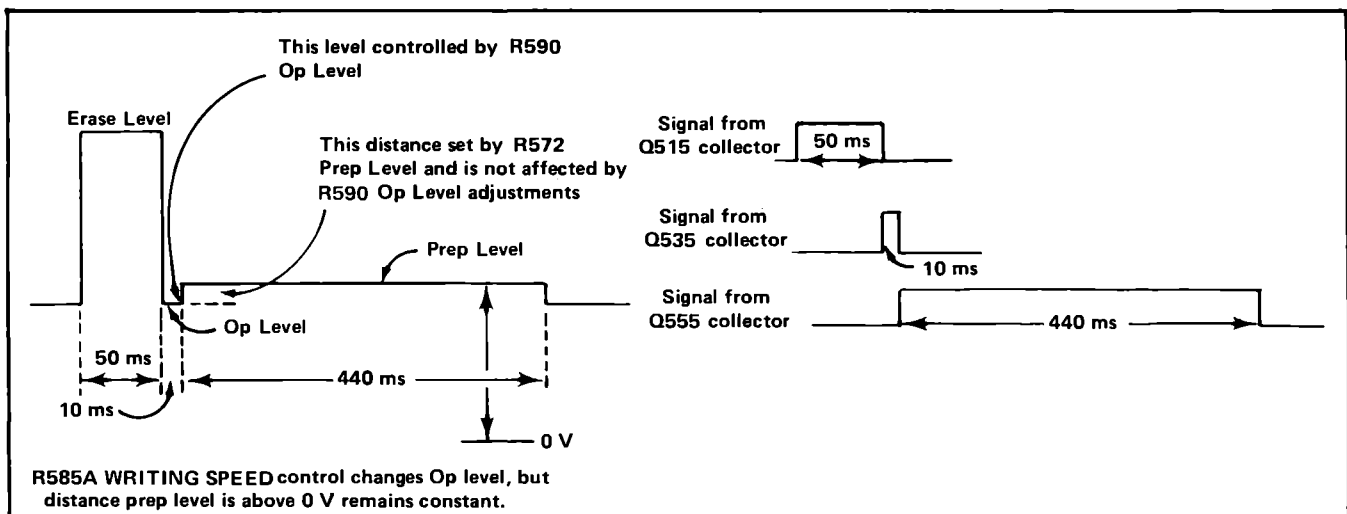


Fig. 3-1. Erase cycle waveform as seen at the storage mesh-connection to the crt.

When S610, STORE pushbutton, is pressed in, the 10 ms pulse generator feeds pulses to the storage mesh to increase the background level slightly for better storage and to the Q625-Q640 monostable multivibrator for triggering.

If S675, SAVE pushbutton, is not pushed in (out position), the output of Q640 (Fig. 3-2) is supplied via CR640 to the storage mesh.

When S675, SAVE pushbutton, is pushed in, the output of Q640 (Fig. 3-2) is supplied to the flood-gun cathode. Pushing S675 in forward-biases CR650 and holds pins 16A and 17A of the time-base plug-in high, preventing a sweep.

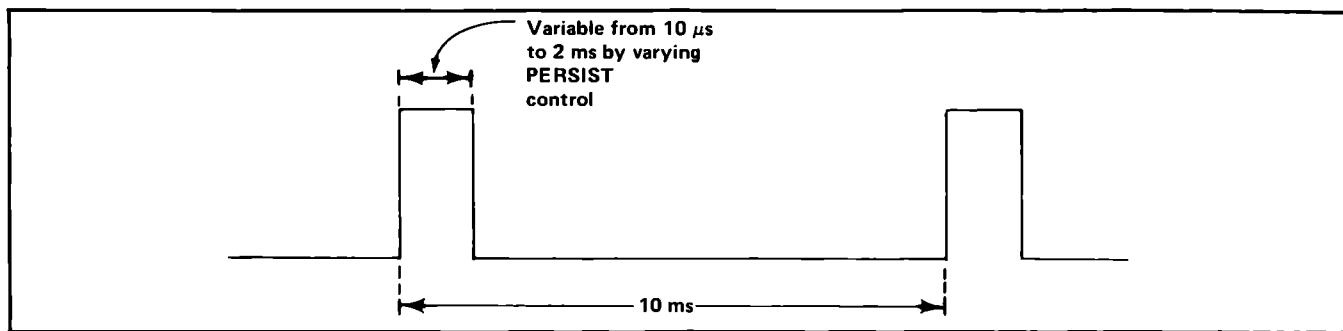


Fig. 3-2. Variable Persistence and Save circuit output waveform.

LOW VOLTAGE POWER SUPPLY

The low-voltage power supply circuit provides the operating power for the oscilloscope system. Electronic regulation is used, where necessary, to provide stable, low-ripple output voltages. The circuit also includes the calibrator circuit to produce an accurate square-wave output.

Power Input

Power is applied to the primary of transformer T800/F300/S300 through fuse F300, thermal cutout S300, and POWER switch S302, and line-selector block P800 or P801. The line-selector blocks allow changing the primary-winding taps of T800 to fit different line requirements.

Low-voltage Rectifiers and Unregulated Outputs

The full-wave bridge rectifiers and associated filter components in the secondaries of T800 provide filtered dc voltages. The unregulated outputs are +200 V, +18 V, +38 V, -18 V, and -38 V. The +200 V outputs to the display unit are protected by F800.

Low-voltage Regulators

-30 V Supply. The -30 V supply, besides providing power to circuitry throughout the instrument, provides a reference-voltage source to establish operating levels for the feedback regulators in the -15 V, +15 V, +30 V and +5 V supplies. The regulator for the -30 V supply is a feedback amplifier system that operates between ground and the unregulated -38 V. Current to the load is delivered by the series-pass transistor, Q940. The supply voltage is established by the drop across R948, R950, and R952, which is compared to the voltage drop across VR950 and the emitter-base junction of Q950. The feedback path is through R949, Q955, and Q958 to the base of Q940. Any variation in output voltage due to ripple, change of current through the load, etc., is immediately transmitted to the base of Q940 and nullified by a change in Q940 conduction, thus maintaining a steady output. The output of the supply is set to exactly -30 V by adjustment of R950, -30 V adj. This control sets the conduction of Q950, which controls the bias levels of Q958 and Q940. CR955 and Q958 provide short-circuit protection by limiting the current through Q940 when the voltage drop across R940 exceeds 1.1 V.

–15 V Supply. The regulator for the –15 V supply consists of series-pass transistor Q880, error amplifier Q900 and error sensing transistors Q894 and Q896. This is a feedback amplifier system that operates between +30 V and –20 V. Current to the load is delivered by the series-pass transistor, Q880. The supply voltage is established by comparing the supply voltage sample at the base of error sensing transistor Q894 with the reference at the base of error sensing transistor Q896. Any differences between the bases of the error sensing transistors causes a change in the Q894 collector. The error sensing circuit change is applied to the base of the error amplifier, Q900. The output of the error amplifier changes the conduction of series-pass transistor Q880 to correct for any output error. Q885 protects the supply, in the event the output is shorted, by limiting the current demanded from the series-pass transistor under excessive load. During normal operation, Q885 is biased off.

+15 V Supply. The regulator for the +15 V supply consists of series-pass transistor Q850, error amplifier Q870, and error sensing transistors Q864 and Q866. Operation of this feedback amplifier system is similar to that described for the –15 V supply.

+30 V Supply. The regulator for the +30 V supply consists of series-pass transistor Q910 and error amplifier Q925. This is a feedback amplifier system similar to that described for the –30 V supply. R920, +30 V adj. provides an adjustment to set the output of the supply at exactly +30 V. Q915 protects the supply, if the output is shorted, by limiting the current demanded from the series-pass tran-

sistor under excessive load. During normal operation, Q915 is biased off.

+5 V Supply. The regulator for the +5 V supply consists of series-pass transistor Q820, error amplifier Q824-Q832, and error sensing transistor Q838. This is a feedback amplifier system that operates between +5 V and –30 V. Current to the load is delivered by the series-pass transistor, Q820. The supply voltage is established by the drop across R845 and R846. The error feedback path is through R845 to the base of Q838. Any variation in output voltage is immediately transmitted to the base of Q820 and nullified by a change in the conduction of Q820, which shifts the whole supply. Q830 protects the supply, if the output is shorted, by limiting the current demanded by the error amplifier transistor, Q824. During normal operation, Q830 is biased off.

Line Trigger

A line-frequency signal is obtained from the secondary of T800 and attenuated by R935, R936, and R937 to provide a line-trigger source for the time-base plug-in unit.

CRT Heater Winding

A separate secondary winding is provided for the crt writing-gun heaters. The writing-gun heaters are elevated to –3000 V in the crt circuit to maintain a potential near that of the crt cathode.

CALIBRATOR

The Calibrator circuit composed of Q982, Q984, and their associated passive components produces a square-wave output with accurate amplitude, and at a rate of twice the power-line frequency. This output is available at the probe test loop on the front panel as a 4 mA (peak to peak) square-wave current, or as a 400 mV (ground to peak) square-wave voltage.

The resistive-capacitive network at the base of Q982 receives a pulsating dc voltage from full-wave rectifier CR980-CR981, and produces a nearly symmetrical switching signal for Q982 and Q984. As Q984 is alternately switched on and off at twice the line frequency, current through R986 is alternately switched through the transistor or through CR986, the probe test loop, and R987, producing the required test signal.

READOUT SYSTEM

The readout system provides an alphanumeric display of information encoded by the plug-in units. This information is presented on the crt on a time-shared basis with the analog waveform display. A schematic for the readout system is available at the rear of this manual.

Display Format

Up to eight groups of characters can be displayed on the crt. The position of each group (word) is fixed and directly related to the originating plug-in. Figure 3-3 shows the word positions on the crt.

Each word in the readout display can contain up to ten characters, although a typical display contains between two and seven characters per word. The characters are chosen from a set of fifty.

Developing The Display

Refer to the readout portion of the block diagram during the following discussion.

The key block in the readout system is the timer stage. This stage produces the basic signals that establish the timing sequences within the readout system. The timer stage also produces control signals for other stages within the readout system, and interrupt signals to the vertical amplifier and Z-Axis amplifier to allow a readout display to be presented.

Included in the timer block is the time-slot generator. The time-slot generator has ten outputs, each of which is energized sequentially. After the tenth output is energized, the first is again energized to repeat the cycle. The ten outputs

are connected to the vertical and horizontal plug-in compartments as well as to other stages within the readout system. Each time the first time-slot output line is energized, an address counter is incremented by one. The address counter counts to seven, then returns to zero. The address counter's three outputs are connected to various readout system stages.

Within each plug-in are readout coding resistors. The coding resistors are selected by the plug-in control settings,

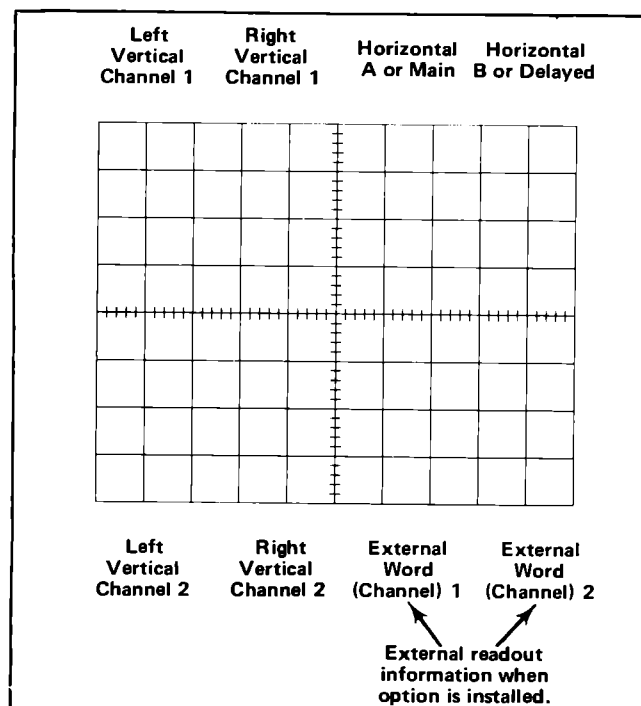


Fig. 3-3. Location of readout words on the crt, identifying the originating plug-in and channel.

which connect the resistors between the various time-slot lines and one of four plug-in output lines. Two of the plug-in output lines are associated with channel 1 of amplifier plug-ins or the main sweep of sweep plug-ins. The other two output lines are associated with channel 2 of the amplifier plug-ins, or with delayed (or B) sweep of time-base plug-ins.

Each pair of output lines from the plug-ins or external readout (Option 03) is connected to the data switches. Currents in these eight pairs (two pairs added with Option 03) of lines are transferred to the outputs of the data switches, as selected by the address counter.

The data decoders convert each of the current signals from the data switches to make one of ten logic lines (together with signals from the timer) select the character generated by the character generators.

The output amplifier combines signals from the character generator with positioning signals from the address counter position generator. The combined signals then form the vertical and horizontal components of the readout display.

The vertical component of the readout display is injected directly into the output of the vertical channel switch on the Interface board. During the interval when the readout is generated, the vertical channel switch is turned off, so only the readout signal is displayed.

The horizontal component of the readout display is connected to the horizontal channel switch. When the readout is not displayed, signals from the horizontal plug-in pass through the channel switch without change. During the interval when readout is displayed, the horizontal readout signal appears at the output of the horizontal channel switch instead of the horizontal plug-in signal.

CIRCUIT ANALYSIS OF READOUT SYSTEM

The following analysis of the Readout System discusses the operation of each stage in detail. A complete schematic of the readout system is shown on the diagram at the rear of this manual.

The definitions of several terms used in this description of the Readout System follow.

Character. A character is a single number, letter or symbol that is displayed on the crt, either alone or in combination with other characters.

Word. A word is made up of a related group of characters. In the readout system, a word can consist of up to ten characters.

Frame. A frame is a display of all words for a given operating mode and plug-in combination. Up to eight words can be displayed in one frame.

Column. One of the vertical groups in the character selection matrix (see Fig. 3-8). Columns C-0 (column 0) to C-10 (column 10) can be addressed in the system.

Row. One of the horizontal groups in the character selection matrix (Fig. 3-8). Row R-1 (row 1) to R-10 (row 10) can be addressed in the system.

Time Slot. A location in a pulse train. In the readout system, the pulse train consists of 10 negative-going pulses. Each of these time-slots is assigned a number between one and ten. For example, the first time-slot is TS-1.

Timer

Timer U1000 establishes the timing sequence for all circuits within the readout system. This stage produces seven time-related output waveforms (see Fig. 3-4). The triangle waveform produced at pin 6 forms the basis for the remaining signals. The basic period of this triangle waveform is approximately 250 μ s, as controlled by RC network C1021-R1021. The triangle waveform is clipped and amplified by U1000 to form the trapezoidal output signal at pin 10. The amplitude of this output signal is exactly 15 V as determined by U1000 (exact amplitude necessary to accurately encode data in plug-in units; see Encoding the Data). The trigger output at pin 5 provides the switching signal for the time-slot counter and readout intensity control Q1018.

The signals at pin 12, 13, 14, and 16 are produced only when the triangle waveform is on its negative slope and the trapezoidal waveform has reached the lower level. The timing sequence of these waveforms is very important to the correct operation of the readout system (see expanded waveforms in Fig. 3-5). The Z-Axis blank at pin 14 is produced first. This negative going signal drives Q1015, which removes the current input for the interface to the Z-Axis amplifier to blank the crt before the display is switched to the readout system. It also produces the strobe pulse through R1010, Q1010, and CR1013 to signal other stages within the readout system to begin the sequence necessary to produce a character. The collector level of Q1010 is also connected to character generator No. 2, U1092, through Q1010-CR1010. This activates U1092 during the quiescent period of the strobe pulse (collector of Q1010 negative) and diverts the output current of row decoder U1035 to row 2.

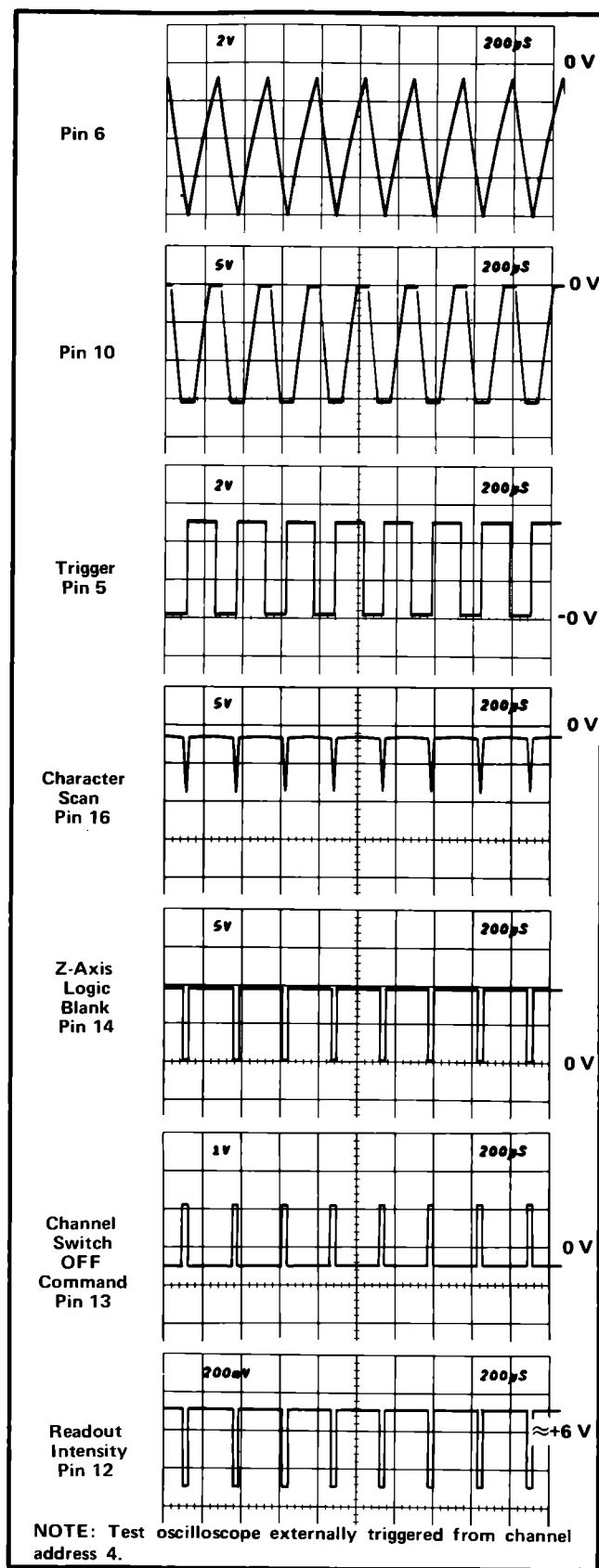


Fig. 3-4. Output waveform of timer stage.

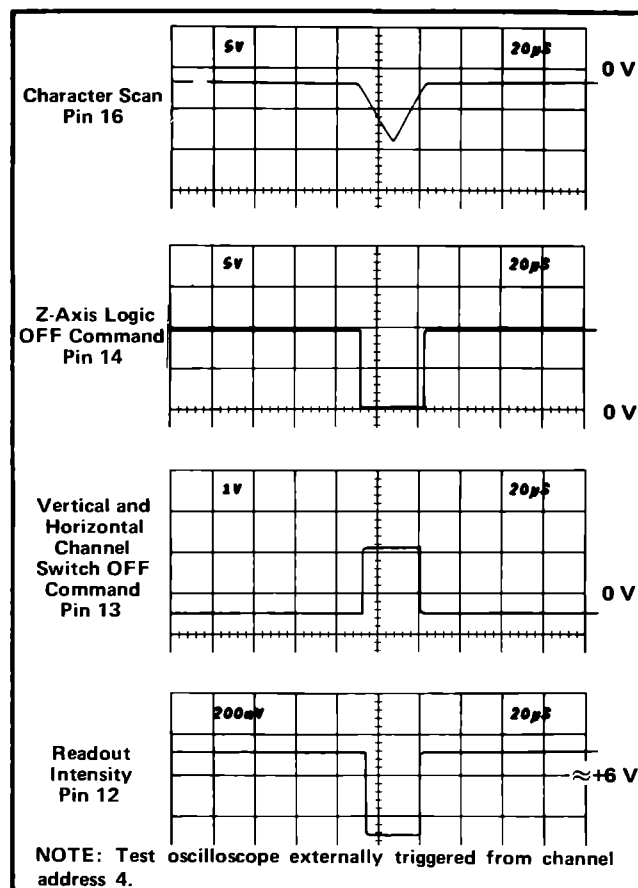


Fig. 3-5. Detail of output at pins 12, 13, 14, and 16 of U1000.

The purpose of this configuration is to prevent the zero logic and memory stage, U1060, from storing incorrect data during the quiescent period of the strobe pulse. When the strobe pulse goes positive, CR1010 is reverse biased to disconnect Q1010 from U1092, and allow the row decoder to operate in the normal manner.

The next signal to be produced is the channel switch off command at pin 13. This positive-going signal disconnects the plug-in signals in the vertical and horizontal deflection system so that the plug-in units do not control the position of the crt beam during the readout display. This signal is also connected to the decimal point logic and character position counter stage and the format generator stage. The readout unblanking output at pin 12 is produced next. This current is connected to the Z-Axis amplifier to unblank the crt to the intensity level determined by READOUT INTENS control R1000. However, Q1018 prevents the intensity current from reaching the Z-Axis amplifier until the character scan ramp at pin 16 begins its positive slope. The character scan ramp at pin 16 started to go negative as this timing sequence began. The triangular character scan ramp runs negatively from approximately -2 V to approximately -8.5 V , then returns back to the original level. This wave-

form provides the scanning signal for the character generator stages. Full character scan adjustment R1006 sets the dc level of the character scan ramp to provide complete characters on the display.

The timer stage operates in one of two modes, as controlled by the display skip level at pin 4. The basic mode, just described, is a condition that does not occur unless all ten characters of each word (80 characters total) are displayed on the crt. Under typical conditions, only a few characters are displayed in each word. The display skip level at pin 4 determines the period of the timer output signal. When a character is to be generated, pin 4 is LO and the circuit operates as just described. However, when a character is not to be displayed, a HI level is applied to pin 4 of U1000 through CR1003 from the display skip generator stage. This signal causes the timer to shorten its period of operation to approximately 210 μ s. The waveforms in Fig. 3-6 show the operation of the timer stage when the display skip conditions occur for all positions in a word. Notice that there is no output at pins 12, 13, 14, and 16 under this condition. This means that the crt display is not interrupted to display characters. Also notice that the triangle waveform at pin 6 does not go as far negative and that the negative portion of the trapezoidal waveform at pin 10 is shorter. Complete details on operation of the display-skip generator are given later.

READOUT INTENS control R1000 sets the intensity of the readout display independently of the INTENSITY control. The READOUT INTENS control also provides a means of turning the readout system off when a readout display is not desired. When R1000 is turned fully counterclockwise, switch S1000 opens. The current to pin 11 of U1000 is interrupted and, at the same time, a positive voltage is applied to pin 4 through R1003 and CR1002. This positive voltage switches the stage to the same conditions that were present under the display-skip conditions. Therefore, the crt display is not interrupted to present characters. However, time-slot pulses continue to be generated.

Time-Slot Counter

Time-Slot counter U1025 is a sequential switch that directs the trapezoidal waveform input at pin 8 to one of its 10 output lines. These time-slot pulses are used to interrogate the plug-in units to obtain data for the readout system. The trigger pulse at pin 15 switches the time-slot counter to the next output line; the output signal is sequenced consecutively from time-slot 1 through time-slot 10. Figure 3-7 shows the time-relationship of the time-slot pulses. Notice that only one of the lines carries a time-slot pulse at any given time. When time-slot 10 is completed, a negative-going end-of-word pulse is produced at pin 2. The end-of-word pulse provides a drive pulse for the channel counter and also provides an enabling level to the display-skip generator during time-slot 1 only. The end-of-word pulse also resets the decimal point logic and zeros logic.

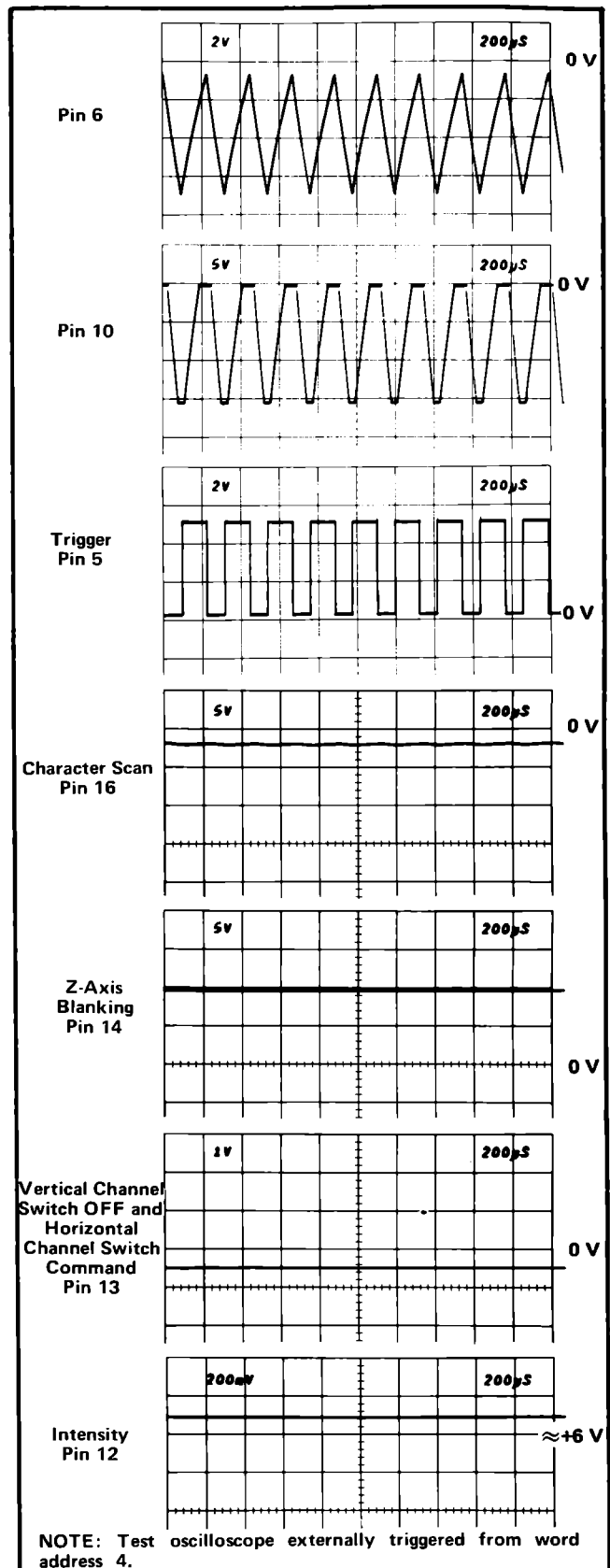


Fig. 3-6. Timer stage operation when display-skip condition occurs.

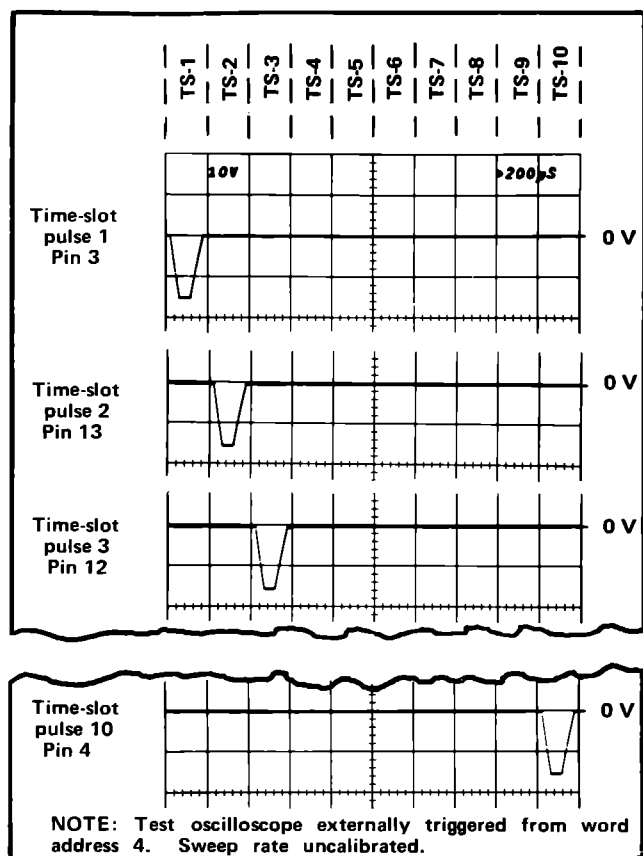


Fig. 3-7. Time relationship of the time-slot (TS) pulses produced by U1025.

Word Counter

The word counter, made up of three flip-flops in integrated circuit U1075, is a binary counter that produces the word address code for the column and row decoder stages.

This code instructs these stages to sequentially select and display the data from the plug-ins. The input channel that is displayed with each combination of the word address code is given in the discussion for the applicable stages.

Encoding The Data

Data is conveyed from the plug-in units to the readout system in the form of an analog code having up to 11 current levels (from 0 to 1 mA in 100 μ A steps). The characters that can be selected by the encoded data are shown on the character selection matrix (see Fig. 3-8). Each character requires two currents to define it; these currents are identified as the column current and the row current, which correspond to the column and row of the matrix. The column and row data is encoded by resistive programming in the plug-in units. The resistors are connected between the time-slot lines and the row or column lines.

The amplitude of the time-slot pulses is exactly -15 V as determined by the timer stage. Therefore, the resultant output from the plug-in units can be accurately controlled by the programming resistors in the plug-in units.

Figure 3-9(A) shows an idealized current waveform of row analog data, which results from the 10 time-slot pulses. Each of the steps to current shown in these waveforms correspond to 100 μ A of current. The row numbers on the left-hand side of the waveform correspond to the rows in the character selection matrix shown in Fig. 3-8. The row analog data is connected back to the readout system via contact B28 of the plug-in interface. Idealized column current waveforms at contact A28 of the plug-in interface are shown in Fig. 3-9(B).


Referring to the character selection matrix, two units of column current, along with the two units of row current encoded during TS-1, indicates that two zeros should be added to the display. One unit of column current during time-slot 2, along with the one unit of current from the row output, instructs the readout system to add an invert arrow to the display.

No column current output during TS-3 means no display on the crt (see Display-Skip Generator for further information). Two units of column current are encoded during TS-4. There is no row current encoded during this time-slot; this results in the numeral 1 being displayed on the crt. Neither row nor column analog data is encoded during time-slots 5, 6, and 7. During TS-8, two units of column current and three units of row current are encoded. This addresses the μ prefix in the character selection matrix. The final data output is provided from time slot 9; three units of column current and four units of row current cause a V (volts) to be displayed. The resultant crt readout is 100 μ V.

The column analog data encoded by the plug-in unit can be modified by attenuator probes connected to the input connectors of vertical plug-in units. A special coding ring around the input connector of the plug-in unit senses the attenuation ratio of the probe (with readout-coded probes only). The probe contains a resistor that causes additional column current. For example, if a 10X attenuator probe is connected to a plug-in with the coding for 100 μ V, an additional unit of current is added to the column analog data during time-slot 1. Since two units of current were encoded in Fig. 3-9, this additional current results in a total of three units of column analog current during this time-slot.

Referring to the character selection matrix, three units of column current, along with the two units of row current, indicates that the prefix should be reduced. Since this instruction occurs in the same time-slot that previously indicated that two zeros should be added to the display, and

Fig. 3-8. Character selection matrix for 5000-Series readout system.

COLUMN NUMBER →		C-0	C-1	C-2	C-3	C-4	C-5	C-6	C-7	C-8	C-9	C-10
ROW NUMBER ↓	CURRENT (MILLI-AMPERES)	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	≥ 1.0
R-1	0	 SKIP ¹	0	1	2	3	4	5	6	7	8	9
R-2	0.1		/	<	I	/	+	-	+	C	Δ	>
R-3	0.2		ADD ¹ ONE ZERO	ADD ¹ TWO ZEROS	SHIFT ¹ PREFIX ←	SHIFT ¹ PREFIX ← AND ADD ONE ZERO						IDENTIFY ¹
R-4	0.3		<i>m</i>	<i>μ</i>	<i>n</i>	<i>p</i>	<i>X</i>	<i>K</i>	<i>M</i>	<i>G</i>	<i>T</i>	<i>R</i>
R-5	0.4		<i>S</i>	<i>V</i>	<i>A</i>	<i>W</i>	<i>H</i>	<i>d</i>	<i>B</i>	<i>c</i>	Ω	<i>E</i>
R-6	0.5		<i>U</i>	<i>N</i>	<i>L</i>	<i>Z</i>	<i>Y</i>	<i>P</i>	<i>F</i>	<i>J</i>	<i>Q</i>	<i>D</i>
R-7	0.6				DECIMAL ¹ POINT LOCATION NO. 3	DECIMAL ¹ POINT LOCATION NO. 4	DECIMAL ¹ POINT LOCATION NO. 5	DECIMAL ¹ POINT LOCATION NO. 6	DECIMAL ¹ POINT LOCATION NO. 7			
R-8	0.7										DECIMAL ² POINT	
R-9	0.8											
R-10	0.9		ADD SPACE IN DISPLAY ¹									



UNUSED LOCATIONS. AVAILABLE FOR FUTURE EXPANSION OF READOUT SYSTEM

¹ OPERATIONAL ADDRESS.² DECIMAL POINT CHARACTER. SEE DECIMAL POINT CHARACTER DESCRIPTION IN TEXT:

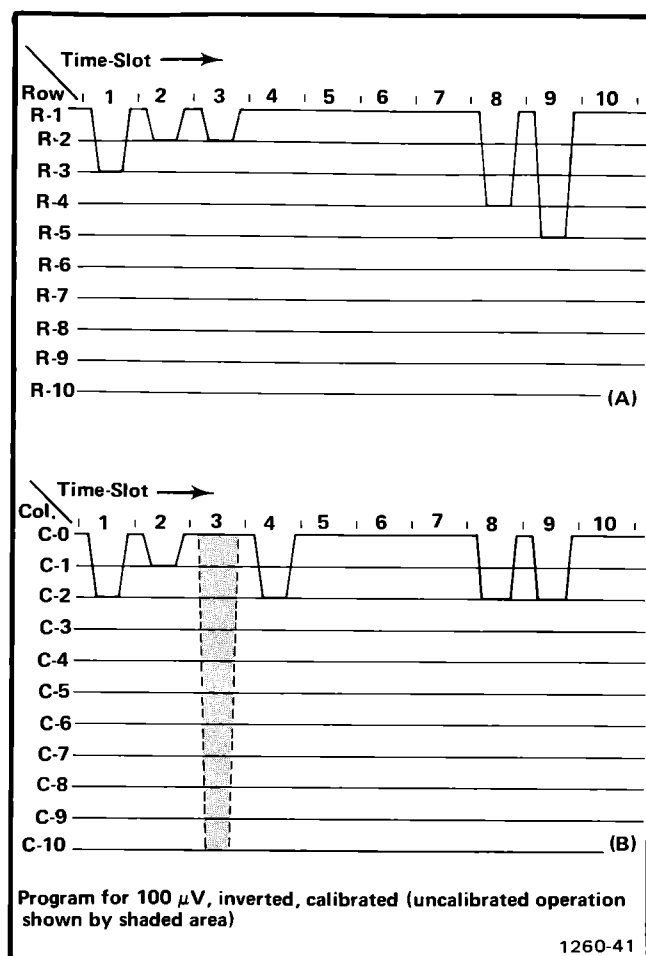


Fig. 3-9. Idealized current waveforms of (A) Row analog data, (B) Column analog data.

only one instruction can be encoded during a time-slot, the zeros do not appear in the display. The crt readout now changes to 1 mV.

Likewise, if a 100X readout-coded probe is connected to the input of the plug-in unit, the column current during time-slot 1 is increased two units for a total of four units of column current. This addresses an instruction in the character selection matrix, which reduces the prefix and adds one zero to the display. The resultant crt readout with the previous program is 10 mV.

Two other lines of information are connected from each plug-in compartment to the readout system. The column and row analog data from channel 2 of a dual-channel plug-in are connected to the readout system through contacts A24 and B24 of the plug-in interface, respectively.

Column and Row Data Switches

The readout data from the plug-in units is connected to the column and row data switch stages. A column-data line and a row-data line convey analog data from each of the eight data sources (two channels from each of the three plug-in compartments and two external channels, Option 03).

The column data switch, U1040, and the row data switch, U1030, receive the word address code from the word counter. This binary code directs the column data switch and the row data switch as to which channel should be the source of the readout data. Table 3-1 gives the eight combinations of the word address code, and the resultant channel is selected with each combination. These stages have eight inputs and provide a single time-multiplexed output at pin 7, which includes the information from all of the input channels. Six of the eight inputs to each stage originate in the plug-in units; the seventh and eighth inputs come from an optional external access jack.

Table 3-1
WORD ADDRESS CODE

Pin 8 U1075	Pin 9 U1075	Pin 12 U1075	Channel Selected
LO	LO	LO	Channel 2 Left Vertical
LO	LO	HI	Channel 1 Left Vertical
LO	HI	LO	Channel 2 Right Vertical
LO	HI	HI	Channel 1 Right Vertical
HI	LO	LO	Channel 2 Horizontal
HI	LO	HI	Channel 1 Horizontal
HI	HI	LO	Channel 2 External Access
HI	HI	HI	Channel 1 External Access

Display-Skip Generator

The display-skip generator, Q1040-Q1048-Q1050-Q1052, monitors the time-multiplexed column data at the output of the column data switch during each time-slot, to determine if the information at this point is valid data that should result in a crt display. The voltage at the base of Q1040B is set by divider CR1040-CR1041-R1046-R1047-R1048. Quiescently, there is approximately 100 μ A of current flowing through R1040 from Q1056 and the zeros logic and memory stage (purpose of this quiescent current will be discussed in connection with the zeros logic and memory stage). This current biases Q1040A so that its base is approximately 0.2 V more positive than the base of Q1040B in the absence of column data. Therefore, since Q1040A and

Q1040B are connected as a comparator, Q1040A will remain on unless its base is pulled more negative than the base of Q1040B. The analog data output from the column data switch produces a 0.5 V change at the base of Q1040 for each unit of column current that has been encoded by the plug-in unit. Therefore, whenever any information appears at the output of the column data switch, the base of Q1040A is pulled more negative than the base of Q1040B, resulting in a negative (LO) display-skip output to the timer stage through Q1052. Recall that a LO was necessary at the skip input of the timer so it could perform the complete sequence necessary to display a character.

Q1048-Q1050 also provide display-skip action. The end-of-word level connected to their emitters through R1050 is LO only during time-slot 1. This means that Q1048-Q1050 are enabled only during time-slot 1. These transistors allow the zero logic and memory stage to generate a display-skip signal during time-slot 1 when information that is not to be displayed on the crt has been stored in memory (further information given under zeros logic and memory discussion).

Column and Row Decoder

The column decoder, U1070, and row decoder, U1035, sense the magnitude of the analog voltages at their inputs and produce a binary output on one of ten lines corresponding to the column or row data that was encoded by the plug-in unit. These outputs provide the column digital data and row digital data that is used by the character generator stages to select the desired character for display on the crt. The column and row data is also used throughout the readout system to perform other functions. The input current at pin 9 of the column decoder stage is steered to only one of the ten column digital data outputs. When a display-skip signal is present (collector of Q1052 HI), pin 9 is pulled HI through CR1052. This ensures that no current is connected to the character generator stage under this condition. Notice the corresponding input on the row decoder. This input is connected to ground and causes one of the ten row outputs to saturate to ground.

Zeros Logic and Memory

The zeros logic and memory stage, U1060, stores data encoded by the plug-in units to provide zeros-adding and prefix-shifting logic for the readout system. The strobe pulse at pin 15 goes positive when the data has stabilized and can be inspected. This activates the zeros logic and memory stage so it can store the encoded data. A block representation of the memory sequence is shown in Fig. 3-10. If the plug-in unit encoded data from column 1, 2, 3, 4, or 10 agrees with row 3, the appropriate memory (or memories) is set.

If data is encoded, a negative-going output is produced at pin 7 as the memories are being set. This negative-going

pulse is connected to the base of Q1050 in the display-skip generator to produce a display-skip output. Since the information that is encoded is only provided to set the memories and not intended to be displayed on the crt at this time, the display-skip output prevents a readout display if this encoding occurs in time-slot 1.

During time-slot 5, memory A is interrogated. If information is stored in this memory, a positive-going output is produced at pin 7. This pulse is connected to pin 10 of the column decoder through Q1056 to add one unit of current at the input of the column decoder. This produces a zero after the character displayed on the crt during time-slot 4. During time-slot 6, memory B is interrogated to see if another zero should be added. If another zero is necessary, a second positive output is produced at pin 7, which again results in a column 1 output from the column decoder and a second zero in the crt display.

Finally, memory C is interrogated during time-slot 8, to obtain information on whether the prefix should be reduced or left at the value that was encoded. If data has been encoded that calls for a reduction in prefix, a negative-going output level is produced at pin 7. This negative level subtracts one unit of column current from the data at the input to the column decoder. Notice on the character selection matrix of Fig. 3-8 that a reduction of one column when row 4 is programmed results in a one unit reduction of the prefix. For example, with the 100 μ V program, if data was received from the plug-in calling for a reduction in prefix, the crt readout would be changed to 1 mV (zeros deleted by program; see Encoding the Data).

The 100 μ A of quiescent current through R1041, provided by Q1056 (see Display-Skip Generator), allows the prefix to be reduced from μ (200 μ A column current; column 2) to m (00 μ A column current; column 1). (Notice that if the prefix program is reduced from column 1 to column zero, the readout system does not display a character at this readout location.)

A further function of the zeros logic is the blank function. If ten units of column current are encoded along with two units of row current (row 3, column 10), the zero logic produces a negative-going output pulse at pin 1 of U1060. This pulse lasts until the end of time-slot 10. Pin 1 of U1060 is connected to the base of Q1018 through R1020. When turned on, Q1018 prevents the readout intensity current from reaching the Z-Axis amplifier.

The end-of-word signal from the time-slot counter is connected to pin 9 of U1060 through C1065. At the end of each word of readout information, this pulse goes LO. This erases the four memories in the zeros logic and memory in preparation for the data to be received from the next channel.

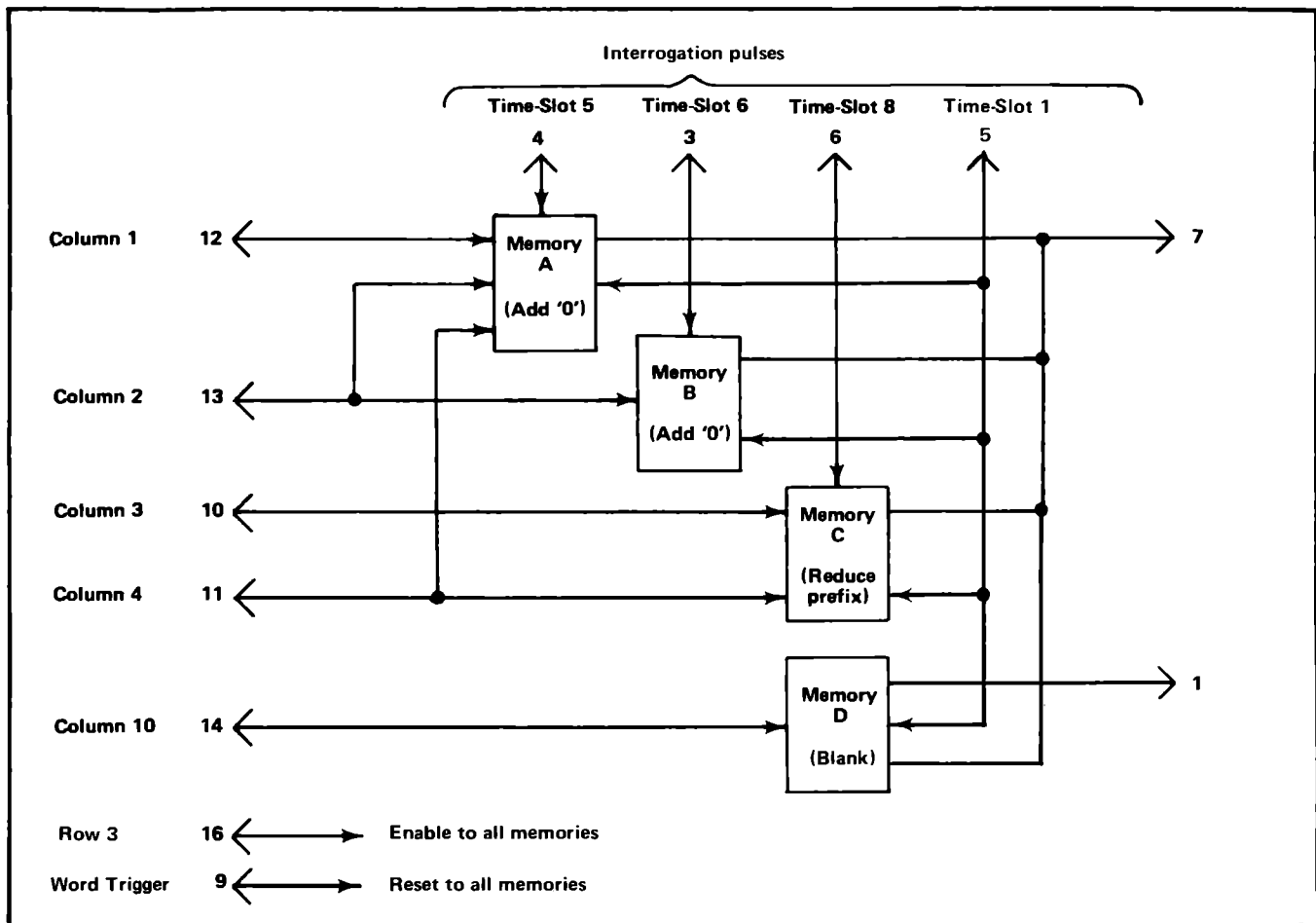


Fig. 3-10. Block representation of memory sequence in U1060.

Character Generators

The character generator stage consists of five similar integrated circuits, U1090-U1098, which generate the X (horizontal) and Y (vertical) outputs at pins 16 and 1, respectively, to produce the character displayed on the crt. Each integrated circuit can produce 10 individual characters. U1090, which is designated as the "numerals" character generator, can produce the numerals 0 through 9 shown in row 1 of the character selection matrix (Fig. 3-8). U1092 can produce the symbols shown in row 2 of the character selection matrix and U1094 produces the prefixes and some letters of the alphabet that are used as prefixes in row 4. U1096 and U1098 produce the remaining letters of the alphabet shown in rows 5 and 6 of the character selection matrix. All of the character-generator stages receive the column digital data from column decoder U1070 in parallel. However, only one of the character generators receives row data at a particular time and only the stage that receives both row and column data is activated. For example, if column 2 is encoded by a plug-in unit, the five character generators are enabled so that either a 1, <, μ , V, or N can be produced. However, if at the same time row 4 has also been

encoded by the plug-in unit, only the prefix character generator U1094 will produce an output, to result in a μ displayed on the screen. This integrated circuit provides current outputs to the format generator, which produce the selected character on the crt. In a similar manner, any of the 50 characters shown in the character selection matrix can be displayed by correct addressing of the row and column.

Decimal Point Logic and Character Position Counter

Decimal point logic and character position counter U1080 performs two functions. The first function is to produce a staircase current, which is added to the X (horizontal) signal to space the characters horizontally on the crt. After each character is generated the negative-going edge of the channel switch Off signal at pin 5 advances the character position counter. This produces a current step output at pin 3, which, when added to the X signal, causes the next character to be displayed one character space to the right. This stage can also be advanced when a space instruction is encoded by the plug-in unit, so that a space is left between

the displayed characters on the crt. Row 10 information from the row decoder is connected to pin 4 of U1080 through R1083. When row 10 and column 0 is encoded, the output of this stage advances one step to move the next character another space to the right. However, under this condition, no display is produced on the crt during this time-slot, since the character generators are not activated.

Time-slot pulses 1, 2, and 3 are also connected to pin 4 of U1080 through VR1080, VR1081, and VR1082, respectively, and R1088, R1082. This configuration adds a space to the displayed word during time-slots 1, 2, and 3 even if information is not encoded for display during these time-slots. With this feature, the information that is displayed during time-slot 4 (1-2-5 data) always starts in the fourth character position whether data has been displayed in the previous time-slots or not. Therefore, the resultant crt display does not shift position as normal/invert or cal/uncal information is encoded by the plug-in. The end-of-word pulse connected to pin 8 of U1080 through C1080 resets the character position counter to the first character position at the end of each word.

The decimal point logic portion of this stage allows decimal points to be added to the crt display as encoded by the plug-in units. When row 7 is encoded in coincidence with columns 3 through 7 (usually encoded during time-slot 1), a decimal point is placed at one of the five locations on the crt identified in row 7 of the character selection matrix (Fig. 3-8). This instruction refers to the decimal point location in relation to the total number of characters that can be displayed on the crt (see Fig. 3-11). For example, if column 3 and row 7 are encoded during time-slot 1, the system is instructed to place a decimal point in location No. 3. As shown in Fig. 3-11, this displays a decimal point before the third character that can be displayed on the crt (first three time-slots produce a space whether data is encoded or not; see previous paragraph). The simultaneous application of row 7 data to the Y-input of the format generator through R1080 raises the decimal point so it appears between the displayed characters.

When decimal-point data is encoded, the crt is unblanked so a readout display is presented. However, since row 7 does not activate any of the five character generators, the crt beam is not deflected, but instead remains in a fixed position to display a decimal point between the character along the bottom line of the readout word. After the decimal point is produced in the addressed location, the crt beam returns to the location indicated by the character position counter to produce the remainder of the display.

Format Generator

The X and Y deflection signals, produced by the character generator stage, are connected to pins 2 and 7, respectively, of format generator U1100. The word address code from the word counter is also connected to pins 1, 8, and 15 of this stage. The word address code directs the format generator to add current to the X and Y signals to deflect

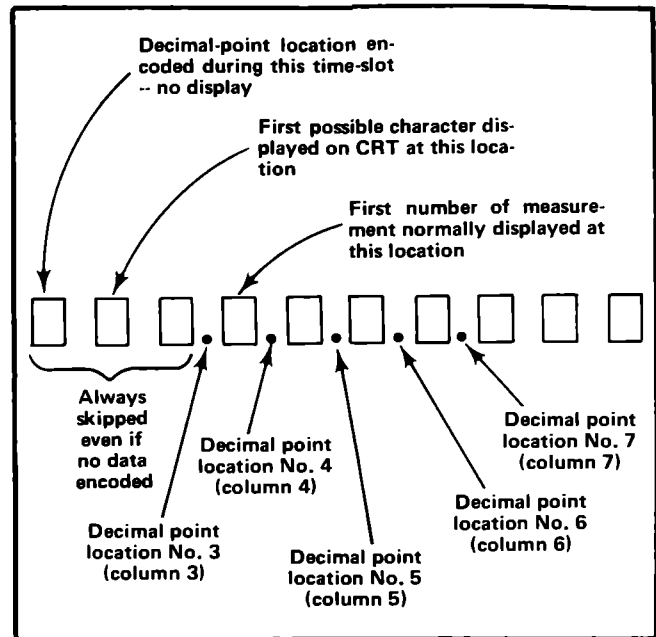


Fig. 3-11. Readout word relating 10 possible character locations to the decimal point instructions that can be encoded, and the resultant crt display.

the crt beam to the area of the crt that is associated with the plug-in channel that originated the information (see Fig. 3-3).

In addition, the character position current from the decimal point logic and character position stage is added to the X (horizontal) input signal to space the characters horizontally on the crt (see previous discussion). The channel switch Off signal at pin 13 activates this stage when a character is to be displayed on the crt. The vertical spacing adjustment, R118, sets the separation between the upper and lower readout displays.

Y-Output Amplifier

The Y-output signal at pin 6 of U1100 is connected to the Y-output amplifier, Q1100. This stage provides a low impedance load for the format generator while providing isolation between the readout system and the vertical amplifier.

X-Output Amplifier

The X-output amplifier, Q1110, operates similarly to the Y-output amplifier. It provides the horizontal deflection from the readout signal available at pin 4 of U1100. Horizontal position is controlled by R1110, which changes the emitter current of Q1110.

Horizontal channel switch U1130 normally passes signals from the horizontal plug-in connector to the horizontal amplifier with unit gain. When the channel switch Off signal is generated by timer U1000, the channel switch substitutes the horizontal readout signal for the horizontal plug-in connector signal.

PERFORMANCE CHECK AND ADJUSTMENT

Introduction

This section contains information necessary to perform a complete instrument performance check and adjustment. Limits given in the procedure are adjustment guides and should not be interpreted as performance requirements unless preceded by a check mark (✓). Where possible, instrument performance is checked before an adjustment is made.

PRELIMINARY INFORMATION

Adjustment Interval

To maintain instrument accuracy, check the performance of the 5441 every 1000 hours of operation, or every six months if used infrequently. Before complete adjustment, thoroughly clean and inspect this instrument as outlined in Section 5, Maintenance.

Tektronix Field Service

Tektronix Field Service Centers and the Factory Service Centers provide instrument repair and adjustment services. Contact your Tektronix Field Office or representative for further information.

Using This Procedure

This Performance Check and Adjustment procedure can be used for a complete adjustment procedure or as a check of the instrument's performance. Completion of each step in the procedure ensures that the instrument is correctly adjusted and operating within specified limits. Refer to the following discussion for instructions on a complete or partial check and adjustment.

Performance Check. Instrument performance can be checked by performing the complete Performance Check and Adjustment procedure and omitting only the ADJUST part of the steps. A check mark (✓) preceding a CHECK indicates that the limit given is a performance requirement specified in Section 1, Specification.

Adjustment. Completion of each step in the Performance Check and Adjustment procedure ensures that the

instrument is correctly adjusted and performing within specified limits. For best overall performance when performing the complete adjustment procedure, make each adjustment to the exact setting indicated.

Partial Procedures. The following procedure is written to completely check and adjust the instrument to the Performance Requirements listed in Section 1, Specification. If the applications for which the instrument is used do not require the full available performance, the procedures and the required equipment list can be shortened accordingly.

A partial performance check and adjustment may be desirable after replacing components, or to touch up the adjustment of a portion of the instrument. To check or adjust only part of the instrument, refer to the Equipment Required list that precedes the portion of the procedure to be performed. To avoid unnecessary adjustment of other parts, adjust only if the tolerance given in each CHECK is not met.

NOTE

Titles for external controls of the 5441 are capitalized in this procedure (e.g., GRAT ILLUM, POWER). Internal adjustments are initial capitalized only (e.g., Crt Grid Bias, Vertical Centering).

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1 is required for a complete performance check and adjustment of this instrument. The specifications given in Table 4-1 for test equipment are the minimum required to meet the Performance Requirements listed in Section 1, Specification. Detailed operating instructions for test equipment are omitted in this procedure. Refer to the test equipment instruction manual if more information is needed.

Special Fixtures

Special fixtures are used only where they facilitate instrument adjustment. These fixtures are available from Tektronix, Inc.; order by part number from Tektronix Field Offices or representatives.

Test Equipment Alternatives

The test equipment listed in the Examples of applicable test equipment column, Table 4-1, is required to check and adjust this instrument. The Performance Check and Adjustment procedure is based on the first item of equipment given as an example. If other equipment is substituted, control settings or setups may need to be altered. If the exact item or equipment given as an example is not available, refer to the Performance Requirements column to determine if other equipment may be substituted. Then check the Application column. If you determine that your measurement require-

ments will not be affected, the item and corresponding step(s) can be deleted.

Signal Connections

Detailed signal-connection information is not provided except when critical for a particular test. Rear-panel output connectors should be connected to other equipment with 50 Ω bnc cables. When simultaneously connecting a signal to two inputs, use a bnc T connector. For test equipment signal-connection and termination information, refer to the test equipment instruction manuals.

Table 4-1
LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Examples
Oscilloscope	Bandwidth dc to 1 MHz; minimum deflection factor, 1 mV/div; sweep rate, 1 ms/div.	LV power supply ripple check.	TEKTRONIX 5110, 5A13N, 5B10N.
Digital Multimeter	Range, zero to 200 volts; accuracy, within 0.1%.	LV power supply check and adjustment.	TEKTRONIX DM 501 Digital Multimeter. ²
Dc voltmeter (vom) w/test leads	Range, zero to 3000 volts; accuracy, checked to within 1% at 3000 volts.	HV power supply check.	Valhalla Model 4500 HV Digital Multimeter Tektronix Part No. 003-0120-00 test leads
Calibration Generator	Amplitude calibration, 10 mV to 1 V; accuracy, $\pm 0.25\%$ into 1 M Ω output, square wave at approximately 1 kHz.	Vertical and horizontal gain check and adjustment.	TEKTRONIX PG 506 Calibration Generator. ²
Time-mark generator	Marker outputs, 5 ns and 10 ns; accuracy, within 1%.	Sweep timing checks and adjustment at 10 ns.	TEKTRONIX TG 501 Time-Mark Generator. ²
Pulse Generator	Pulse duration, 10 ns or less; pulse amplitude, .5 V to at least 5 V into 50 Ω load.	Vertical compensation check and adjustment.	TEKTRONIX PG 501 Pulse Generator. ²
Medium-frequency signal generator	Sine-wave output, to at least 50 MHz, leveled; output amplitude 5 V p-p; accuracy, 2%.	Vertical bandwidth check.	TEKTRONIX SG 503 Signal Generator. ²
Amplifier plug-in unit ³	Bandwidth, dc to 50 MHz; display mode, CH 1 and dual-trace; deflection factor, 5 mV to 10 V/div.	Vertical and horizontal gain check and adjustment.	TEKTRONIX 5A48 Amplifier plug-in unit.
Time-base unit	Sweep rate, at least 10 ns/div.	Sweep timing check and adjustment. Use to provide sweep throughout procedure.	TEKTRONIX 5B42 Time-Base unit.
Calibration fixture (Pulser)	Produces gain-check and pulse-response waveforms.	Focus and Astigmatism adjustment. Vertical and horizontal gain check and adjustment.	TEKTRONIX Calibration Fixture 067-0680-00.

Table 4-1 (cont)

Description	Performance Requirements	Application	Examples
Coaxial cable (2 required)	Impedance, 50 Ω ; length, 42 inches; connectors, bnc.	Provides signal interconnection.	Tektronix Part No. 012-0057-01.
1X passive probe	Compatible with 5A-series amplifiers used in the oscilloscope.	Calibrator signal check.	TEKTRONIX P6028 Probe.
Termination	Impedance, 50 Ω ; accuracy, within 2%; connectors, bnc.	Vertical check and adjustment.	Tektronix Part No. 011-0049-01.
T connector	Connectors, bnc.	External Z-axis amplifier check.	Tektronix Part No. 103-0030-00.
Screwdriver	3-inch shaft, 3/32 inch bit.	Adjustments.	Xcelite R3323.

¹Required only for Adjustment procedure.

²Requires TM 500-Series Power Module.

³Additional amplifier, such as 5A24N, required to check dual amplifier operation.

Preliminary Procedure

1. Ensure that the line voltage selector block has been installed on the correct line selector pins on the Low Voltage and Calibrator circuit board and that the regulating range includes the applied line voltage. Refer to the Operating Voltage section of this manual.

2. Ensure that all test equipment is suitably adapted to the applied line voltage.

3. If applicable, install the TM 500-series test equipment into the test equipment power module.

4. Install a vertical amplifier unit into the left vertical compartment of the 5441.

5. Install a time-base unit in the horizontal compartment of the 5441.

6. Connect the equipment under test and the test equipment to a suitable line voltage source. Turn all equipment on and allow at least 20 minutes for the equipment to stabilize.

PERFORMANCE CHECK

A. DISPLAY & STORAGE

Equipment Required

Time-base unit
Amplifier unit

Install Plug-in Units

Install the amplifier unit in the vertical compartment and the time-base unit in the horizontal compartment.

Initial Control Settings

Set the following controls during warm-up time:

5441 Oscilloscope

INTENSITY, FOCUS Set for well-defined trace and normal brightness.

Amplifier Unit

Display	On
Position	Centered
CH 1 Volts/Div	.1
CH 1 Cal	Fully clockwise
CH 1 Input coupling	Dc
Trigger	CH 1
Mode	CH 1

Time Base Unit

Display	Alt
Position	Centered
Main Sec/Div	1 ms
Main Variable	Cal
Swp Mag	Off
Main Triggering	+ Slope
	Auto Trig
	AC Coupl
Trig Source	Left

1. Check Trace Alignment

a. Position the horizontal trace over the center horizontal graticule line.

b. CHECK—For alignment error of 0.1 div or less.

c. Press the POWER switch to turn off the oscilloscope.

d. Interchange the amplifier and time-base units in their respective compartments. Pull the POWER switch to on.

e. Position the vertical trace over the center vertical graticule line.

f. CHECK—For alignment error of 0.1 div or less.

2. Check Geometry

a. Set the FOCUS and INTENSITY controls for a well-defined trace, extending vertically above and below the graticule line.

✓ b. CHECK—Vertical bowing and tilt of the trace display is less than 0.1 division when positioned horizontally across the entire graticule line.

c. Press the POWER switch to turn off the oscilloscope and interchange the amplifier and time-base units.

d. Pull the POWER switch to on.

3. Check Beam Finder

a. Press the BEAM FINDER switch.

b. CHECK—The display is compressed within the graticule area and is intensified.

c. Press and hold the BEAM FINDER switch in, then rotate the Position control of the vertical amplifier and the time-base unit fully clockwise and counterclockwise.

d. CHECK—The display is compressed within the graticule area and is intensified.

4. Check Storage Operation

a. Set the WRITING SPEED and VARIABLE PERSIST controls fully clockwise. Adjust the INTENSITY and FOCUS for the brightest trace without blooming.

b. Set the vertical amplifier Volts/Div to 1, and Mode to CH 1.

c. Set the horizontal time-base, Main Sec/Div to $.2 \mu\text{s}$ and Trig Source to Line. Adjust the Main Trig Level to center.

d. Position the trace off the top of the screen, and push in the STORE button.

e. Position the trace down across the screen and off the bottom.

✓ f. CHECK—For stored traces on the screen, and that they remain for at least 15 seconds.

g. Set the WRITING SPEED counterclockwise and push the ERASE button. Also, set the time-base Main Sec/Div to $1 \mu\text{s}$.

h. Position the trace across the screen and off the top. Then turn the WRITING SPEED clockwise until the traces are visible.

✓ i. CHECK—That the stored traces remain at least 1 minute.

B.TRIGGER

Equipment Required

Time-base unit	42 inch bnc cable
Amplifier unit	50 Ω terminator
Medium-frequency signal generator	

1. Check Trigger Amplifier

a. Connect a 50 MHz sine-wave signal from the Medium Frequency (MF) signal generator to the vertical amplifier input, using a 42 inch bnc cable and a 50 Ω termination.

b. Set the vertical amplifier and generator controls to obtain a signal amplitude of one major division.

c. Set the time-base unit for 20 ns/div (Swp Mag on) and adjust the trig level control for a stable display.

d. CHECK—That a stable display can be obtained.

e. Press the POWER switch to turn off the oscilloscope and change the amplifier from the left vertical compartment to the center compartment.

f. Pull the POWER switch to on, select the right trigger source, and repeat parts b through d of this step.

g. Disconnect the bnc cable and termination from the vertical amplifier input connector and release the Swp Mag pushbutton.

C. LOGIC

Equipment Required

Time-base unit
Amplifier units (2)

1. Check Alternate Operation

- a. Push both CH 1 and CH 2 Mode pushbuttons in.
- b. Set the time-base unit for 10 ms/div and position the traces about two divisions apart.
- c. Turn the time-base Sec/Div switch throughout its range.
- ✓ d. CHECK—Trace alternation at all sweep rates (except AMP position). At faster sweep rates, alternation is not apparent; instead, display appears as two traces on the screen.
- e. Press the POWER switch to turn off the oscilloscope and change the amplifier from the center vertical compartment to the left compartment.
- f. Pull the POWER switch on and repeat parts a through d of this step.

2. Check Chop Operation

- a. Push the Chop button in on the time-base unit.
- b. Turn the time-base Sec/Div switch throughout its range.

✓ c. CHECK—For dual-trace display at all sweep rates, without alternation (except Amp position).

d. Press the POWER switch to turn off the oscilloscope and change the amplifier from the left vertical compartment to the center compartment.

e. Pull the POWER switch to on and repeat parts a, b, and c of this step.

3. Check Alternate Operation Between Amplifiers

- a. Install a second vertical dual-trace plug-in unit in the left plug-in compartment and set its controls for dual-trace operation.
- b. Set the time-base Chop pushbutton to its out position and the Sec/Div switch to 20 ms/div.
- c. CHECK—For two traces for the left amplifier (one for each channel), then two traces for the center amplifier, alternately. (If a single-channel amplifier is used instead of the second dual-trace amplifier, the single-channel trace will appear twice for each alternation.)
- d. Press the POWER switch to turn off the oscilloscope and interchange the two vertical amplifiers in their respective compartments. Remove the vertical amplifier from the center compartment. Pull the POWER switch to on.

D. VERTICAL

Equipment Required

Time-base unit	42 inch bnc cable
Amplifier unit	50 Ω termination
Pulse generator	Calibration generator
Medium-frequency signal generator	

NOTE

The 5A48 is used for the vertical system performance procedure. When a different amplifier plug-in is used to verify vertical specifications, the oscilloscope system frequency response may be degraded.

1. Check Vertical Gain

a. Connect a 1 kHz square-wave signal from the calibration generator to the amplifier input, using a 42-inch bnc cable. Set the time-base Sec/Div to 1 ms.

b. Set the amplifier and generator controls to obtain a five-volt reference signal. Center the display.

c. CHECK—The crt display for a vertical deflection of 5 div, ± 0.15 div ($\pm 3\%$).

d. Press the POWER switch to turn off the oscilloscope, and remove the amplifier from the left vertical compartment and install it in the center compartment. Pull the POWER switch to on.

e. CHECK—The crt display for a vertical deflection of 5 div, ± 0.15 div ($\pm 3\%$).

f. Disconnect the bnc cable from the 5A48 input connector.

2. Check Vertical Compensation

a. Set the amplifier CH 1 Volts/Div switch to .1. Connect the pulse generator to the CH 1 input connector with the 42 inch cable and a 50 Ω termination.

b. Set the time-base unit for a calibrated sweep rate of 20 ns/div and triggering for auto mode, ac coupled, and Right Trig Source. Adjust the trigger level control for a stable display, triggered on the rising portion of a 1 MHz pulse. Center the pulse horizontally on the graticule.

✓ c. CHECK—For optimum square leading corner and flat top on a 5-div displayed pulse with aberrations not to exceed +0.2 or –0.2 div, with total peak-to-peak aberrations not to exceed 0.2 div.

d. Press the POWER switch to turn off the oscilloscope and install the amplifier in the left compartment. Pull the POWER switch to on.

e. Push in the Left Trig Source button. Adjust the trigger level control for a stable display, triggered on the rising portion of the pulse. Center the pulse horizontally on the graticule.

✓ f. CHECK—For optimum square leading corner and flat top on a 5-div displayed pulse with aberrations not to exceed +0.2 or –0.2 div, with total peak-to-peak aberrations not to exceed 0.2 div.

3. Check Vertical Bandwidth

a. Disconnect the bnc cable from the pulse generator and connect it to the output connector of the MF signal generator.

b. Set the amplifier Volts/Div switch to .1 and adjust the MF signal generator controls for a 6-div display, at the frequency of 50 kHz. Center the display on the graticule.

c. Set the time-base unit for a sweep rate of 10 μ S/div.

d. Without changing the output amplitude, increase the generator frequency until the displayed amplitude is reduced to 4.2 div.

✓ e. CHECK—The generator for a reading of at least 50 MHz.

f. Press the POWER switch to turn off the oscilloscope and install the amplifier in the center compartment. Pull the POWER switch to on.

h. Disconnect the bnc cable and termination from the amplifier input connector.

g. Repeat parts b through e for the center vertical compartment.

E. HORIZONTAL

Equipment Required

Time-base unit
 Amplifier unit
 Pulse generator
 Medium-frequency signal generator

Time-mark generator
 42 inch bnc cable
 50 Ω termination
 Calibration generator

NOTE

The 5A48 amplifier is used for the horizontal system adjustment procedure. When a different amplifier plug-in is used to verify horizontal specifications, the amplifier frequency must be considered.

1. Check Horizontal Gain

a. Press the POWER switch to turn off the oscilloscope and interchange the amplifier and the time-base units in their respective compartments. Pull the POWER switch to on.

b. Connect a 1 kHz square-wave signal from the calibration generator to the amplifier input connector, using a 42 inch bnc cable.

c. Set the amplifier and generator controls to obtain a five-volt reference signal. Center the display between the second and seventh vertical graticule lines.

d. CHECK—The crt display for a horizontal deflection of 5 div, ± 0.15 div.

e. Disconnect the bnc cable from the amplifier input connector.

2. Check Horizontal Bandwidth

a. Connect a 50 kHz sine-wave signal from the MF signal generator to the amplifier input, using a 42 inch bnc cable and 50 Ω termination.

b. Set the amplifier and generator controls to obtain a 6-div display. Center the display between the second and eighth vertical graticule lines.

c. Without changing the output amplitude, increase the generator frequency until the displayed amplitude is reduced to 4.2 div.

✓ d. CHECK—The generator for a reading of at least 2 MHz.

e. Press the POWER switch to turn off the oscilloscope, and interchange the amplifier and the time-base units in their respective compartments. Pull the POWER switch to on.

3. Check 10 ns Timing

NOTE

A 5B42 time-base or a time-base having a 10 ns sweep must be used.

a. Disconnect the bnc cable and 50 Ω termination from the amplifier input connector and connect the time-mark generator signal to the input connector.

b. Set the time-mark generator for 10 ns markers. Set the deflection factor of the amplifier so the markers are at least five divisions in amplitude.

c. Set the time-base unit for a sweep rate of 10 ns/div. Adjust the time-base triggering control for a stable display.

d. CHECK—For one 10 ns marker per division over the center eight graticule divisions of the display (position as necessary). Sweep accuracy is $\pm 5\%$ over the entire sweep, excluding the first 30 and the last 100 ns of the magnified sweep.

4. Check 5 ns Timing

a. Set the time-mark generator for 5 ns markers.

b. Adjust the time-base triggering control for a stable display.

c. CHECK—For two 5 ns markers per division over the center eight graticule divisions of the display (position as necessary). Sweep accuracy is $\pm 6\%$ over the entire sweep, excluding the first 30 and the last 100 ns of the magnified sweep.

d. Disconnect all cables.

F. READOUT

Equipment Required

Time-base unit
Amplifier unit

NOTE

If the Readout System was deleted from the instrument (Option 01), omit this procedure.

Check Readout Modes

- a. Set the time-base unit for a free-running sweep.
- b. Set the READOUT INTENS control for a visible read-out display.
- c. Select dual-trace operation on the amplifier.
- d. CHECK—That the characters are displayed at the top and bottom of the crt. Characters do not touch or overlap and they correlate to the respective volts/div dial settings.
- e. Rotate both the CH 1 and the CH 2 Cal controls counterclockwise.
- f. CHECK—That a > symbol is displayed at the left of the readout character. Return the Cal controls to the calibrated position (fully clockwise).
- g. Rotate the time-base Main Sec/Div control throughout its range.
- h. CHECK—That the characters are displayed at the top-center of the crt. Characters do not touch or overlap and they correlate to the respective s/div dial settings.
- i. Rotate the Main Variable control counterclockwise.
- j. CHECK—That a > symbol is displayed at the left of the readout character. Return the control the calibrated position (fully clockwise).
- k. Push the Dly'd Swp pushbutton in on the time-base unit.
- l. CHECK—That characters are displayed at the top-right of the crt and that characters do not touch or overlap and they correlate to the dly'd swp s/div dial settings.
- m. Push the Display Mode button to Main Swp.

G. Z-AXIS

Equipment Required

Time-base unit	42 inch bnc cable
Amplifier unit	bnc T connector
Medium-frequency signal generator	

Check Z-Axis Amplifier

- a. Connect a 50 kHz sine-wave signal from the generator to the amplifier input connector (use a bnc T connector at the amplifier input) using a 42 inch bnc cable.
- b. Set the amplifier and generator controls to obtain a calibrated five volt reference display.
- c. Set the time-base unit for auto, internal triggering at a sweep rate of 10 μ S/div.
- d. Connect the signal from the output of the T connector at the amplifier input to the EXT INTENSITY INPUT connector on the rear panel.
- e. CHECK—The bottom portion of the waveform is blanked out (reduce trace brightness to observe Z axis modulation).

H. CALIBRATOR

Equipment Required

Time-base unit
Amplifier unit
1X Probe

Check Calibrator Signal

a. Connect the 1X probe to the CH 1 input of the amplifier. Connect the probe tip to the calibrator loop.

b. Set the amplifier CH 1 Volts/Div switch to .1, and select CH 1.

c. Set the time-base sweep rate to 10 ns/div.

✓ d. CHECK—The crt display for a vertical deflection of 4 div, ± 0.04 div.

e. Disconnect the 1X probe.

f. Turn off all equipment and remove all plug-ins and cables.

This completes the Performance Check of the 5441 Oscilloscope.

ADJUSTMENT

A. POWER SUPPLY AND CALIBRATOR

Equipment Required

Time-base unit
Amplifier unit
Digital voltmeter

Dc voltmeter w/test leads (HV test)
Screwdriver

Install Plug-in Units

Install an amplifier unit in the left vertical compartment and the time-base unit in the horizontal compartment.

Control Settings

5441 Oscilloscope

INTENSITY	Counterclockwise (off)
FOCUS	Midrange
GRAT ILLUM	As desired
READOUT INTENS	Midrange
POWER	On

1. Adjust -30 V Power Supply

a. Remove the bottom dust cover of the 5441 to gain access to the LV power supply circuit board.

b. Connect the digital voltmeter between the -30 V test point on the LV power supply circuit board and chassis ground. See Fig. 4-1 for voltage test point locations.

c. CHECK—For a meter reading of -29.925 V to -30.075 V.

NOTE

If the -30 V supply is within the specified tolerance, proceed with step 2. If the -30 V adjustment is to be made, all circuits will be affected and the entire power supply adjustment procedure should be performed to verify the accuracy of the supplies.

d. ADJUST—-30 Adj R950 for a meter reading of -30 V. See Fig. 4-1 for the adjustment location.

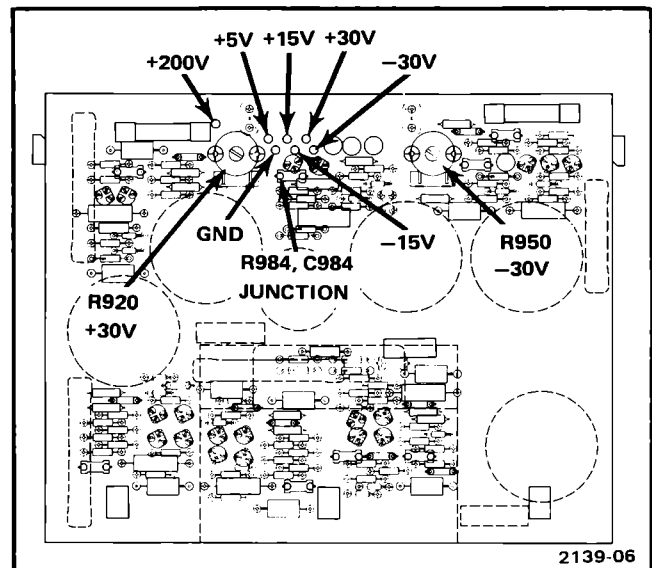


Fig. 4-1. Location of power supply test points and -30 V and +30 V adjustments.

2. Adjust +30 V Power Supply

a. Connect the digital voltmeter between the +30 V test point on the LV power supply circuit board and chassis ground. See Fig. 4-1 for the voltage test point location.

b. CHECK—For a meter reading of +29.925 V to +30.075 V.

NOTE

If the +30 V supply is within the specified tolerance, proceed with step 3. If the +30 V adjustment is to be made, all circuits will be affected and the entire power supply adjustment procedure should be performed to verify the accuracy of the supplies.

c. ADJUST—+30 Adj R920 for a meter reading of exactly +30 V. See Fig. 4-1 for adjustment location.

3. Check Remaining Power Supply Voltages

a. CHECK—Each supply with the digital voltmeter to ensure that all output voltages are within the limits given in Table 4-2. See Fig. 4-1 for voltage test point locations.

Table 4-2
POWER SUPPLY VOLTAGE, TOLERANCES, AND RIPPLE

Supply	Tolerance	Typical 120 Hz Ripple (P-P)
−30 V	−29.925 V to −30.075 V	2 mV or less
−15 V	−14.85 V to −15.15 V	2 mV or less
+5 V	+4.9 V to +5.1 V	2 mV or less
+15 V	+14.85 V to +15.15 V	2 mV or less
+30 V	+29.925 V to +30.075 V	2 mV or less
+200 V	+180 V to +240 V	2 V or less

NOTE

Ripple and regulation of the individual supplies can be checked using the procedure given under Troubleshooting Techniques in the Maintenance section of this manual.

b. Disconnect the digital voltmeter.

4. Check Calibrator Output Voltage

a. Connect the digital voltmeter between the CALIBRATOR current loop and a ground test point. See Fig. 4-1 for ground test point location.

b. Apply a ground connection (short circuit) between the junction of R984 and C984 and a ground test point on the low-voltage and calibrator board. See Fig. 4-1 for the junction and ground test point location.

c. CHECK—For a meter reading of +396 mV to +404 mV.

d. Disconnect the short circuit from the junction and the ground test point.

e. Disconnect the digital voltmeter

5. Check High-Voltage Power Supply

a. Press the POWER switch to turn off the oscilloscope.

b. Remove the time-base unit from the horizontal compartment and insert the vertical amplifier into the compartment.

c. Remove the three 4-40 screws securing the HV cover to the High Voltage circuit board assembly, and remove the cover.

d. Set the dc voltmeter (vom) to measure at least −1500 V dc and connect it between the HV Test Point and chassis ground. See Fig. 4-2 for the test point location.

e. Pull the POWER switch to turn on the oscilloscope.

f. CHECK—For a meter reading of −1500 V dc, $\pm 2\%$.

g. Press the POWER switch to turn off the oscilloscope before disconnecting the voltmeter.

h. Disconnect the dc voltmeter and replace the HV cover, reversing the procedure given in part c of this step.

i. Pull the POWER switch to turn on the oscilloscope.



An insulated screwdriver must be used to adjust variable components on the HV board, to prevent shorting voltages to ground and damaging the instrument.

6. Adjust Intensity Range

a. Turn the INTENSITY control slowly clockwise and check for a visible spot display. Note that the spot appears when the control is between its 8 and 11 o'clock positions. If the spot appears before or after the given control position, proceed with part b of this step.

b. Turn the INTENSITY control fully counterclockwise.

c. ADJUST—Intensity Range R435 so the spot is just extinguished. See Fig. 4-2 for the adjustment location.

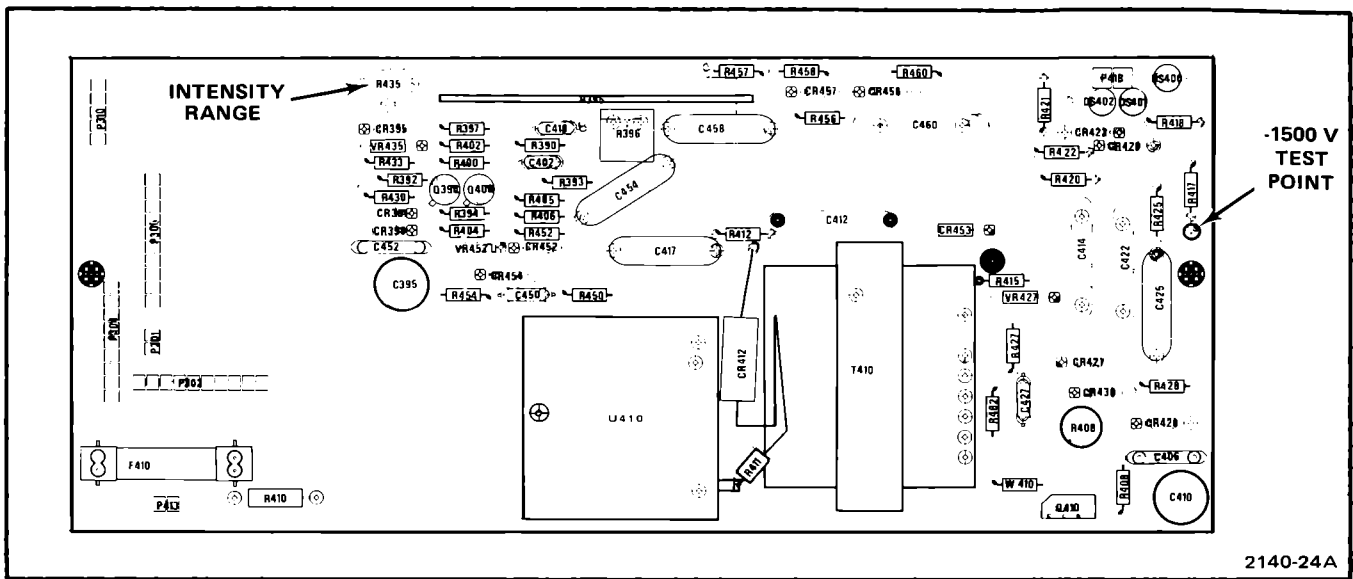


Fig. 4-2. Location of Intensity Range and HV test point on High Voltage assembly. (Board shown with cover removed.)

- d. Repeat part a of this step.
- e. Press the POWER switch to turn off the oscilloscope. Install the time-base unit in the horizontal compartment and a pulser in the vertical compartment.

B. CRT DISPLAY

Equipment Required

Time-Base unit
Amplifier unit

067-0680-00 Calibration Fixture (Pulser)
Screwdriver

Control Settings

5441 Oscilloscope

INTENSITY	Midrange
FOCUS	Midrange
GRAT ILLUM	Midrange
READOUT INTENS	Midrange
POWER	On

Time-Base Unit

Main Triggering	+ Slope Auto Trig
Trig Source	Left
Position	As Desired
Swp Mag	X1
Main Sec/Div	1 ms
Display Mode	Main Swp

Pulser

Vert or Horiz	+ Step Response
REP RATE	1 MHz
AMPLITUDE	Fully counterclockwise

1. Adjust Focus and Astigmatism

- Set the INTENSITY control for a normal viewing level.
- Set the time-base Main Sec/Div switch to Amp (fully counterclockwise).
- Preset the Auto Focus Bias (R306) and Auto Focus Gain (R304) adjustments counterclockwise (see Fig. 4-3).
- ADJUST—The Focus Preset (R396) on the HV board, and the Astigmatism (R370) on the Horizontal board for the smallest round dot possible (see Fig. 4-3).
- Set the Main Sec/Div to $.1 \mu\text{sec}$.
- Set the Amplitude fully clockwise and position the top of the trace to the center of the screen.

g. Set the front-panel INTENSITY control to 10:00 and adjust the Main Trig Level to trigger the trace.

h. ADJUST—the Auto Focus Bias (R306) fully clockwise. The trace should defocus.

i. ADJUST—R306 counterclockwise until the trace just comes into focus.

j. Set the front-panel INTENSITY control to 3:00.

k. ADJUST—the Auto Focus Gain (R304) clockwise until the trace just focuses.

l. Return the front-panel INTENSITY control to the normal viewing level.

m. Remove the Pulser and install the amplifier unit.

n. Set the input coupling to DC, MODE to CH 1 and Trigger to CH 1.

o. Set the time-base Main Sec/Div to 1 ms.

2. Adjust Trace Alignment

- Position the trace to center horizontal graticule line.
- CHECK—That the trace is aligned with the center horizontal graticule line.
- ADJUST—ROTATION (Trace) R375 to align the trace with the center horizontal graticule line (located on rear panel).
- Press the POWER switch to turn off the oscilloscope.

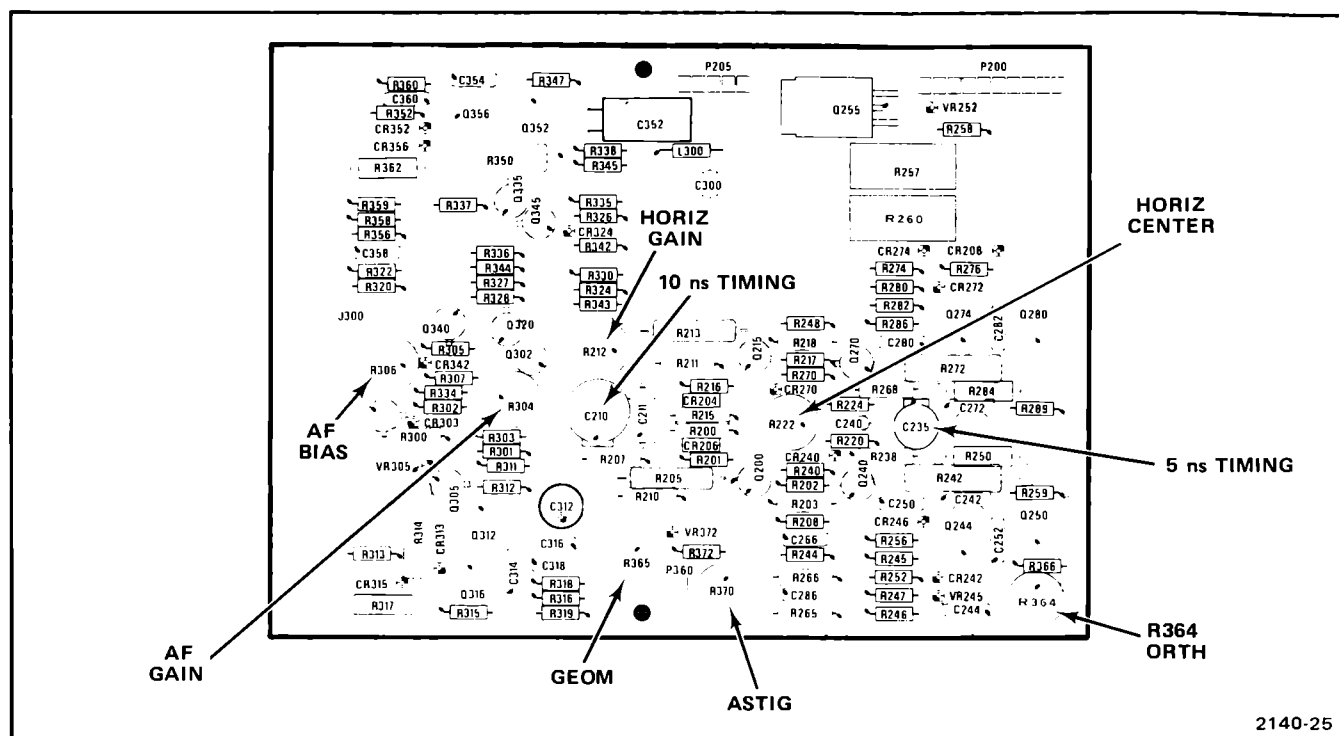


Fig. 4-3. Location of Geom, Astig, Orth, and crt display adjustments (Horizontal circuit board).

3. Adjust Geometry and Orthogonality

a. Remove the time-base unit from the right horizontal compartment and install it in the center vertical compartment.

b. Remove the vertical amplifier unit from the left vertical compartment and install it in the right horizontal compartment.

c. Pull the POWER switch to turn on the oscilloscope.

d. Set the FOCUS and INTENSITY controls for a well-defined trace, extending vertically above and below the graticule area.

e. CHECK—Vertical bowing and tilt of the trace display is less than .1 div when positioned horizontally across the entire graticule area.

f. ADJUST—Y-axis alignment (orthogonality) R364 for minimum tilt (see Fig. 4-3).

g. ADJUST—Geom R365 for minimum bowing or tilt of the trace display at the left and right edges of the graticule. Adjustment may have to be compromised to obtain less than .1 graticule division bowing and tilt everywhere within the graticule area. (See Fig. 4-3 for adjustment location.)

h. CHECK—That the focus at the edges and corners of the screen are similar to the focus at the center.

i. Press the POWER switch to turn off the oscilloscope. Install the vertical amplifier unit and time-base unit in their respective compartments.

C. STORAGE

Equipment Required

Time-base unit
Amplifier unit
Screwdriver

Control Settings

5441 Oscilloscope

INTENSITY	Counterclockwise
FOCUS	Midrange
GRAT ILLUM	Midrange
READOUT INTENS	Off
POWER	On
WRITING SPEED	Fully clockwise
PERSIST	Fully clockwise

Amplifier Unit

Position	Midrange
Input coupling	dc
Mode	CH 1
Trigger	CH 1
CH 1 Volts/Div	1 V

Time-Base Unit

Main Triggering	Auto Trig
Trig Source	Line
Position	Midrange
Mag	X1
Main Sec/Div	.2 μ sec
Display mode	Main Swp

1. Preset Storage Adjustments

- a. R590 OP Level to 10:00.
R572 Prep Level to 10:00
R655 CE1 to 6:00
R600 CE3 to 6:00

(Located on Storage board, see Fig. 4-4.)

- b. Push the STORE button in.

2. Check Erase

- a. Push the ERASE button.
- b. CHECK—for one flash.

- c. Push and hold the ERASE button in.

- d. CHECK—for repetitive flashes.

- e. Release the ERASE button.

3. Adjust Storage Levels

- a. ADJUST—CE1 and CE3 to fully and evenly flood the screen.

- b. Alternate pushing ERASE and turning the Op Level counterclockwise until the screen fades to a barely visible glow.

- c. Alternate pushing ERASE and turning the Prep Level counterclockwise until the screen brightens to a uniform glow.

4. Check Screen and Target

- a. Push ERASE.
- b. CHECK—that there are no stored traces present.
- c. CHECK—that the screen does not flicker.
- d. CHECK—crt for spots and any other target defects.
- e. Turn WRITING SPEED fully counterclockwise.
- f. CHECK—for no background glow.
- g. Turn WRITING SPEED clockwise and release STORE.

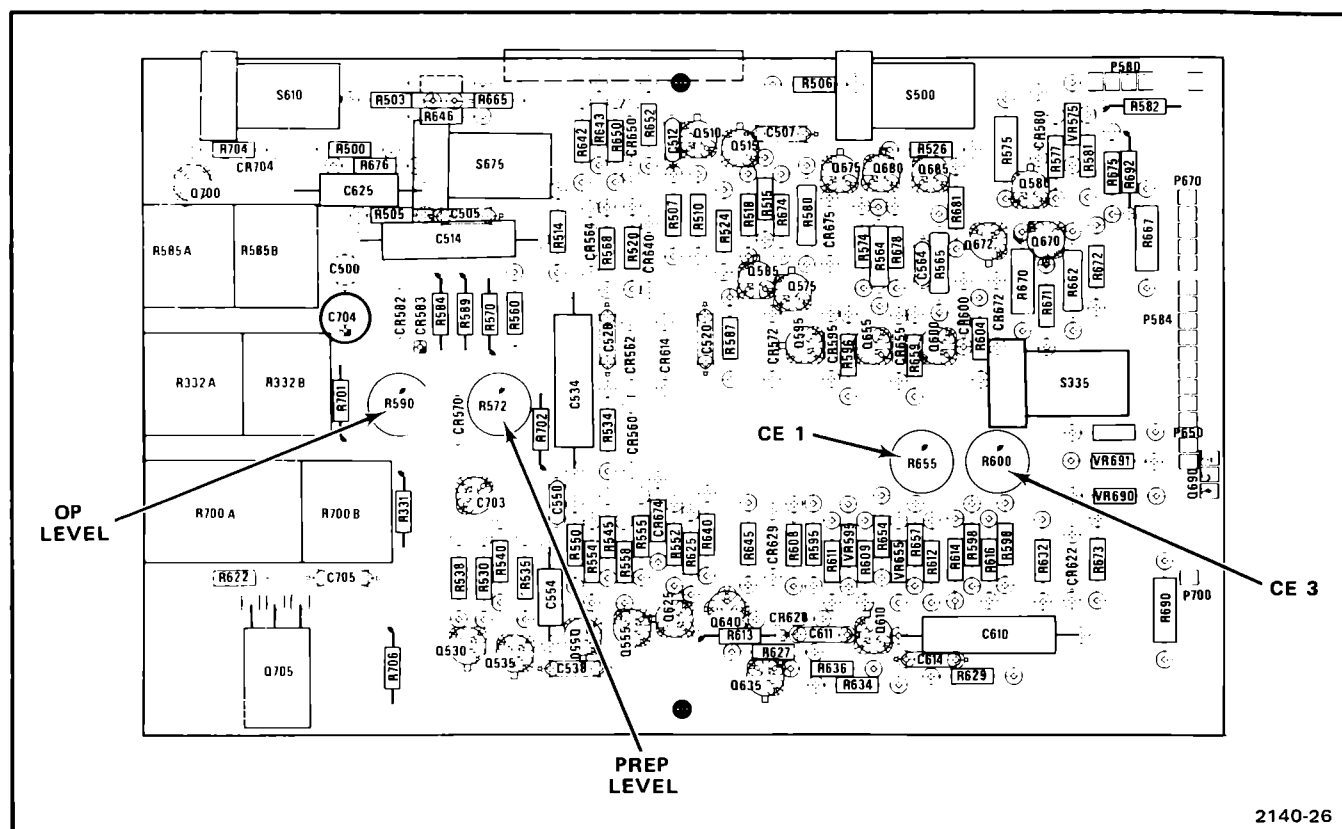


Fig. 4-4. Location of storage adjustments (storage circuit board).

- h. Press the **POWER** switch to turn off the oscilloscope and keep the plug-ins installed for the next step.

D. VERTICAL SYSTEM

Equipment Required

Amplifier unit
Time-base unit
Calibration generator
Pulse Generator
Medium-frequency signal generator

Calibration fixture (Pulser)
42 inch bnc cable
50 Ω termination
Screwdriver

NOTE

When a different amplifier plug-in is used to verify vertical specifications, the Oscilloscope system frequency must be considered.

Control Settings

Amplifier Unit

Position	Midrange
Input Coupling	Dc
Mode	CH 1
Trigger	CH 1
CH 1 Volts/Div	1

Time-base Unit

Position	Midrange
Main Trigger	Auto Trig
Main Sec/Div	1 ms

1. Adjust Vertical Centering

- Pull the POWER switch to turn on the oscilloscope.
- Short together the vertical deflection pins 7A and 7B, at the vertical plug-in with an appropriate shorting bar.
- CHECK—That the displayed trace is within 0.5 div of the center horizontal graticule line.
- ADJUST—Vertical Centering R135 to position the trace to the center horizontal graticule line. See Fig. 4-5 for adjustment location.
- Press the POWER switch to turn off oscilloscope and install vertical amplifier unit in center compartment. Pull the POWER switch on.

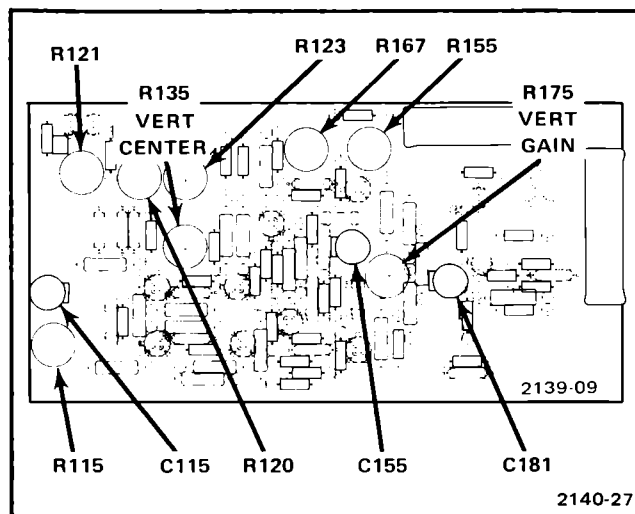


Fig. 4-5. Location of Vertical Amplifier adjustments (Vertical Amplifier board).

- CHECK—That the displayed trace is within 0.5 div of the center horizontal graticule line.

2. Adjust Vertical Gain

- Press the POWER switch to turn off the oscilloscope and install vertical amplifier in the left vertical compartment. Pull the POWER switch on.
- Connect a 1 kHz square-wave signal from the calibration generator to the vertical amplifier input, using a 42-inch bnc cable.
- Set the vertical amplifier and generator controls to obtain a 6 V reference signal. Center the display.
- CHECK—The crt display for a vertical deflection of 6 div, ± 0.18 div.

e. ADJUST—Vertical Gain, R175, for 6 div of deflection.

f. Press the POWER switch to turn off the oscilloscope and remove the vertical amplifier from the left vertical compartment and install it in the center compartment. Pull the POWER switch on.

g. Repeat part d of this step, and if necessary, readjust Vertical Gain R175 for the optimum gain setting. Compromise for both vertical compartments.

3. Adjust Vertical Compensation

a. Press the POWER switch to turn off the oscilloscope and install the vertical amplifier in the left vertical compartment. Pull the POWER switch on.

b. Set the vertical amplifier CH 1 Volts/Div switch to .1. Connect the pulse generator to the CH 1 input connector with a 50 Ω termination and a 42-inch bnc cable.

c. Set the time-base unit for a calibrate sweep rate of 20 ns/div and triggering for auto mode, ac coupled from the LEFT source. Adjust the trigger level control for a stable display, triggered on the rising portion of the pulse. Center the pulse horizontally on the graticule.

d. CHECK—For optimum square leading corner and flat top on a 5-div displayed pulse with aberrations not to exceed +0.2 or -0.2 div, with total peak-to-peak aberrations not to exceed 0.2 div.

e. ADJUST—Vertical compensation R121 for optimum flat top on the displayed pulse, then adjust R120 and R123, increasing the sweep rate of the time-base, when necessary. Repeat as necessary to obtain optimum flat top on the waveform. See Fig. 4-5 for adjustment location.

NOTE

C637 was a fixed capacitor prior to SN B061533 and a fixed capacitor from SN B094064 to SN B094584.

f. ADJUST—Vertical compensations C637 (this adjustment is located on the main interface board between vertical compartments, SN B061533 to B094064, and SN B094585 & Up), C115, R115, C155, R155, R167, and C181 in the order given, for optimum square leading corner with aberrations within the limits given in part d of this step. There is direct interaction between C115 and R115, and between C155 and R155. Best results are usually obtained by setting R115 fully clockwise, results are usually obtained by setting R115 fully clockwise, then adjusting C115. See Fig. 4-5 for adjustment location.

g. ADJUST—R155 and R167 for minimum ringing of front corner. Adjust C637 (on the main interface board between vertical compartments, SN B061533 to B094064), C155 and C115 for a level front corner. After front corner adjustments have been made, adjust C181 for optimum risetime and minimum front corner spikes.

h. Press the POWER switch to turn off the oscilloscope, and install the vertical amplifier in the center compartment. Pull POWER switch on.

i. Repeat parts d through g. If necessary, compromise the vertical compensation adjustment to obtain the best response for both left and right vertical compartments.

4. Check Bandwidth

a. Press the POWER switch to turn off the oscilloscope and install the vertical amplifier in the left vertical compartment. Pull the POWER switch on.

b. Set the time-base unit for a sweep rate of 10 μ s/div.

c. Disconnect the bnc cable from the pulse generator and connect it to the output connector of the MF signal generator.

d. Set the vertical amplifier Volts/Div switch to .1 and adjust the MF signal generator controls for a 6-div display at a frequency of 3 MHz.

e. Without changing the output amplitude, increase the generator frequency until the displayed amplitude is reduced to 4.2 div.

f. CHECK—The generator for a reading of at least 50 MHz.

g. Press the POWER switch to turn off the oscilloscope and install the vertical amplifier in the center vertical compartment. Pull the POWER switch on.

h. Repeat parts d through f for the center vertical compartment.

i. Press the POWER switch to turn off the oscilloscope and disconnect cable and termination from the equipment.

ALTERNATE PROCEDURE

NOTE

Use the following alternate procedure when the calibration fixture (Pulser) is used for the vertical system adjustment.

Control Settings

Pulser

Position	Midrange
Amplitude	Midrange
Test Switch	Common Mode
Rep Rate	100 kHz

1. Adjust Vertical Centering

- a. Pull the POWER switch to turn on the oscilloscope.
- b. CHECK—That the displayed trace is within 0.5 div of the center horizontal graticule line.
- c. ADJUST—Vertical Centering R135 to position the trace to the center horizontal graticule line. See Fig. 4-5 for adjustment location.
- d. Press the POWER switch to turn off oscilloscope, and install the Pulser in center compartment. Pull POWER switch on.
- e. CHECK—That the displayed trace is within 0.5 div of the center horizontal graticule line.

2. Adjust Vertical Gain

- a. Press the POWER switch to turn off oscilloscope, and install the Pulser in the left vertical compartment. Pull the POWER switch on.
- b. Set the Test switch of the Pulser to Vert or Horiz Gain, and press the 1 kHz Rep Rate switch.
- c. Position the display with the Pulser Position control to align the bright center trace of the display with the center horizontal graticule line.

d. CHECK—That the center seven traces coincide with the respective horizontal graticule lines, one trace per division, ± 0.1 div.

e. ADJUST—Vertical Gain R175 for 6 div of deflection over the center seven horizontal graticule lines.

f. Press the POWER switch and remove the Pulser from the left vertical compartment and install it in the center compartment. Pull the POWER switch on.

g. Repeat part d of this step, and if necessary, readjust Vertical Gain R175 for the optimum gain setting compromise for both vertical compartments.

3. Adjust Vertical Compensation

- a. Install the Pulser in the left vertical compartment.
- b. Set the Test switch of the Pulser to Vert or Horiz + Step Resp and press the 100 kHz Rep Rate switch. Adjust the Amplitude and Position controls for a 6-div display centered vertically on the graticule.
- c. Set the time-base unit for a calibrated sweep rate of $2 \mu\text{s}/\text{div}$ and triggering for auto mode, ac coupled from the internal source. Adjust trigger level controls for a stable display, triggered on the rising portion of the pulse. Center the pulse horizontally on the graticule.
- d. CHECK—For optimum square leading corner and flat top on the displayed pulse with aberrations not to exceed $+0.3$ or -0.3 division, with total peak-to-peak aberrations not to exceed 0.3 division.

NOTE

The calibration fixture (Pulser) has a high bandwidth, and aberrations can typically measure near the specification limit. The following compensation adjustments may not be necessary if aberrations and bandwidth meet specification.

e. ADJUST—Vertical compensation R121 for optimum flat top on the displayed pulse, then adjust R120 and R123, increasing the sweep rate of the time-base unit to $1 \mu\text{s}/\text{div}$ and $0.5 \mu\text{s}/\text{div}$, respectively. Repeat as necessary to obtain optimum flat top on the waveform. See Fig. 4-5 for the adjustment locations.

f. Press the 1 MHz Rep Rate switch on the calibration fixture, and set the sweep rate of the time-base unit to 0.1 μ s/div. Adjust trigger level controls for a stable display.

NOTE

C637 was a fixed capacitor prior to SN B061533 and is a fixed capacitor after SN B094064.

g. ADJUST—Vertical compensations C637 (this adjustment is located on the main interface board between vertical compartments, SN B061533 to B094064), C115, R115, C155, R155, R167, and C181 in the order given, for optimum square leading corner with aberrations within the limits given in part d. There is direct interaction between C115 and R115, and between C155 and R155. Best results are usually obtained by setting R115 fully clockwise, then adjusting C115. See Fig. 4-5 for the adjustment location.

h. ADJUST—R155 and R167 for minimum ringing of front corner. Adjust C637 (on the main interface board between vertical compartments, SN B061533 to B094064), C155 and C115 for a level front corner. After front-corner adjustments have been made, adjust C181 for optimum risetime and minimum front corner spike.

i. Press the POWER switch to turn off the oscilloscope, and install the Pulser in the center compartment. Pull the POWER switch on.

j. Repeat parts c through h. If necessary, compromise the vertical compensation adjustment to obtain the best response for both left and right vertical compartments.

4. Check Vertical Position Effect

a. Set the Pulser to obtain a centered, positive-going, 6-div display. Set the time-base unit for a triggered display on the rising portion of the pulse, at a sweep rate of 20 ns/div.

b. Position the 6-div display down so a 3-div display remains within the graticule area.

c. CHECK—For optimum square leading corner and flat top on the displayed pulse with aberrations not to exceed 0.3 div (6.0%).

d. Set the Pulser to obtain a centered, negative-going, 6-div display. Set the time-base unit for a triggered display on the falling portion of the pulse, at a sweep rate of 20 ns/div.

e. Position the 6-div display up so a 3-div display remains within the graticule area.

f. CHECK—For optimum square leading corner and flat top on the displayed pulse with aberrations not to exceed 0.3 div (6.0%).

5. Check Bandwidth

a. Set the Test switch to Vert or Horiz Freq Resp and turn the Amplitude control fully clockwise.

b. Set the time-base unit for a sweep rate of 1 ms/div.

c. Connect the MF signal generator output to the CW IN connector of the Pulser.

d. Set the MF signal generator for a reference frequency of 3 MHz and adjust the output for an 8-div display.

e. Set the Pulser Position and Amplitude controls to obtain a centered, 6-div display.

NOTE

The calibration fixture (Pulser) CW Leveled light must be on and the MF signal generator must be properly connected for a valid check. Refer to the calibration fixture and MF signal generator manual for detailed instructions.

f. Without changing the output amplitude, increase the generator frequency until the displayed amplitude is reduced to 4.2 div.

g. CHECK—The generator for a reading of at least 90 MHz.

h. Press the POWER switch off and install the Pulser in the center plug-in compartment. Pull the POWER switch on.

i. Repeat parts a through g for the center vertical compartment.

j. Press the POWER switch to turn off the oscilloscope and disconnect the cable from the Pulser input connector.

Adjustment Procedure—5441/R5441

k. Remove the Pulser and the time-base from the oscilloscope.

l. Install the time-base unit in the vertical compartment and the Pulser in the horizontal compartment.

E. HORIZONTAL SYSTEM

Equipment Required

Calibration fixture (Pulser)
Time-base unit
Amplifier unit

Time-mark generator
42-inch bnc cable
Screwdriver

NOTE

The calibration fixture is used for the horizontal system adjustment procedure. When a different amplifier plug-in is used to verify horizontal specifications, the amplifier frequency must be considered. An alternate procedure is provided when the 5A48 is substituted for the calibration fixture plug-in unit.

Control Settings

Pulser

Position	Midrange
Amplitude	Midrange
Test Switch	Common Mode
Rep Rate	1 MHz

Time-Base Unit

Main Triggering	+ Slope, Auto Trig
Trig Source	Left
Position	As desired
Swp Mag	X1
Main Sec/Div	1 ms
Display Mode	Main Swp

1. Adjust Horizontal Centering

a. Pull the POWER switch to turn on the oscilloscope and check for a vertical trace over the entire graticule area.

b. CHECK—That the displayed trace is within 0.5 div of the center vertical graticule line.

c. ADJUST—Horizontal Centering R222 to position the trace to center vertical graticule line. See Fig. 4-6 for the adjustment location.

2. Adjust Horizontal Gain

a. Set the Test switch of the Pulser to Vert or Horiz Gain.

b. Position the display with the Pulser Position control to align the bright center trace of the display with the center vertical graticule line.

c. CHECK—That the center seven traces coincide with the respective vertical graticule lines, one trace per division, ± 0.25 div.

d. ADJUST—Horizontal Gain R212 for 6 div of deflection over the center seven vertical graticule lines.

e. Press the POWER switch to turn off the oscilloscope and interchange the Pulser and the time-base unit in their respective compartments. Pull the POWER switch on.

3. Adjust 10 ns Timing

NOTE

A 5B42 time-base or a time-base having a 10 ns sweep must be used.

a. Set the Pulser Test switch to Aux In.

b. Connect the time-mark generator to the Aux In connector of the Pulser with a 42-inch bnc cable.

c. Set the time-mark generator for 10 ns markers. Set the Pulser Amplitude control so the markers are at least five divisions in amplitude.

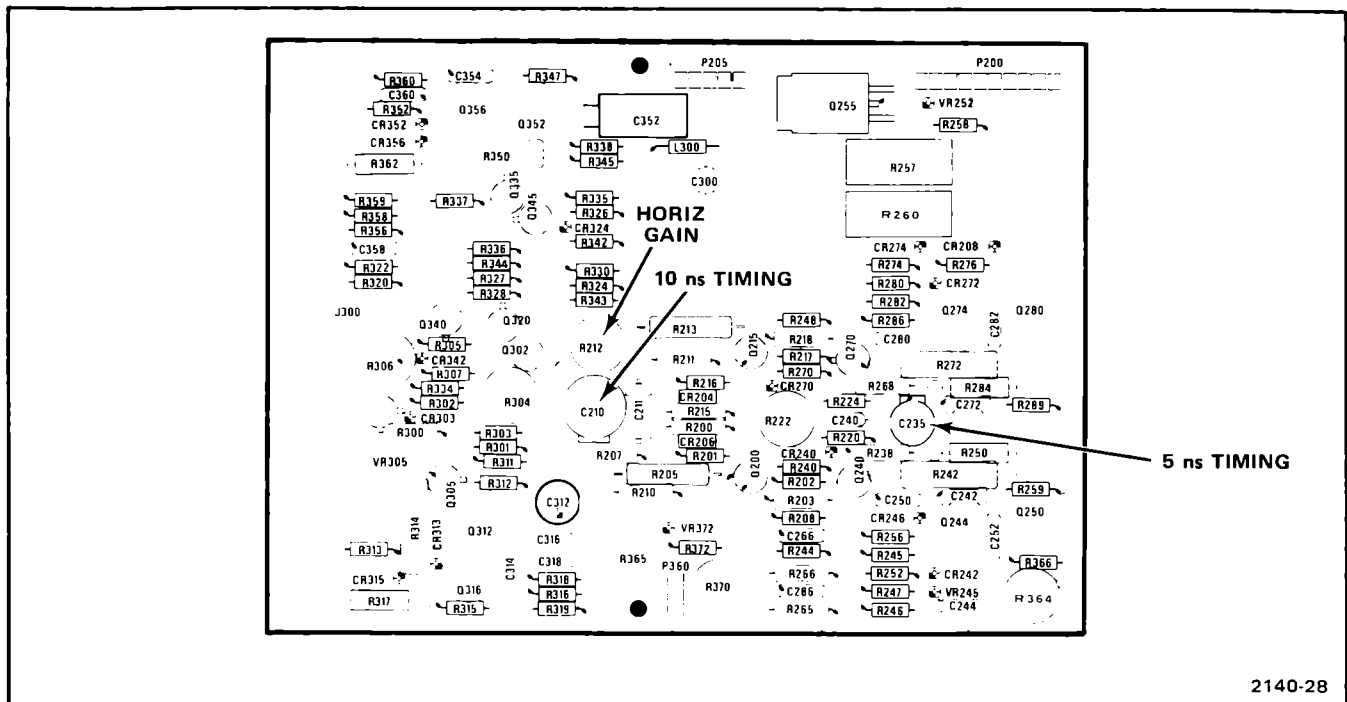


Fig. 4-6. Location of Horizontal adjustments (Horizontal circuit board).

d. Set the time-base unit for auto, internal triggering, and the sweep rate to 10 ns/div. Adjust the time-base triggering controls for a stable display.

e. CHECK—For one 10 ns marker per division over the center eight major graticule divisions of the display (position as necessary).

f. ADJUST—C210 for one 10 ns marker per division over the center eight major graticule divisions of the display. Sweep accuracy is $\pm 5\%$ over the entire sweep, excluding the first 30 ns and the last 10 div of the magnified sweep. See Fig. 4-6 for the adjustment location.

d. ADJUST—C235 for two 5 ns markers per division over the center eight graticule divisions of the display. Sweep accuracy is $\pm 6\%$ over the entire sweep, excluding the first 30 ns and the last 10 div of the magnified sweep. See Fig. 4-6 for the adjustment location.

e. Interaction will occur between the adjustment of C210 and C235. Repeat step 3 and step 4 to achieve a timing compromise.

f. Press the POWER switch to turn off the oscilloscope. Disconnect all cables.

4. Adjust 5 ns Timing

a. Set the time-mark generator for 5 ns markers. Set the Pulser Amplitude control so the markers are at least five divisions in amplitude.

b. Set the time-base unit for auto, internal triggering, and the sweep rate to 10 ns/div. Adjust the time-base triggering controls for a stable display.

c. CHECK—For two 5 ns markers per division over the center eight major graticule divisions of the display (position as necessary).

ALTERNATE PROCEDURE

NOTE

Use the following alternate procedure when the 5A48 is substituted for the calibration fixture (Pulser) plug-in unit.

Control Settings

Amplifier Unit

Position

Midrange

Adjustment Procedure—5441/R5441

Input coupling	Dc
Mode	CH 1
Trigger	CH 1
CH 1 Volts/Div	1

Time-Base Unit

Main Triggering	+ Slope Auto Trig
Trig Source	Left
Position	As desired
Mag	X1
Main Sec/Div	1 ms
Display Mode	Main Swp

1. Adjust Horizontal Centering

a. Pull the POWER switch to turn on the oscilloscope and check for a vertical trace over the entire graticule area.

b. Short together pins 7A and 7B on the 5A48 vertical amplifier with an appropriate shorting bar.

c. CHECK—That the displayed trace is within 0.5 div of the center vertical graticule line.

d. ADJUST—Horizontal Centering R222 to position the trace to the center vertical graticule line. See Fig. 4-6 for the adjustment location.

2. Adjust Horizontal Gain

a. connect a 1 kHz square-wave signal from the calibration generator to the 5A48 input, using a 42-inch bnc cable.

b. Set the vertical amplifier and generator controls to obtain a five volt reference signal. Center the display between the third and eighth vertical graticule lines.

c. CHECK—The crt display for a horizontal deflection of 5 div, ± 0.15 div.

d. ADJUST—Horizontal Gain R212 for 5 div of deflection. See Fig. 4-6 for the adjustment location.

e. Press the POWER switch to turn off the oscilloscope and interchange the vertical amplifier and the time-base unit in their respective compartments. Pull the POWER switch on.

f. Disconnect the bnc cable from the vertical amplifier input connector.

3. Adjust 10 ns Timing

NOTE

A 5B42 time-base or a time-base having a 10 ns sweep must be used.

a. Connect the time-mark generator signal to the input of the 5A48.

b. Set the time-mark generator for 10 ns markers. Set the deflection factor of the vertical amplifier so the markers are at least five divisions in amplitude.

c. Set the time-base unit for a sweep rate of 10 ns/div. Adjust the time-base triggering control for a stable display.

d. CHECK—For one 10 ns marker per division over the center eight graticule divisions of the display (position as necessary).

e. ADJUST—C210 for one 10 ns marker per division over the center eight major graticule divisions of the display. Sweep accuracy is $\pm 5\%$ over the entire sweep, excluding the first 30 ns and the last 10 div of the magnified sweep. See Fig. 4-6 for the adjustment location.

4. Adjust 5 ns Timing

a. Press the POWER switch to turn off the oscilloscope and install an appropriate time-base unit in the horizontal compartment. Pull the POWER switch on.

b. Set the time-mark generator for 5 ns markers. Set the deflection factor of the vertical amplifier so the markers are at least five divisions in amplitude.

c. Set the time-base unit for a sweep rate of 10 ns/div. Adjust the time-base triggering control for a stable display.

d. CHECK—For two 5 ns markers per division over the center eight graticule divisions of the display (position as necessary).

Adjustment Procedure—5441/R5441

e. ADJUST—C235 for two 5 ns markers per division over the center eight graticule divisions of the display. Sweep accuracy is $\pm 6\%$ over the entire sweep, excluding the first 30 ns and the last 10 div of the magnified sweep. See Fig. 4-6 for adjustment location.

f. Interaction will occur between adjustment of C210 and C235. Repeat step 3 and step 4 to achieve a timing compromise.

g. Press the POWER switch to turn off the oscilloscope and remove all plug-ins.

F. READOUT SYSTEM

Equipment Required

Screwdriver

NOTE

If the Readout System was deleted from the instrument (Option 01), omit the following procedure.

It is not necessary to install any plug-ins to perform this procedure. With plug-ins installed and Q1040 removed, random characters will appear; with plug-in and Q1040 removed, all zeros will appear.

1. Adjust Vertical Spacing

a. Remove Q1040 from its socket on the Readout board. See Fig. 4-7A for the location.

b. Pull the POWER switch on and set the READOUT INTENS control for visible characters.

c. CHECK—Crt display for two rows of zeros, 40 zeros to a row with no overlap. The two rows of zeros should be located vertically in the middle of the top and bottom divisions of the graticule. See Fig. 4-7B.

d. ADJUST—Vertical Spacing R1118 to position the top row of readout characters to the middle of the top graticule division. Then adjust Vertical Centering R135 (located on vertical circuit board) so the bottom row of readout characters is in the middle of the bottom graticule division. Some interaction will occur between adjustment of R1118 and R135. Repeat until correct readout character location is achieved. See Fig. 4-7A and 4-7B.

2. Adjust Horizontal Positioning

a. CHECK—That the first and last characters of both rows of zeros are within the graticule area. See Fig. 4-7B.

b. ADJUST—Horizontal Positioning R1110 to position both rows of zeros so the first and last characters are within the graticule area. See Fig. 4-7B for correct positioning of the readout display.

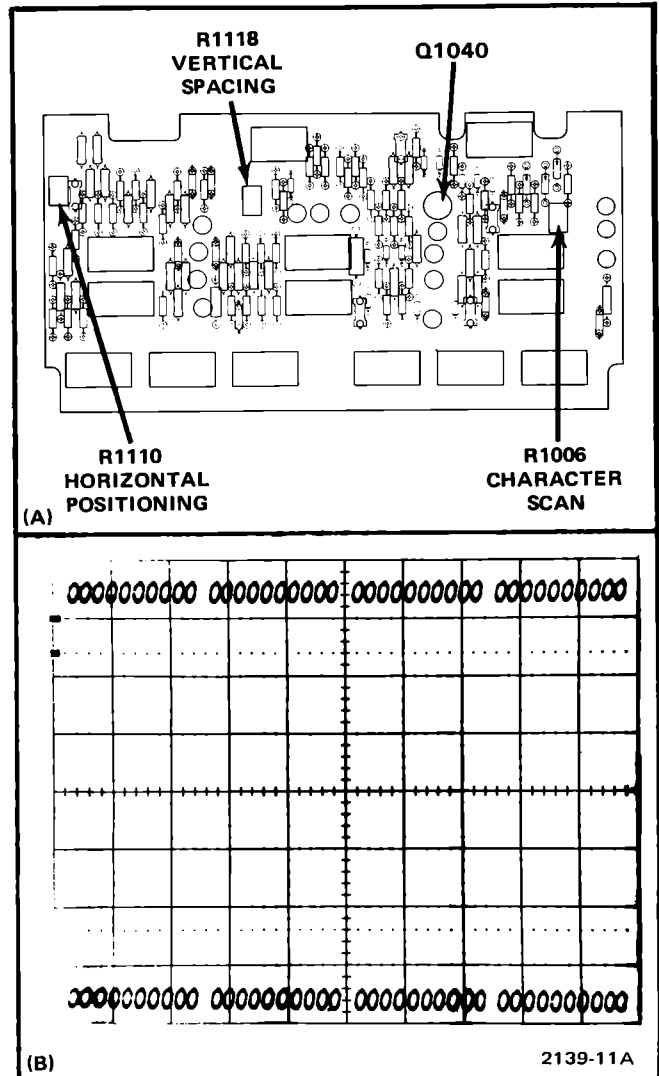


Fig. 4-7. (A) Locations of Readout Adjustment and Q1040; (B) Readout display with Q1040 removed (with plug-ins removed).

3. Adjust Character Scan

a. CHECK—Displayed characters for completeness without overscanning (overscanning causes a bright dot where traces overlap).

Adjustment Procedure—5441/R5441

b. ADJUST—Character Scan R1006 for fully scanned characters without overscanning. See Fig. 4-7A and 4-7B.

c. Press the POWER switch to turn off the oscilloscope. Replace Q1040 to its socket.

This completes the adjustment procedure.

MAINTENANCE

This section of the manual contains information for performing preventive maintenance, troubleshooting, and corrective maintenance for this instrument.

PREVENTIVE MAINTENANCE

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis may prevent instrument breakdown and will improve the reliability of the instrument. The severity of the environment to which this instrument is subjected determines the frequency of maintenance. A convenient time to perform preventive maintenance is preceding adjustment of the instrument.

CABINET REMOVAL

WARNING

Dangerous voltages exist at several points throughout this instrument. When the instrument is operated with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Disconnect power before cleaning the instrument or replacing parts.

The cabinet sides are held in place by four latches. To remove the cabinet sides, turn the latches 90° and pull the sides away from the carrying handle; then, lift the cabinet sides away from the instrument. The cabinet bottom is held in place with four latches and four screws.

The cabinet sides protect this instrument from dust in the interior, and also provide protection to personnel from the operating voltages present. They also reduce the electromagnetic radiation from this instrument or interference to the display due to other equipment.

CLEANING

This instrument should be cleaned as often as operating conditions require. Accumulation of dirt on components acts as an insulating blanket and prevents efficient heat dissipation, which can cause overheating and component breakdown.

CAUTION

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

Exterior

Loose dust accumulated on the front panel can be removed with a soft cloth or small brush. Dirt that remains can be removed with a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners should not be used.

Interior

Dust in the interior of the instrument should be removed occasionally due to its electrical conductivity under high-humidity conditions. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air. Remove any dirt that remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces.

Switch Contacts

Switch contacts and pads are designed to operate dry for the life of the switch. However, as the switches are not sealed, dust attracted to the contact area may cause switch contacts to become electrically noisy. Cleaning may be accomplished by flushing the contact area with isopropyl alcohol or kelite (1 part kelite to 20 parts water). Do not use

chemical cleaning agents that leave a film or that might damage plastic parts. Do not use cotton swabs or similar applicators to apply cleaning agents, as they tend to snag and leave strands of cotton on switch contacts. Should it become necessary to remove a switch for replacement or cleaning, refer to Component Removal and Replacement in this section.

VISUAL INSPECTION

This instrument should be inspected occasionally for such defects as broken connections, improperly seated semiconductors, damaged circuit boards, and heat-damaged parts.

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

LUBRICATION

Generally, there are no components in this instrument that require a regular lubrication program during the life of the instrument.

Cam Switch Lubrication

In most cases, factory lubrication should be adequate for the life of the instrument. However, if the switch has been disassembled for replacement of switch sub-parts, a lubrication kit containing the necessary lubricating materials and instructions is available through any Tektronix Field Office. General Electric Versilube® silicone grease should be applied sparingly so that the lubricant does not get on the contacts. Refer to Fig. 5-1 for lubrication instructions.

SEMICONDUCTOR CHECKS

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

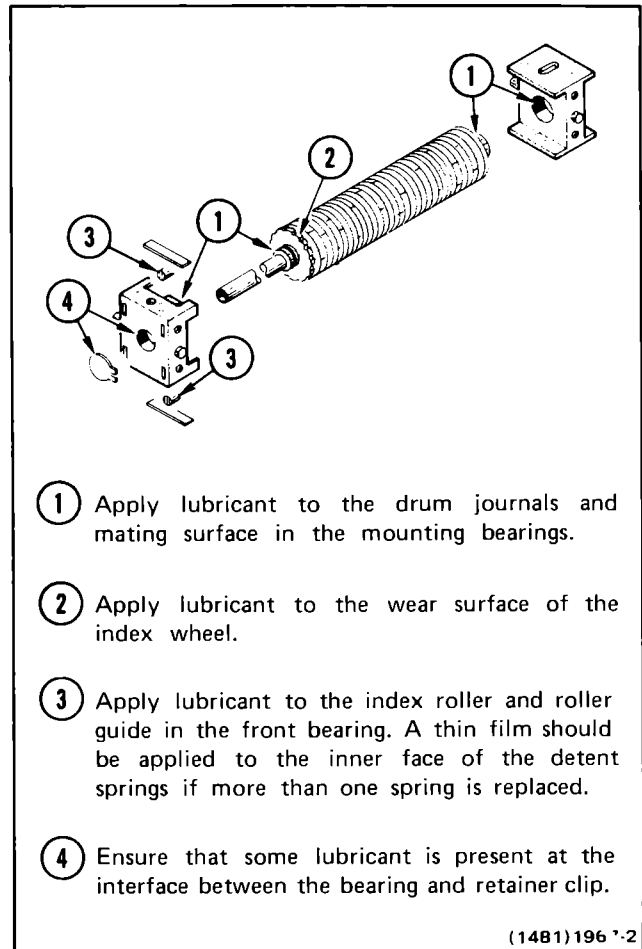


Fig. 5-1. Lubrication procedure for a typical cam switch.

ADJUSTMENT AFTER REPAIR

After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as the adjustment of other closely related circuits. The Performance Check and Adjustment procedure in this manual provides a quick and convenient means of checking instrument operation. In some cases, minor troubles may be revealed or corrected by adjustment.

TROUBLESHOOTING

The following information is provided to help troubleshoot this instrument. Information contained in other sections of this manual should be used along with the following information to aid in locating the defective component. An understanding of the circuit operation is very helpful in locating troubles.

TROUBLESHOOTING AIDS

Diagrams

Circuit diagrams are given on foldout pages in Section 8. The component number and electrical value of each component in this instrument is shown on the diagrams.

Circuit-board Illustrations

Circuit-board illustrations are shown on the foldout page preceding the associated diagram. Each board-mounted electrical component is identified by its circuit number, as are interconnecting wires and connectors.

Wiring Color Code

Insulated wire and cable used in this instrument is color-coded to facilitate circuit tracing.

Semiconductor Basing

Figure 5-2 illustrates the basing configuration for all semiconductors used in this instrument. Some plastic-case transistors have lead configurations that do not agree with those shown here. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram. All transistor sockets in this instrument are wired for the standard basing used for metal-case transistors.

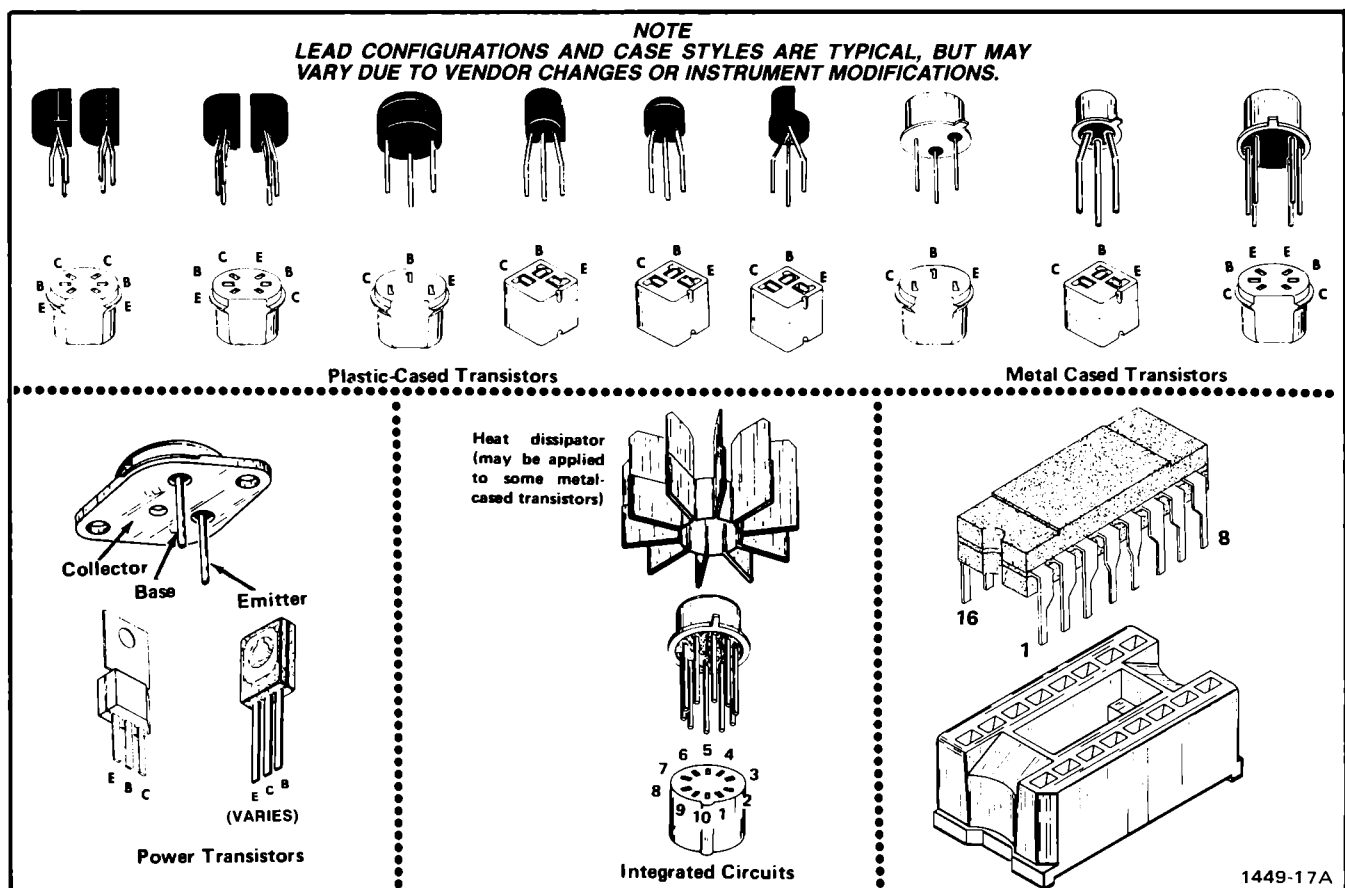


Fig. 5-2. Electrode configuration data for semiconductor devices.

Multi-pin Connector Identification

Multi-pin connectors mate with groups of pins soldered to circuit boards. Pin number 1 is indexed with a triangular mark on the circuit board and molded on the holder of the multi-pin connector, as shown in Fig. 5-3.

Interface Connector Pin Locations

The Interface circuit board couples the plug-in unit to the associated mainframe (oscilloscope). Figure 5-4 identifies the pins on the interface connector as shown on the main Interface diagram in the Diagrams and Circuit Board Illustrations section.

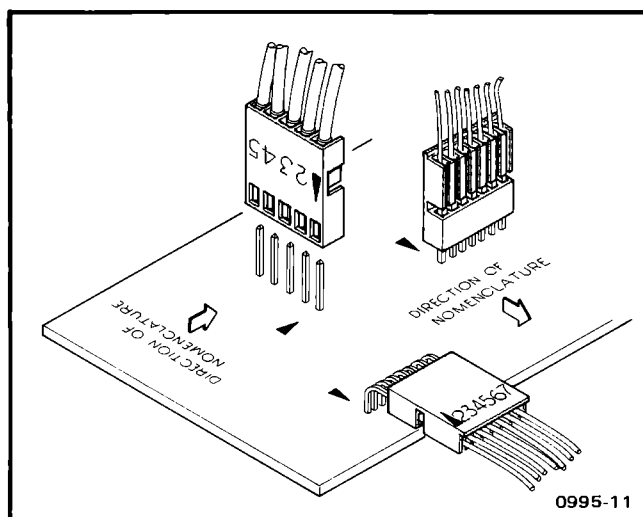


Fig. 5-3. Multi-pin connector holder orientation.

Performance Check

The Performance Check procedure, given in Section 4 of this manual, provides a quick and convenient means of checking instrument operation. In some cases, minor troubles may be revealed or corrected by adjustment.

TROUBLESHOOTING EQUIPMENT

The following equipment, in addition to that listed in the Performance Check section, is useful for troubleshooting.

Transistor Tester

Description: Dynamic-type tester.

Purpose: Test semiconductors

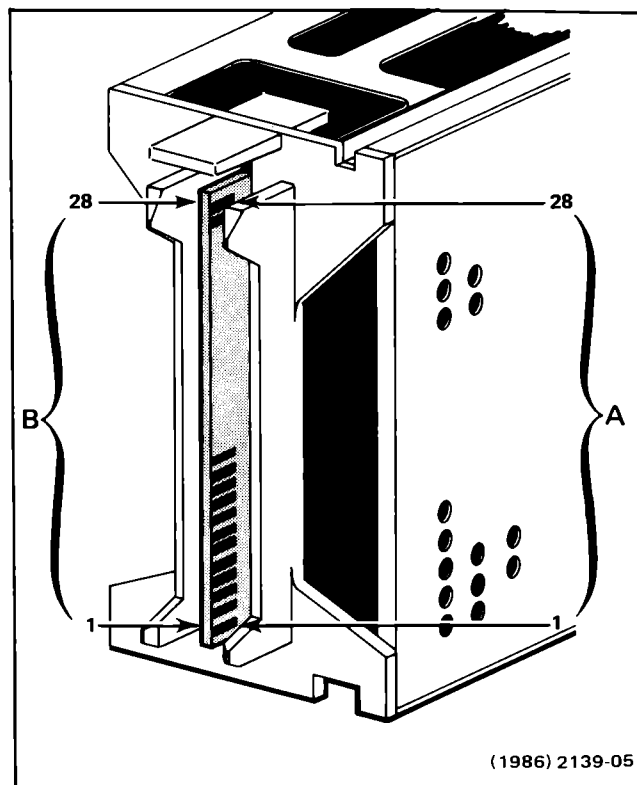


Fig. 5-4. Location of pin numbers on interface connector.

Recommended Tektronix types: 576 Curve Tracer, 577/177 Curve Tracer system, 7CT1N Curve Tracer unit and a 7000-series oscilloscope system, or a 5CT1N Curve Tracer unit and a 5000-series oscilloscope.

Multimeter

Description: Voltmeter, 10 M Ω input impedance and a range of 0 to at least 50 V dc; accuracy, within 0.1%. Ohmmeter, 0 to 20 M Ω . Test probes should be insulated to prevent accidental shorting.

Purpose: Check voltage and resistance.

Test Oscilloscope

Description: Frequency response, dc to 50 MHz minimum; deflection factor 1 mV to 5 V/div. A 10X, 10 M Ω voltage probe should be used to reduce circuit loading.

Purpose: Check operating waveforms.

TROUBLESHOOTING TECHNIQUES

The following troubleshooting procedure is arranged to check the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation, and adjustment. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, it should be replaced using the replacement procedure given under Corrective Maintenance.

Troubleshooting Procedure

1. Check Control Settings. Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, see Fig. 2-1.

2. Check Associated Equipment. Before troubleshooting, check that the equipment used with this instrument is properly connected and that the interconnecting cables are not defective. Also, check the power source.

3. Visual Check. Visually check the portion of the instrument in which the trouble is located. Many troubles can be located by visible indications such as unsoldered connections, broken wires, damaged circuit boards, damaged components, etc.

4. Isolate Trouble to a Circuit. To isolate trouble to a circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by taking voltage and waveform readings. Incorrect operation of all circuits often indicates trouble in the power supply. Check first for correct voltages of the individual supplies. See Table 5-1. However, a defective component elsewhere in the instrument can appear as a power-supply trouble and may also affect the operation of other circuits.

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

6. Check Instrument Adjustment. Check the adjustment of this instrument, or the affected circuit if the trouble appears in one circuit. The apparent trouble may be the result of misadjustment. Complete adjustment instructions are given in Section 4.

Table 5-1
POWER SUPPLY TOLERANCES

Power Supply	Tolerance	Typical 120 Hz Ripple
200 V	+ 80 V to + 240 V	2 V or less
+ 30 V	+ 29.925 V to + 30.075 V	2 mV or less
+ 15 V	+ 14.85 V to + 15.15 V	2 mV or less
− 15 V	− 14.85 V to − 15.15 V	2 mV or less
− 30 V	− 29.925 V to − 30.075 V	2 mV or less

7. Check Individual Components. The following procedures describe methods for checking individual components. Two-lead components that are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

CAUTION

To avoid component damage, disconnect the power source before removing or replacing semiconductors.

TRANSISTORS. The best check of transistor operation is actual performance under operating conditions. A transistor can be most effectively checked by substituting a new component or one that has been checked previously. However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

INTEGRATED CIRCUITS. IC's can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of circuit operation is desirable when troubleshooting circuits using IC's. Use care when checking voltages and waveforms around the IC's so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the 14- and 16-pin IC's is with an IC test clip. This device also serves as an extraction tool.

CAUTION

Do not use an ohmmeter scale that has a high internal current. High currents may damage the diode.

DIODES. A diode can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter scale having a low internal source current, such as the R X 1K scale. The resistance should be very high in one direction and very low when the meter leads are reversed.

RESISTORS. Check resistors with an ohmmeter. See the Replaceable 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 that specified.

INDUCTORS. Check for open inductors by checking continually with an ohmmeter. Shorted or partially shorted inductors can usually be found by checking the waveform

response when high-frequency signals are passed through the circuit. Partial shorting often reduces high-frequency response.

CAPACITORS. A leaky or shorted capacitor can usually be detected by checking resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking that the capacitor passes ac signals.

8. Repair and Adjustment. If any defective parts are located, follow the replacement procedures given in Corrective Maintenance. Be sure to check the performance of any circuit that has been repaired or had any electrical components replaced.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in this instrument are given here.

OBTAINING REPLACEMENT PARTS

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

NOTE

When selecting replacement parts, remember that the physical size and shape of a component may affect the performance of the instrument, particularly at high frequencies. All parts should be direct replacements unless a different component will not adversely affect instrument performance.

Some parts are manufactured or selected by Tektronix, Inc. to satisfy particular requirements, or are manufactured to specifications for Tektronix, Inc. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. To determine the manufacturer of parts, refer to parts list Cross Index Mfr. Code Number to Manufacturer.

SOLDERING TECHNIQUES

WARNING

To avoid electrical shock, disconnect the instrument from the power source before soldering.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques, which apply to maintenance of any precision electronic equipment, should be used when working on this instrument. Use only 40/60 rosin-core, electronic-grade solder. The choice of soldering iron is determined by the repair to be made. When soldering on circuit boards, use a 15- to 40-watt pencil-type soldering iron with a 1/8-inch wide, wedge-shaped tip. Keep the tip properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material. Avoid excessive heat; apply only enough heat to remove the component or to make a good solder joint. Also, apply only enough solder to make a firm solder joint; do not apply too much solder.

CAUTION

Most circuit boards in this instrument are multi-layer type boards with a conductive path(s) laminated between the top and bottom board layers. All soldering on these boards should be done with extreme care to prevent breaking the connections to the center conductor(s); only experienced maintenance personnel should attempt repair of these boards.

For metal terminals (e.g., switch terminals, potentiometers, etc.), a higher wattage-rating soldering iron may be required. Match the soldering iron to the work being done. For example, if the component is connected to the chassis or other large heat-radiating surface, it will require a 75 W or larger soldering iron.

The following techniques should be used to replace a component on a circuit board.

1. Grip the component lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board, as it may damage the board.

2. When the solder begins to melt, gently pull the lead out. If unable to pull out the lead without using force, try removing the other end of the component, as it may be more easily removed.

NOTE

The reason some component leads are troublesome to remove is due to a bend placed on each lead during the manufacturing process. The bent leads hold components in place during a process that solders many components at one time.

If a component lead is extremely difficult to remove, it may be helpful to straighten the leads on the back side of the board with a small screwdriver or pliers while heating the soldered connection.

Use only enough heat to remove the component lead without removing the solder from the board. If it is desired to remove solder from a circuit-board hole for easier installation of a new component, a solder-removing wick should be used.

3. Bend the leads of the new component to fit the holes in the board. If the component is replaced while the board is

mounted in the instrument, cut the leads so they will just protrude through the board. Insert the leads into the holes so the component is firmly seated against the board (or as positioned originally). If it does not seat properly, heat the solder and gently press the component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip any excess lead protruding through the board (if not clipped in step 3).

6. Clean the area around the solder connection with a flux-removing solvent. Be careful not to remove information printed on the board.

COMPONENT REMOVAL AND REPLACEMENT

WARNING

To avoid electrical shock, disconnect the instrument from the power source before replacing components.

The exploded-view drawing associated with the Replaceable Mechanical Parts list may be helpful in the removal or disassembly of individual components or subassemblies. Component locations are shown in the Diagrams and Circuit Board Illustrations section.

Circuit Boards

If a circuit board is damaged beyond repair, replace the entire board assembly. Part numbers for completely wired boards are given in the Replaceable Electrical Parts list.

To remove or replace a board, proceed as follows.

1. Disconnect all leads connected to the board (both soldered lead connections and solderless pin connections).

2. Remove all screws holding the board to the chassis or other mounting surface. Some boards may be held fast on one side by a slotted plastic bar in addition to the screws; for these, remove the screws, then pull the circuit board from its slot to free the board. Also, remove any obstructions that would prevent the board from being lifted out of the instrument.

3. Lift the circuit board out of the unit. Do not force or bend the board.

4. To replace the board, reverse the order of removal. Use care when replacing pin connectors; if forced into place incorrectly, the pin connectors may be damaged.

Circuit-board Pins

CAUTION

Most circuit boards in this instrument are multi-layer type boards with a conductive path(s) laminated between the top and bottom board layers. All soldering on these boards should be done with extreme care to prevent breaking the connection to the center conductor(s); only experienced maintenance personnel should attempt repair of these boards.

A circuit-board pin replacement kit including the necessary tools, instructions, and replacement pins is available from Tektronix, Inc. Order from your local Tektronix Field Office or representative. Replacement of circuit-board pins on multi-layer boards is not recommended; refer such repairs to your local Tektronix Field Office or representative.

Semiconductors

CAUTION

To avoid component damage, power must be turned off before removing or replacing semiconductors.

Semiconductors should not be replaced unless actually defective. If semiconductors are removed during routine maintenance, return them to their original sockets. Unnecessary replacement of semiconductors may affect the adjustment of this instrument. When semiconductors are replaced, check the operation of that part of the instrument that may be affected.

WARNING

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

Replacement devices should be of the original type or a direct replacement. Figure 5-2 shows the lead configurations of the semiconductor devices used in this instrument. Some plastic-case transistors have lead configurations that do not agree with those shown here. When replacing, check the manufacturer's basing diagram for correct basing. All transistor sockets in this instrument are wired for the standard basing used for metal-case transistors. Semiconductors that have heat radiators use silicone grease to increase heat transfer. Replace the silicone grease with replacing these semiconductors.

An extraction tool should be used to remove the 14- and 16-pin integrated circuits to prevent damage to the pins. This tool is available from Tektronix, Inc. If an extraction tool is not available when removing one of these integrated circuits, pull slowly and evenly on both ends of the device. Try to avoid having one end of the integrated circuit disengage from the socket before the other, as the pins may be damaged.

To replace one of the power transistors mounted on the chassis adjacent to the Power Supply circuit board, first unsolder the leads. Then, loosen the nuts on the plastic bar, or the screw in the metal clamp, that clamps the transistor to the chassis. Remove the defective transistor. When replacing the transistor, use silicone grease on both sides of the insulator plate and on the metal tab, if the transistor has one, to increase heat transfer from the transistor to the chassis.

Interconnecting Pin Replacement. To replace a pin that is mounted on a circuit board, first disconnect any pin connectors. Then, unsolder the damaged pin and pull it out of the board with a pair of pliers. Be careful not to damage the wiring on the board with too much heat. Ream out the hole in the circuit board with a 0.031-inch drill. Remove the ferrule from the new interconnecting pin and press the new pin into the hole in the circuit board. Position the pin in the same manner as the old pin. If the old pin was bent at an angle to mate with a connector, bend the new pin to match the associated pins.

Switches

Two types of switches are used in this instrument. Contact alignment and spacing are critical to the operation of the pushbutton and cam switches. Therefore, defective switches should either be replaced as a unit or repaired only by personnel experienced with these types of switches. Your local Tektronix Field Office or representative can provide additional information. The following special maintenance information is provided for switch replacement.

Switch Replacement. The following maintenance information is provided for the cam switches and pushbutton switches used in this instrument system.

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.

A. CAM SWITCHES

Two cam switch repair kits are available from Tektronix Inc. The first kit is used to repair the cam switches in most time-base plug-in units and some vertical plug-in units. The second kit is used to repair the cam switches using the high-frequency contact, which is used in several vertical plug-in units.

The cam switches consist of a rotating drum with lobes, whose position is controlled by the front-panel knobs, which actuate spring-leaf contacts.

The following instructions have been generalized to fit all instruments. Detailed instructions for cam switch repair, where required, will be found in the appropriate manual.

1. Remove any shields, switch shafts, interfering wires, components, or circuit boards that prevent access to the circuit board with the bad cam switch contact.

NOTE

Cam switch bearing blocks that attach to more than one circuit board should not be separated from both boards during disassembly, unless absolutely necessary, as proper bearing alignment will be difficult.

2. Completely remove from the instrument the circuit board having the defective cam switch contact.

3. To replace the defective cam switch contacts, follow the instructions given in the switch repair kit.

4. To reassemble the instrument, reverse the disassembly procedure.

B. PUSHBUTTON SWITCHES

The pushbutton switches are not repairable and should be replaced as a unit if defective. Use a de-soldering tool to remove solder from the holes in the circuit board when unsoldering the switches.

Cathode-Ray Tube

The following procedure outlines the removal and replacement of the cathode-ray tube (crt).

WARNING

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

A. REMOVAL

1. Remove the bezel assembly, which is held in place with two screws. (The bezel assembly includes a snap-in implosion shield.)

2. Disconnect deflection leads from crt neck pin receptacles and disconnect the storage-element cable connector from the Storage circuit board.

NOTE

The red and black wires entering the crt shield are connected to the trace-rotation coil inside the shield. They will not hamper crt removal and need not be unsoldered.

3. Remove the crt base cover on the rear panel of the instrument. Remove the crt base-pin socket.

4. Disconnect the crt anode plug from the jack located on the panel adjacent to the left side of the crt shield. Ground the crt anode plug to the chassis momentarily to dissipate any stored charge.

5. With one hand on the crt faceplate, push on the crt base, being sure to feed the storage-element cable and the anode lead through the slot and hole in the bottom and rear of the main portion of the crt shield as the crt slides forward. Pull the crt out of the instrument from the front.

B. REPLACEMENT

1. Make sure the soft plastic crt faceplate supports are in place, then insert the crt into the shield while feeding the storage-element cable and the anode lead through the slot and hole in the bottom and rear of the crt shield.

2. With the crt fully inserted and the shield hardware loose, mount the bezel assembly into place and tighten the bezel screws.

NOTE

If the crt support ring has come out of the crt shield, place it over rear of crt and position inside crt shield between crt and crt shield.

3. Position the rear of the crt (socket end) so that there is no tilt of the faceplate in relation to the bezel assembly, then tighten the positioning screws. Check that the four deflection crt neck-pin receptacles are centered in the neck shield cutout, then tighten the clamp hardware.

4. Place the crt base socket onto the crt base pins. Replace the crt base cover on the rear panel. Connect the storage-element cable to the pin connectors on the Storage circuit board, and connect the deflection leads to the crt neck pins. Reconnect the crt anode plug to the jack from the high-voltage circuit board.

5. Replacing the crt will require partial instrument adjustment. Refer to the Adjustments information in this manual.

Bulbs

To replace the knob-skirt deflection-factor readout bulbs, proceed as follows:

NOTE

To gain access to bulbs, it may be necessary to remove circuit boards and pushbutton switch extension shafts. Extension shafts are removed and installed by pulling straight off and pushing straight on.

1. Remove the light shield.

2. Unsolder the defective bulb, and install its replacement.

3. Replace the light shield.

To replace the graticule lights, proceed as follows.

1. Remove the crt bezel assembly.

2. Pull out the light reflector assembly slightly.

3. Replace the burned out light(s).

4. Replace the light reflector assembly back into its original position.

5. Re-install the crt bezel assembly.

Power Transformer

Replace the power transformer only with a direct replacement Tektronix transformer. After the transformer has been replaced, check the power supply output voltages and the crt operation as outlined in the Operating Information section.

Fuses

Table 5-2 gives the rating, location, and function of the fuses used in this instrument system.

**Table 5-2
FUSES**

Circuit Number	Rating	Function	Location
F300	120 V ac — 1.25 A Slow 240 V ac — 0.7 A Slow	Line-Voltage Input	Display unit rear panel
F800	0.25 A Fast	+ 200 V Unreg supply	LV Power Supply board
F410	0.3 A Slow	+ 38 V Unreg supply	HV Power Supply board

REPACKAGING FOR SHIPMENT

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

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

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane

foam between carton and instrument, on all sides. Seal the carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 275 pounds.

SELECTED COMPONENTS CRITERIA

During initial performance verification, selected values of the following component(s) may have been installed to meet certain performance requirements for this instrument. If, during adjustment, following corrective maintenance, or hours-of-service performance checks, it is determined that one or more of these components needs replacement, the following criteria (Table 5-3) should be used.

Table 5-3
SELECTED COMPONENT CRITERIA

Component	Circuit Involved	Range of Values	Criteria/Effects
C100	Vert. Ampl. — Input	2.2 pf to 10 pf (7.5 pf nominal value)	Selected for optimum rise time and minimum aberrations. An increase in capacitance decreases frequency response (rolls off front corner).

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 01	Removes Readout Circuitry	Described in this section.
Option 03	External Readout Input	Described in this section.
Option 04	Protective Front Panel cover	Described in this section.

OPTION 01

This modification removes the Readout circuitry from the 5441.

ELECTRICAL PARTS LIST

	Ckt. No.	Tektronix Part No.	Description
Remove:			
	A3	670-2413-00	READOUT Circuit Board Assembly
	U1030	155-0015-01	Monolithic Analog Data Switch
	U1040	155-0015-01	Monolithic Analog Data Switch
Add:			
		131-1398-00	Contact, Elect. 16 Pin, dip. gnd
		131-1398-00	Contact, Elect. 16 Pin, dip. gnd
(131-1398-00 are installed where the 155-0015-01 are removed)			

OPTION 03

EXTERNAL READOUT INPUT

The External Readout Input option provides access to the two readout display words that cannot be programmed via plug-ins in the 5441. This option does not alter the display or words that are programmed from plug-ins.

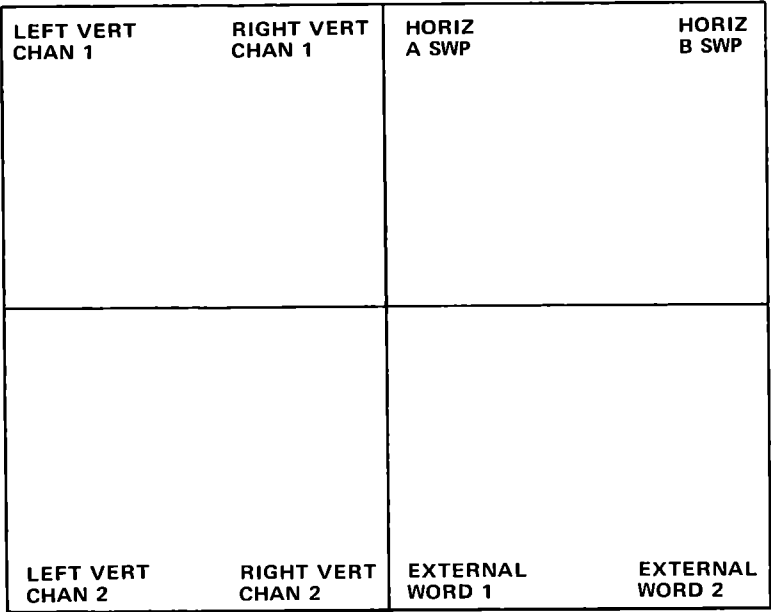
The words that are accessed by this option appear at the bottom of the screen as shown in Fig. 6-1. These words are designated EXT. 1 and EXT. 2.

CONNECTOR DESCRIPTION

The connector provided for the External Redout Input is a 25-pin, female connector located on the rear panel of the 5441. The connector mates with an ITT—Cannott DB—25P, or equivalent, connector. Refer to Fig. 6-2 for connector pin assignments.

GROUND	Readout System Ground.
+5 V, +15 V, -15 V	Power supply connections. Maximum allowable currents; +5, 100 mA; +15, 20 mA; -15, 20 mA.

EXT. COLUMN 1	Column data input for External word 1.
EXT. COLUMN 2	Column data input for External word 2.
EXT. ROW 1	Row data input for External word 1.
EXT. ROW 2	Row data input for External word 2.
40 V LINE FREQ	Line frequency signal approx. 40 V p-p. 10 mA maximum.
TS1—TS10	Time Slot signals.
TRAPEZOID	Trapezoid signal from pin 10 of Timer, U1000 on Readout Board.
END-OF-WORD	End-of-word pulse from pin 2 of Time Slot counter U1025 on Readout Board.
TRIGGER	Pulse from pin 5 of Timer U1000 on Readout Board.



2139-12

Fig. 6-1. Readout word location.

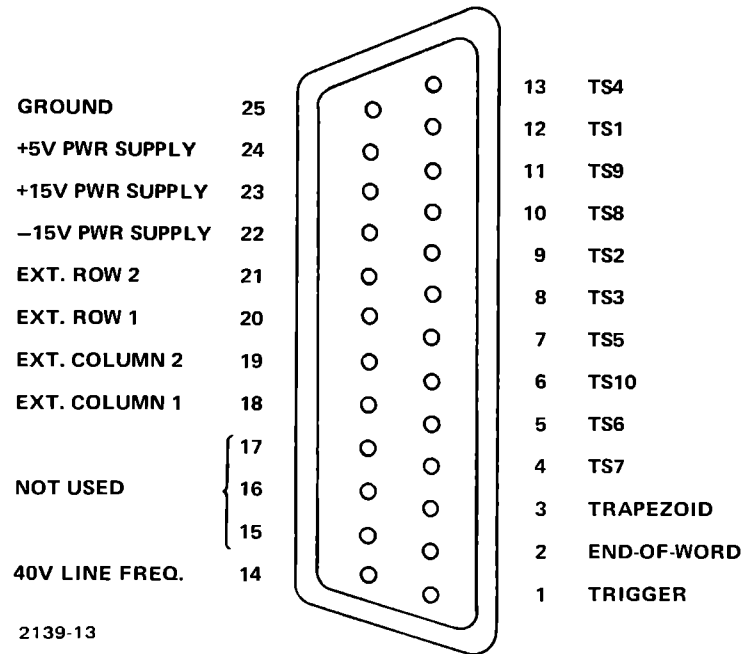


Fig. 6-2. Connector pin assignments (view looking at rear panel of 5441).

PROGRAMMING

The 5411 Readout system is programmed by resistors, which are connected between Time Slot lines and Row or Column lines. The resistors are chosen according to the character displayed or the operation performed. For the values of programming resistors, see Fig. 3-8 (the Character Selection Matrix). All programming resistors smaller than 51 k Ω and larger than 13 k Ω should be 1% tolerance or better; all others can be 5% or less.

To illustrate resistor selection, consider the display "TEST 1" in EXT. 1. Required resistor values are shown in Table 6-1.

In Table 6-1 the Matrix indicates, for example, that the character "T" is programmed by Column 9 and Row 4. The Selection Matrix also indicates that a 16.5 k Ω resistor is required for Column 9 while 51 k Ω is required for Row 4. To obtain the space before the "1", the "ADD SPACE" operation is used.

The choice of Time Slots depends on the desired position of the character within the word. Programming the first character from TS1 displays that character in the left-most character position of the display word. Similarly, programming the first character from TS2, TS3, or TS4 displays that character in the second, third, or fourth position within the display word respectively. Programming the first character

Table 6-1
RESISTOR PROGRAM FOR "TEST 1"

Character	Column	Column Resistor	Row	Row Resistor
T	9	16.5 k Ω	4	51 k Ω
E	10	13 k Ω	5	37.4 k Ω
S	1	150 k Ω	5	37.4 k Ω
T	9	16.5 k Ω	4	51 k Ω
(Space)	0	Open	10	16.5 k Ω
1	2	75 k Ω	1	Open

from TS5 to TS10, however, displays the character as if it is programmed from TS4. To move the character further right requires programming "ADD SPACE" (Column 0, Row 10) in Time Slots after TS3.

Once the Time Slot for the first character is chosen, succeeding characters are programmed in succeeding Time Slots. If, however, a Time Slot other than TS1, TS2, or TS3 is left unprogrammed, character position is unchanged during that Time Slot. For example, if TS6 and TS8 are programmed and TS7 is not, then the character displayed in TS8 is displayed in the same position as if it were programmed in TS7.

To further clarify the programming concepts outlined here, a complete circuit diagram for programming a word is given in Fig. 6-3. This circuit displays "TEST n" where "n" is a number from 0 to 99, selectable by the user. Time Slots TS1 to TS5 are used to program "TEST (space)". Time Slot 6 with Switch S1 and R10 through R19 programs the tens digit of the number. S1 selects the number displayed. Similarly, S2 selects the units digit programmed in TS7. There are several choices for the format of the number when the number is less than 10. If it is desirable to display the number "8" as "08", then R10B is used to program a "0" in the

tens digit and R10A is not used. If a space is desired in the tens digit (in addition to the space in TS5) so that the location of the units digit does not shift when changing from "9" to "10", then R10A is used and R10B is not. If neither R10A nor R10B is used, the units digit in numbers less than 10 is displayed in the display location of the tens digit.

Column and Row connections are chosen according to the display location of the word on the screen. Connection of programming resistors of Row 1 and Column 1 displays in the location of EXT 1. Likewise, connection to Row 2 and Column 2 displays in the location of EXT 2.

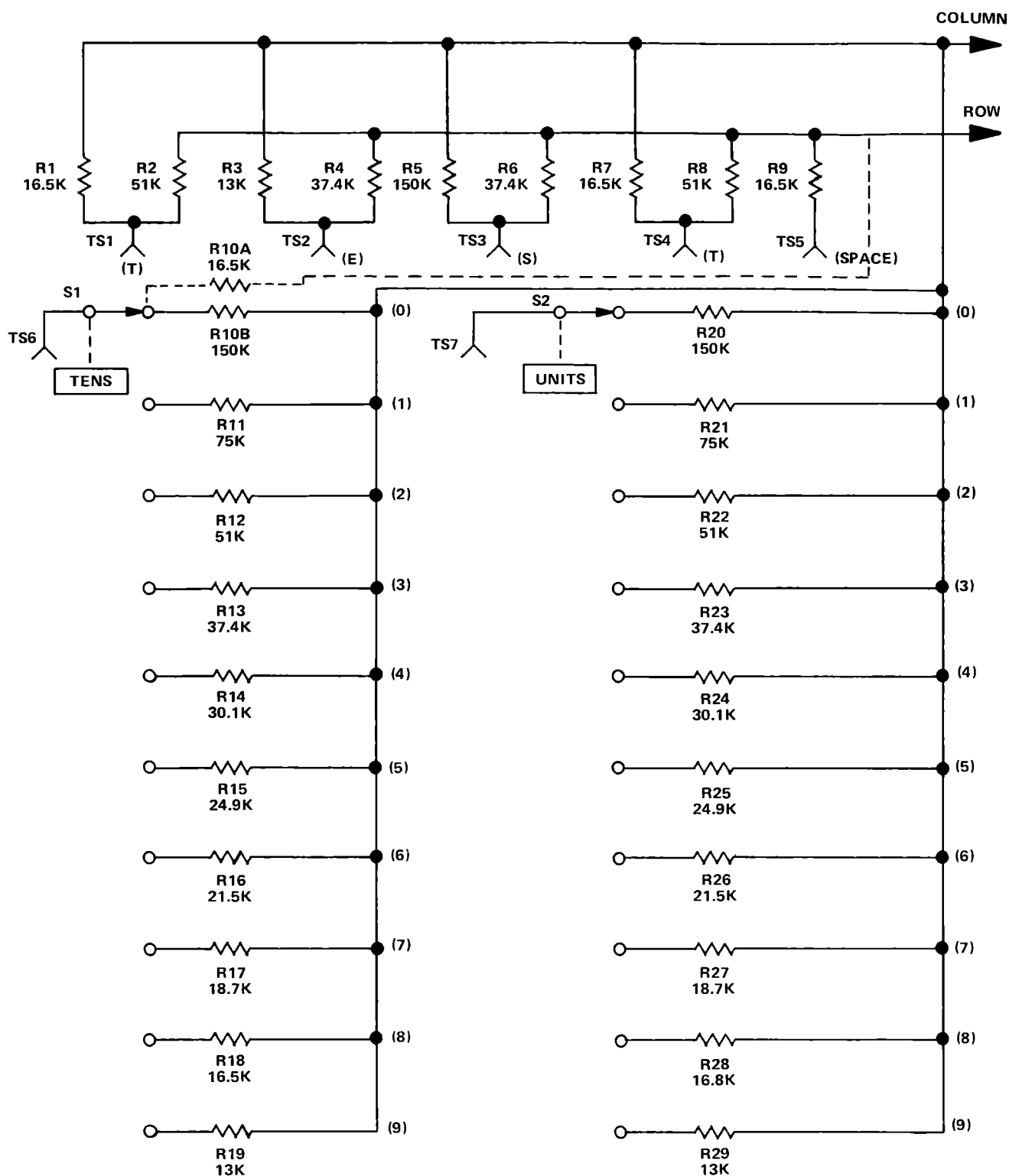
ADDITIONAL CONSIDERATIONS

The connections to the External Readout Input connector are not short-circuit protected. Shorts may damage the Readout System.

The Trapezoid, End-of-Word, and Trigger signals are for special processing applications. They have very limited driving capability and should be emitter follower buffered if used for any purpose.

MECHANICAL PARTS LIST

Fig. & Index No.	Tektronix Part No.	Quantity	Description
Add:			
	131-0569-00	1	Connector, 25-Pin, Female
	131-0570-00	1	Connector, 25-Pin, Male
	210-0004-00	2	Washer, Lock No. 4
	210-0406-00	2	Nut, 4-40 X 3/16
	129-0370-00	2	Post, Metallic (Stud)
	200-1055-00	1	Cover, Connector
Change to:			
	333-1775-00	1	Rear Panel



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Fig. 6-3. PROGRAMMING "TEST n".

OPTION 04

The purpose of Option 04 is to provide a protective front-panel cover. The cabinet sides have been modified by the addition of a retaining hook for the protective cover.

MECHANICAL PARTS LIST

Fig. & Index No.	Tektronix Part No.	Quantity	Description
Change to:	390-0193-01	1	Cabinet Side (left)
	390-0192-01	1	Cabinet Side (right)
Add:	200-1375-00	1	Cover Front (oscilloscope)

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.

LIST OF ASSEMBLIES

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

CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

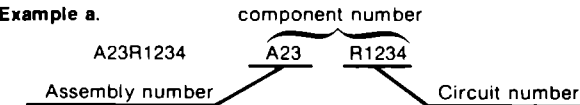
The Mfr. Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

ABBREVIATIONS

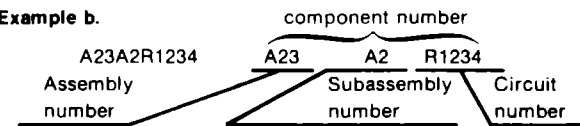
Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:



Read: Resistor 1234 of Assembly 23



Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

NAME & DESCRIPTION (column five of the Electrical Parts List)

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.

MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000AX	BUEHLER PRODUCTS INC.	PO BOX A,HIGHWAY 70 EAST	KINGSTON, NC 28501
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC.		
	SEMICONDUCTOR GROUP	P.O. BOX 5012	DALLAS, TX 75222
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT		
04222	AVX CERAMICS, DIVISION OF AVX CORP.	ELECTRONICS PARK	SYRACUSE, NY 13201
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	P O BOX 867	MYRTLE BEACH, SC 29577
05397	UNION CARBIDE CORPORATION, MATERIALS SYSTEMS DIVISION	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
05828	GENERAL INSTRUMENT CORP ELECTRONIC SYSTEMS DIV.	11901 MADISON AVENUE	CLEVELAND, OH 44101
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	600 W JOHN ST.	HICKSVILLE LI, NY 11802
12954	SIEMENS CORPORATION, COMPONENTS GROUP	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
12969	UNITRODE CORPORATION	8700 E THOMAS RD, P O BOX 1390	SCOTTSDALE, AZ 85252
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.	580 PLEASANT STREET	WATERTOWN, MA 02172
14193	CAL-R, INC.		LOS GATOS, CA 95030
14433	ITT SEMICONDUCTORS	1601 OLYMPIC BLVD.	SANTA MONICA, CA 90404
		3301 ELECTRONICS WAY	
		P O BOX 3049	WEST PALM BEACH, FL 33402
14552	MICRO SEMICONDUCTOR CORP.	2830 E FAIRVIEW ST.	SANTA ANA, CA 92704
14936	GENERAL INSTRUMENT CORP., SEMICONDUCTOR PRODUCTS GROUP		
15454	RODAN INDUSTRIES, INC.	P.O. BOX 600,600 W. JOHN ST.	HICKSVILLE, NY 11802
19701	ELECTRA-MIDLAND CORP., MEPCO ELECTRA INC.	2905 BLUE STAR ST.	ANAHEIM, CA 92806
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	P O BOX 760	MINERAL WELLS, TX 76067
27014	NATIONAL SEMICONDUCTOR CORP.	550 HIGH STREET	BRADFORD, PA 16701
31514	STANFORD APPLIED ENGINEERING, INC.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32997	ADVANCED PACKAGING DIV.		
50157	BOURNS, INC., TRIMPOT PRODUCTS DIV.	3080 AIRWAY DRIVE	COSTA MESA, CA 92626
	MIDWEST COMPONENTS INC.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
		P. O. BOX 787	
50434	HEWLETT-PACKARD COMPANY	1981 PORT CITY BLVD.	MUSKEGON, MI 49443
51406	MURATA CORPORATION OF AMERICA	640 PAGE MILL ROAD	PALO ALTO, CA 94304
52306	HIGH VOLTAGE DEVICES, INC.	2 WESTCHESTER PLAZA	ELMSFORD, NY 10523
54473	MATSUSHITA ELECTRIC, CORP. OF AMERICA	7485 AVENUE 304	VISALIA, CA 93277
55680	NICHICON/AMERICA/CORP.	1 PANASONIC WAY	SECAUCUS, NJ 07094
56289	SPRAGUE ELECTRIC CO.	6435 N PROESEL AVENUE	CHICAGO, IL 60645
57668	R-OHM CORP.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
58224	XENELL CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
59660	TUSONIX INC.	HWY 77S PO BOX 726	WYNNEWOOD, OK 73098
59821	CENTRALAB INC	2155 N FORBES BLVD	TUCSON, AZ 85705
	SUB NORTH AMERICAN PHILIPS CORP	7158 MERCHANT AVE	EL PASO, TX 79915
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.		
71450	CTS CORP.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	905 N. WEST BLVD	ELKHART, IN 46514
71744	CHICAGO MINIATURE LAMP WORKS	P O BOX 858	FORT DODGE, IA 50501
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	4433 RAVENSWOOD AVE.	CHICAGO, IL 60640
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	644 W. 12TH ST.	ERIE, PA 16512
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	2500 HARBOR BLVD.	FULLERTON, CA 92634
76493	BELL INDUSTRIES, INC., MILLER, J. W., DIV.	401 N. BROAD ST.	PHILADELPHIA, PA 19108
80009	TEKTRONIX, INC.	19070 REYES AVE., P O BOX 5825	COMPTON, CA 90224
80031	ELECTRA-MIDLAND CORP., MEPCO DIV.	P O BOX 500	BEAVERTON, OR 97077
81073	GRAYHILL, INC.	22 COLUMBIA ROAD	MORRISTOWN, NJ 07960
82104	STANDARD GRIGSBY CO., DIV. OF SUN CHEMICAL CORPORATION	561 HILLGROVE AVE., PO BOX 373	LA GRANGE, IL 60525
83003	VARO, INC.	920 RATHBONE AVENUE	AURORA, IL 60507
84411	TRW ELECTRONIC COMPONENTS, TRW CAPACITORS	P O BOX 411, 2203 WALNUT STREET	GARLAND, TX 75040
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	112 W. FIRST ST.	OGALLALA, NE 69153
		3029 E. WASHINGTON STREET	
		P. O. BOX 372	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
91929	HONEYWELL, INC., MICRO SWITCH DIV.	CHICAGO & SPRING STS.	FREEMONT, IL 61032

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
93410	ESSEX INTERNATIONAL, INC., CONTROLS DIV. LEXINGTON PLANT	P. O. BOX 1007	MANSFIELD, OH 44903
95238	CONTINENTAL CONNECTOR CORP.	34-63 56TH ST.	WOODSIDE, NY 11377
96733	SAN FERNANDO ELECTRIC MFG CO	1501 FIRST ST	SAN FERNANDO, CA 91341
T0058	NEC ELECTRON INC.	252 HUMBOLT COURT	SUNNYVALE, CA 94086

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-3577-00	B010100	B020659	CKT BOARD ASSY:VERTICAL	80009	670-3577-00
A1	670-3577-01	B020660	B094064	CKT BOARD ASSY:VERTICAL	80009	670-3577-01
A1	670-3577-02	B094065		CKT BOARD ASSY:VERTICAL	80009	670-3577-02
A2	670-3556-00	B010100	B019999	CKT BOARD ASSY:HORIZONTAL	80009	670-3556-00
A2	670-3556-01	B020000	B089999	CKT BOARD ASSY:HORIZONTAL	80009	670-3556-01
A2	670-3556-02	B090000		CKT BOARD ASSY:HORIZONTAL	80009	670-3556-02
A3	670-3514-00	B010100	B020484	CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-00
A3	670-3514-01	B020485	B089999	CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-01
A3	670-3514-02	B090000	B093224	CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-02
A3	670-3514-03	B093225		CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-03
A4	670-2833-00	B010100	B061536	CKT BOARD ASSY:STORAGE	80009	670-2833-00
A4	670-2833-01	B061537	B089999	CKT BOARD ASSY:STORAGE	80009	670-2833-01
A4	670-2833-02	B090000	B095044	CKT BOARD ASSY:STORAGE	80009	670-2833-02
A4	670-2833-03	B095045		CKT BOARD ASSY:STORAGE	80009	670-2833-03
A5	670-0702-05			CKT BOARD ASSY:GRATICULE LAMPS	80009	670-0702-05
A6	670-2335-00	B010100	B053530	CKT BOARD ASSY:INTERFACE	80009	670-2335-00
A6	670-2335-01	B053531	B053858	CKT BOARD ASSY:INTERFACE	80009	670-2335-01
A6	670-2335-02	B053859	B055101	CKT BOARD ASSY:INTERFACE	80009	670-2335-02
A6	670-2335-03	B055102	B062199	CKT BOARD ASSY:INTERFACE	80009	670-2335-03
A6	670-2335-04	B062200	B094064	CKT BOARD ASSY:INTERFACE	80009	670-2335-04
A6	670-2335-05	B094065	B094584	CKT BOARD ASSY:INTERFACE	80009	670-2335-05
A6	670-2335-06	B094585	B094923	CKT BOARD ASSY:INTERFACE	80009	670-2335-06
A6	670-2335-08	B094924		CKT BOARD ASSY:INTERFACE	80009	670-2335-08
A7	670-2336-00	B010100	B094622	CKT BOARD ASSY:POWER SUPPLY	80009	670-2336-00
A7	670-2336-01	B094623		CKT BOARD ASSY:LV SUPPLY & CAL	80009	670-2336-01
A8	670-2413-00	B010100	B094301	CKT BOARD ASSY:READOUT	80009	670-2413-00
A8	670-2413-01	B094302		CKT BOARD ASSY:READOUT	80009	670-2413-01
A9	670-5035-00	B062200		CKT BOARD ASSY:READOUT PROTECTION	80009	670-5035-00
A1	670-3577-00	B010100	B020659	CKT BOARD ASSY:VERTICAL	80009	670-3577-00
A1	670-3577-01	B020660	B094064	CKT BOARD ASSY:VERTICAL	80009	670-3577-01
A1	670-3577-02	B094065		CKT BOARD ASSY:VERTICAL	80009	670-3577-02
A1C100	281-0604-00	B010100	B094064	CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V	04222	7001-C0J-2R2C
A1C100	281-0601-00	B094300		CAP.,FXD,CER DI:7.5PF,500V	59660	301-000C0H0759D
A1C101	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V (NOMINAL VALUE, SELECTED)	59821	D103Z40Z5UJDCEX
A1C101	-----					
A1C102	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A1C115	281-0204-00			CAP.,VAR,PLSTC:2-22PF,100V	80031	2807C00222MJ02
A1C120	281-0638-00			CAP.,FXD,CER DI:240PF,5%,500V	72982	301000Z5D241J
A1C123	281-0524-00			CAP.,FXD,CER DI:150PF,+/-30PF,500V	59660	301000X5U151M
A1C127	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A1C148	281-0623-00	B010100	B094064	CAP.,FXD,CER DI:650PF,5%,500V	59660	301000Y5D651J
A1C148	281-0820-00	B094065		CAP.,FXD,CER DI:680PF,10%,50V	05397	C114K681K1X5CA
A1C153	281-0651-00			CAP.,FXD,CER DI:47PF,5%,200V	59660	0374018T2H0 470J
A1C155	281-0204-00			CAP.,VAR,PLSTC:2-22PF,100V	80031	2807C00222MJ02
A1C156	281-0651-00			CAP.,FXD,CER DI:47PF,5%,200V	59660	0374018T2H0 470J
A1C160	281-0651-00			CAP.,FXD,CER DI:47PF,5%,200V	59660	0374018T2H0 470J
A1C165	281-0623-00	B010100	B094064	CAP.,FXD,CER DI:650PF,5%,500V	59660	301000Y5D651J
A1C165	281-0820-00	B094065		CAP.,FXD,CER DI:680PF,10%,50V	05397	C114K681K1X5CA
A1C167	281-0634-00	B010100	B094064	CAP.,FXD,CER DI:10PF,+/-0.25PF,500V	59660	374 011 C0G0100C
A1C167	281-0645-00	B094065		CAP.,FXD,CER DI:8.2PF,+/-0.25PF,500V	59660	374 018 C0H0829C
A1C170	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A1C173	283-0000-00	B021272	CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610YSU0102P
A1C180	290-0534-00	B010100 B021496	CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
A1C180	283-0111-00	B021497	CAP.,FXD,CER DI:0.1UF,20%,50V	96733	R2632
A1C181	281-0203-00		CAP.,VAR,PLSTC:2-10PF,100V	80031	2807C00210MJ02F0
A1C184	281-0546-00	B010100 B094064	CAP.,FXD,CER DI:330PF,10%,500V	59660	301000X5P331K
A1C184	281-0823-00	B094065	CAP.,FXD,CER DI:470PF,10%,50V	04222	MA105A471KAA
A1C185	281-0546-00	B010100 B094064	CAP.,FXD,CER DI:330PF,10%,500V	59660	301000X5P331K
A1C185	281-0823-00	B094065	CAP.,FXD,CER DI:470PF,10%,50V	04222	MA105A471KAA
A1C188	283-0000-00		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610YSU0102P
A1C192	290-0522-00	B010100 B021496	CAP.,FXD,ELCTLT:1UF,20%,50V	12954	D1R0GS3A50M
A1C192	283-0111-00	B021497	CAP.,FXD,CER DI:0.1UF,20%,50V	96733	R2632
A1C197	290-0534-00	B010100 B021496	CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
A1C197	283-0111-00	B021497	CAP.,FXD,CER DI:0.1UF,20%,50V	96733	R2632
A1C198	290-0523-00	B010100 B021496	CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0020HA1
A1C198	283-0111-00	B021497	CAP.,FXD,CER DI:0.1UF,20%,50V	96733	R2632
A1CR146	152-0422-00		SEMICONV DEVICE:SILICON,4V,7PF	04713	SMV1264
A1L167	108-0733-00		COIL,RF:FIXED,113NH	80009	108-0733-00
A1L197	108-0440-00		COIL,RF:8UH,TOROIDAL INDUCTOR	80009	108-0440-00
A1L198	108-0440-00		COIL,RF:8UH,TOROIDAL INDUCTOR	80009	108-0440-00
A1LR193	108-0328-00		COIL,RF:0.3UH	80009	108-0328-00
A1LR195	108-0328-00		COIL,RF:0.3UH	80009	108-0328-00
A1Q100	151-0441-00		TRANSISTOR:SILICON,NPN	04713	SRF501
A1Q106	151-0212-00		TRANSISTOR:SILICON,NPN	04713	SRF 518
A1Q125	151-0441-00		TRANSISTOR:SILICON,NPN	04713	SRF501
A1Q130	151-0212-00		TRANSISTOR:SILICON,NPN	04713	SRF 518
A1Q140	151-0342-00		TRANSISTOR:SILICON,PNP	07263	S035928
A1Q148	151-0271-00	B010100 B093644	TRANSISTOR:SILICON,PNP	04713	SPS8236
A1Q148	151-0434-00	B093645	TRANSISTOR:SILICON,PNP	04713	SS7144
A1Q165	151-0271-00	B010100 B093644	TRANSISTOR:SILICON,PNP	04713	SPS8236
A1Q165	151-0434-00	B093645	TRANSISTOR:SILICON,PNP	04713	SS7144
A1Q170	151-0434-00		TRANSISTOR:SILICON,PNP	04713	SS7144
A1Q172	151-0434-00		TRANSISTOR:SILICON,PNP	04713	SS7144
A1Q180	151-0451-00		TRANSISTOR:SILICON,NPN	04713	SRF503
A1Q182	151-0451-00		TRANSISTOR:SILICON,NPN	04713	SRF503
A1Q188	151-0446-00		TRANSISTOR:SILICON,NPN	80009	151-0446-00
A1Q190	151-0446-00		TRANSISTOR:SILICON,NPN	80009	151-0446-00
A1R100	321-0085-00		RES.,FXD,FILM:75 OHM,1%,0.125W	91637	CMF55116G75R00F
A1R102	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R103	321-0097-00		RES.,FXD,FILM:100 OHM,1%,0.125W	91637	CMF55116G100R0F
A1R104	321-0097-00		RES.,FXD,FILM:100 OHM,1%,0.125W	91637	CMF55116G100R0F
A1R108	315-0302-00		RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R110	321-0217-00		RES.,FXD,FILM:1.78K OHM,1%,0.125W	91637	CMF55116G17800F
A1R111	321-0089-00		RES.,FXD,FILM:82.5 OHM,1%,0.125W	91637	CMF55116G82R50F
A1R112	321-0217-00		RES.,FXD,FILM:1.78K OHM,1%,0.125W	91637	CMF55116G17800F
A1R115	311-1566-00		RES.,VAR,NONWIR:200 OHM,20%,0.50W	73138	91-88-0
A1R117	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R118	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R120	311-1560-00		RES.,VAR,NONWIR:TRMR,5K OHM,0.5W	32997	3352T-1-502
A1R123	311-1563-00		RES.,VAR,NONWIR:1K OHM,20%,0.50W	73138	91-85-0
A1R125	321-0085-00		RES.,FXD,FILM:75 OHM,1%,0.125W	91637	CMF55116G75R00F
A1R127	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R128	321-0097-00		RES.,FXD,FILM:100 OHM,1%,0.125W	91637	CMF55116G100R0F
A1R129	321-0097-00		RES.,FXD,FILM:100 OHM,1%,0.125W	91637	CMF55116G100R0F
A1R132	315-0302-00		RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1R135	311-1563-00			RES.,VAR, NONWIR:1K OHM,20%,0.50W	73138	91-85-0
A1R136	321-0121-00			RES.,FXD,FILM:178 OHM,1%,0.125W	91637	CMF55116G178R0F
A1R138	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A1R139	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R141	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1R142	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	57668	NTR25J-E 27E
A1R143	315-0220-00	B010100	B020659	RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A1R143	315-0430-00	B020660	B082589	RES.,FXD,CMPSN:43 OHM,5%,0.25W	57668	NTR25J-E 43E
A1R143	315-0750-00	B082590		RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
A1R143	-----			(NOMINAL VALUE, SELECTED)		
A1R144	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	57668	NTR25J-E 430E
A1R145	321-0148-00			RES.,FXD,FILM:340 OHM,1%,0.125W	91637	CMF55116G340R0F
A1R146	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1R148	315-0151-00	B010100	B094064	RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A1R148	315-0131-00	B094065		RES.,FXD,CMPSN:130 OHM,5%,0.25W	57668	NTR25J-E 130E
A1R148A	315-0100-00	B094065		RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1R149	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1R151	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R153	321-0093-00			RES.,FXD,FILM:90.9 OHM,1%,0.125W	91637	MFF1816G90R90F
A1R155	311-1567-00			RES.,VAR, NONWIR:TRMR,100 OHM,0.50W	73138	91-89-0
A1R157	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	57668	NTR25J-E 6K2
A1R158	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R160	321-0148-00			RES.,FXD,FILM:340 OHM,1%,0.125W	91637	CMF55116G340R0F
A1R163	315-0431-00			RES.,FXD,CMPSN:430 OHM,5%,0.25W	57668	NTR25J-E 430E
A1R164	315-0220-00	B010100	B020659	RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A1R164	315-0430-00	B020660	B082589	RES.,FXD,CMPSN:43 OHM,5%,0.25W	57668	NTR25J-E 43E
A1R164	315-0750-00	B082590		RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
A1R164	-----			(NOMINAL VALUE, SELECTED)		
A1R165	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A1R165A	315-0100-00	B094065		RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1R167	311-1564-00			RES.,VAR, NONWIR:TRMR,500 OHM,0.5W	32997	3352T-CK5-501
A1R172	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	CMF55116G200R0F
A1R173	321-0093-00			RES.,FXD,FILM:90.9 OHM,1%,0.125W	91637	MFF1816G90R90F
A1R175	311-1561-00			RES.,VAR, NONWIR:2.5K OHM,20%,0.50W	73138	91-83-0
A1R176	321-0093-00			RES.,FXD,FILM:90.9 OHM,1%,0.125W	91637	MFF1816G90R90F
A1R178	321-0126-00			RES.,FXD,FILM:200 OHM,1%,0.125W	91637	CMF55116G200R0F
A1R180	301-0151-00	B010100	B010170	RES.,FXD,CMPSN:150 OHM,5%,0.5W	01121	EB1515
A1R180	315-0910-00	B010171		RES.,FXD,CMPSN:91 OHM,5%,0.25W	57668	NTR25J-E 91E
A1R181	321-0074-00	B010100	B010170	RES.,FXD,FILM:57.6 OHM,1%,0.125W	91637	CMF55116G57R60F
A1R181	321-0079-00	B010171	B094064	RES.,FXD,FILM:64.9 OHM,1%,0.125W	91637	CMF55116G64R90F
A1R181	321-0073-00	B094065		RES.,FXD,FILM:56.2 OHM,1%,0.125W	91637	CMF55116G56R20F
A1R182	301-0151-00	B010100	B010170	RES.,FXD,CMPSN:150 OHM,5%,0.5W	01121	EB1515
A1R182	315-0910-00	B010171		RES.,FXD,CMPSN:91 OHM,5%,0.25W	57668	NTR25J-E 91E
A1R183	301-0300-00	B010171		RES.,FXD,CMPSN:30 OHM,5%,0.5W	01121	EB3005
A1R184	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	57668	NTR25J-E68E0
A1R185	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	57668	NTR25J-E68E0
A1R187	315-0820-00			RES.,FXD,CMPSN:82 OHM,5%,0.25W	57668	NTR25J-E82E0
A1R188	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1R190	315-0820-00			RES.,FXD,CMPSN:82 OHM,5%,0.25W	57668	NTR25J-E82E0
A1R191	307-0435-00	B010100	B094064	RES.,FXD,FILM:510 OHM,5%,4W	24546	FP45100J
A1R191	308-0758-00	B094065		RES.,FXD,WW:430 OHM,1%,7W	14193	SP1151S-430R0F
A1R192	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1R193	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0

Component No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
A1R194	307-0435-00	B010100	B094064	RES.,FXD,FILM:510 OHM,5%,4W	24546	FP45100J
A1R194	308-0758-00	B094065		RES.,FXD,WW:430 OHM,1%,7W	14193	SP1151S-430R0F
A1R195	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R197	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1R198	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A1RT157	307-0181-00			RES.,THERMAL:100K OHM,10%,4MW/DEG C	15454	1DE104-K-220EC
A1VR175	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A2	670-3556-00	B010100	B019999	CKT BOARD ASSY:HORIZONTAL	80009	670-3556-00
A2	670-3556-01	B020000	B089999	CKT BOARD ASSY:HORIZONTAL	80009	670-3556-01
A2	670-3556-02	B090000		CKT BOARD ASSY:HORIZONTAL	80009	670-3556-02
A2C210	281-0205-00			CAP.,VAR,PLSTC:5.5-65PF,100V	80031	2810C5R565QJ02F0
A2C211	281-0574-00			CAP.,FXD,CER DI:82PF,10%,500V	72982	3008-000S2H820K
A2C235	281-0202-00			CAP.,VAR,PLSTC:1.5-5.5PF,100V	80031	2807C1R406MM02F
A2C240	283-0167-00			CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
A2C242	281-0670-00			CAP.,FXD,CER DI:1.8PF,+/-0.1PF,500V	04222	7040-C0K-1R8B
A2C244	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C250	283-0003-00	B010100	B010146	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C250	283-0142-00	B010147		CAP.,FXD,CER DI:0.0027UF,5%,200V	59660	875571YEE0272J
A2C252	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C266	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C272	281-0670-00			CAP.,FXD,CER DI:1.8PF,+/-0.1PF,500V	04222	7040-C0K-1R8B
A2C280	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	59660	855-547-E-502Z
A2C282	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C286	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C300	290-0778-00	B090000		CAP.,FXD,ELCTLT:1UF,+50-10%,50V	54473	ECE-A50N1
A2C312	290-0758-00	B090000		CAP.,FXD,ELCTLT:2.2UF,+50-10%,160V	56289	502D227
A2C314	283-0110-00	B090000		CAP.,FXD,CER DI:0.005UF,+80-20%,150V	59660	855-547-E-502Z
A2C316	283-0057-00	B090000		CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A2C318	283-0003-00	B090000		CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C335	283-0003-00	B010100	B089999	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C350	281-0627-00	B010100	B089999	CAP.,FXD,CER DI:1PF,+/-0.25PF,500V	04222	77001-C0K-1R0C
A2C352	290-0523-00	B010100	B089999	CAP.,FXD,ELCTLT:2.2UF,20%,20V	56289	196D225X0020HA1
A2C352	290-0758-00	B090000		CAP.,FXD,ELCTLT:2.2UF,+50-10%,160V	56289	502D227
A2C353	283-0002-00	B010100	B089999	CAP.,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z47Z5ULDCEX
A2C354	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	59660	855-547-E-502Z
A2C358	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A2C360	283-0057-00			CAP.,FXD,CER DI:0.1UF,+80-20%,200V	56289	2C20Z5U104Z200B
A2CR204	152-0574-00			SEMICONV DEVICE:SILICON,120V,0.15A	14433	WG1308
A2CR206	152-0574-00			SEMICONV DEVICE:SILICON,120V,0.15A	14433	WG1308
A2CR208	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A2CR240	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A2CR242	152-0574-00			SEMICONV DEVICE:SILICON,120V,0.15A	14433	WG1308
A2CR246	152-0574-00			SEMICONV DEVICE:SILICON,120V,0.15A	14433	WG1308
A2CR270	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A2CR272	152-0574-00			SEMICONV DEVICE:SILICON,120V,0.15A	14433	WG1308
A2CR274	152-0574-00			SEMICONV DEVICE:SILICON,120V,0.15A	14433	WG1308
A2CR303	152-0141-02	B090000		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A2CR313	152-0242-00	B090000		SEMICONV DVC:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A2CR315	152-0242-00	B090000		SEMICONV DVC:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A2CR324	152-0061-00	B010100	B089999	SEMICONV DEVICE:SILICON,175V,100MA	07263	FDH2161
A2CR324	152-0141-02	B090000		SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A2CR342	152-0322-00	B090000		SEMICONV DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
A2CR352	152-0061-00	B010100	B089999	SEMICONV DEVICE:SILICON,175V,100MA	07263	FDH2161
A2CR352	152-0242-00	B090000		SEMICONV DVC:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A2CR356	152-0242-00	B090000		SEMICONV DVC:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A2L300	108-0245-00	B090000		COIL,RF:3.9UH	76493	B6310-1
A2Q200	151-0190-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
A2Q215	151-0190-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
A2Q240	151-0333-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	04713	SPS1752
A2Q244	151-0407-00			TRANSISTOR:SILICON,NPN	04713	SS2456

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A2Q250	151-0406-00		TRANSISTOR:SILICON,PNP	04713	ST1264
A2Q255	151-0262-00		TRANSISTOR:SILICON,NPN	02735	62396
A2Q270	151-0301-00		TRANSISTOR:SILICON,PNP	27014	2N2907A
A2Q274	151-0407-00		TRANSISTOR:SILICON,NPN	04713	SS2456
A2Q280	151-0406-00		TRANSISTOR:SILICON,PNP	04713	ST1264
A2Q300	151-0188-00	B090000	TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A2Q302	151-0188-00	B090000	TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A2Q305	151-0188-00	B090000	TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A2Q312	151-0407-00	B090000	TRANSISTOR:SILICON,NPN	04713	SS2456
A2Q316	151-0406-00	B090000	TRANSISTOR:SILICON,PNP	04713	ST1264
A2Q320	151-0190-00		TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
A2Q335	151-0190-00		TRANSISTOR:NPN,SI,TO-92	04713	SPS7969
A2Q340	151-0223-00		TRANSISTOR:NPN,SI,TO-92	04713	SPS8026
A2Q345	151-0188-00		TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A2Q352	151-0347-00	B010100 B089999	TRANSISTOR:SILICON,NPN	56289	T7916
A2Q352	151-0407-00	B090000	TRANSISTOR:SILICON,NPN	04713	SS2456
A2Q356	151-0350-00	B010100 B089999	TRANSISTOR:SILICON,PNP	04713	SPS6700
A2Q356	151-0406-00	B090000	TRANSISTOR:SILICON,PNP	04713	ST1264
A2R200	321-0065-00		RES.,FXD,FILM:46.4 OHM,1%,0.125W	57668	RB14FXE 46E4
A2R201	317-0047-00		RES.,FXD,CMPSN:4.7 OHM,5%,0.125W	01121	BB47G5
A2R202	315-0151-00		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A2R203	321-0200-00		RES.,FXD,FILM:1.18K OHM,1%,0.125W	91637	CMF55116G11800F
A2R205	322-0205-00		RES.,FXD,FILM:1.33K OHM,1%,0.25W	91637	MFF1421G13300F
A2R207	321-0193-00		RES.,FXD,FILM:1K OHM,1%,0.125W	19701	5043ED1K00F
A2R208	315-0361-00		RES.,FXD,CMPSN:360 OHM,5%,0.25W	57668	NTR25J-E 360E
A2R210	321-0149-00		RES.,FXD,FILM:348 OHM,1%,0.125W	91637	CMF55116G348R0F
A2R211	321-0076-00		RES.,FXD,FILM:60.4 OHM,1%,0.125W	91637	CMF55116G0R40F
A2R212	311-1564-00		RES.,VAR,NONWIR:TRMR,500 OHM,0.5W	32997	3352T-1-203
A2R213	322-0205-00		RES.,FXD,FILM:1.33K OHM,1%,0.25W	91637	MFF1421G13300F
A2R215	321-0065-00		RES.,FXD,FILM:46.4 OHM,1%,0.125W	57668	RB14FXE 46E4
A2R216	317-0047-00		RES.,FXD,CMPSN:4.7 OHM,5%,0.125W	01121	BB47G5
A2R217	315-0151-00		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A2R218	321-0200-00		RES.,FXD,FILM:1.18K OHM,1%,0.125W	91637	CMF55116G11800F
A2R220	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A2R222	311-1558-00		RES.,VAR,NONWIR:TRMR,20K OHM,0.5W	32997	3352T-1-203
A2R224	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A2R238	321-0193-00		RES.,FXD,FILM:1K OHM,1%,0.125W	19701	5043ED1K00F
A2R240	315-0241-00		RES.,FXD,CMPSN:240 OHM,5%,0.25W	57668	NTR25J-E 240E
A2R242	323-0318-00		RES.,FXD,FILM:20K OHM,1%,0.50W	91637	MFF1226D20001F
A2R244	315-0621-00		RES.,FXD,CMPSN:620 OHM,5%,0.25W	57668	NTR25J-E620E
A2R245	315-0221-00		RES.,FXD,CMPSN:220 OHM,5%,0.25W	57668	NTR25J-E220E
A2R246	315-0121-00		RES.,FXD,CMPSN:120 OHM,5%,0.25W	57668	NTR25J-E 120E
A2R247	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R248	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A2R250	301-0393-00		RES.,FXD,CMPSN:39K OHM,5%,0.5W	57668	TR50J-E 39K
A2R252	316-0101-00	B010100 B089999	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A2R252	315-0101-00	B090000	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R256	315-0821-00		RES.,FXD,CMPSN:820 OHM,5%,0.25W	57668	NTR25J-E 820E
A2R257	304-0392-00	B010100 B089999	RES.,FXD,CMPSN:3.9K OHM,10%,1W	01121	GB3921
A2R257	305-0182-00	B090000	RES.,FXD,CMPSN:1.8K OHM,5%,2W	01121	HB1825
A2R258	315-0753-00		RES.,FXD,CMPSN:75K OHM,5%,0.25W	57668	NTR25J-E75K0
A2R259	316-0100-00	B010100 B089999	RES.,FXD,CMPSN:10 OHM,10%,0.25W	01121	CB1001
A2R259	315-0100-00	B090000	RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A2R260	305-0682-00	B090000	RES.,FXD,CMPSN:6.8K OHM,5%,2W	01121	HB6825

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A2R265	321-0268-00			RES.,FXD,FILM:6.04K OHM,1%,0.125W	91637	CMF55116G60400F
A2R266	321-0389-00			RES.,FXD,FILM:110K OHM,1%,0.125W	91637	MFF1816G11002F
A2R268	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	19701	5043ED1K00F
A2R270	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R272	323-0318-00			RES.,FXD,FILM:20K OHM,1%,0.50W	91637	MFF1226D20001F
A2R274	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R276	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R280	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A2R282	316-0101-00	B010100	B089999	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A2R282	315-0101-00	B090000		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R284	301-0393-00			RES.,FXD,CMPSN:39K OHM,5%,0.5W	57668	TR50J-E 39K
A2R286	315-0821-00			RES.,FXD,CMPSN:820 OHM,5%,0.25W	57668	NTR25J-E 820E
A2R289	316-0100-00	B010100	B089999	RES.,FXD,CMPSN:10 OHM,10%,0.25W	01121	CB1001
A2R289	315-0100-00	B090000		RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A2R300	321-0206-00	B090000		RES.,FXD,FILM:1.37K OHM,1%,0.125W	91637	MFF1816G13700F
A2R301	315-0182-00	B090000		RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A2R302	315-0202-00	B090000		RES.,FXD,CMPSN:2K OHM,5%,0.25W	57668	NTR25J-E02K0
A2R303	315-0151-00	B090000		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A2R304	311-1564-00	B090000		RES.,VAR,NONWIR:TRMR,500 OHM,0.5W	32997	3352T-CK5-501
A2R305	315-0302-00	B090000		RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A2R306	311-1564-00	B090000		RES.,VAR,NONWIR:TRMR,500 OHM,0.5W	32997	3352T-CK5-501
A2R307	315-0132-00	B090000		RES.,FXD,CMPSN:1.3K OHM,5%,0.25W	57668	NTR25J-E01K3
A2R311	315-0470-00	B090000		RES.,FXD,CMPSN:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A2R312	315-0102-00	B090000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R313	315-0221-00	B090000		RES.,FXD,CMPSN:220 OHM,5%,0.25W	57668	NTR25J-E220E
A2R314	323-0339-00	B090000		RES.,FXD,FILM:33.2K OHM,1%,0.50W	91637	CMF65116G33201F
A2R315	315-0471-00	B090000		RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R316	315-0102-00	B090000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R317	301-0222-00	B090000		RES.,FXD,CMPSN:2.2K OHM,5%,0.5W	01121	EB2225
A2R318	315-0104-00	B090000		RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A2R319	315-0392-00	B090000		RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A2R320	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A2R322	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	57668	NTR25J-E20K0
A2R324	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A2R326	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	57668	NTR25J-E02K0
A2R327	315-0822-00			RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	57668	NTR25J-E 8K2
A2R328	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A2R330	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A2R334	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	57668	NTR25J-E220K
A2R335	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A2R336	315-0224-00	B010100	B089999	RES.,FXD,CMPSN:220K OHM,5%,0.25W	57668	NTR25J-E220K
A2R336	315-0102-00	B090000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R337	315-0561-00	B090000		RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668	NTRERJ-E 560E
A2R338	315-0474-00	B010100	B089999	RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
A2R338	315-0303-00	B090000		RES.,FXD,CMPSN:30K OHM,5%,0.25W	57668	NTR25J-E 30K
A2R342	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	57668	NTR25J-E51E0
A2R343	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	57668	NTR25J-E 240E
A2R344	315-0561-00	B090000		RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668	NTRERJ-E 560E
A2R345	315-0470-00			RES.,FXD,CMPSN:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A2R347	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A2R349	321-0311-00	B010100	B089999	RES.,FXD,FILM:16.9K OHM,1%,0.125W	91637	MFF1816G16901F
A2R350	321-0311-00	B010100	B089999	RES.,FXD,FILM:16.9K OHM,1%,0.125W	91637	MFF1816G16901F
A2R350	323-0339-00	B090000		RES.,FXD,FILM:33.2K OHM,1%,0.50W	91637	CMF65116G33201F
A2R352	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	57668	NTR25J-E220E

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A2R356	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R358	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A2R359	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A2R360	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A2R362	305-0153-00	B010100	B089999	RES.,FXD,CMPSN:15K OHM,5%,2W	01121	HB1535
A2R362	301-0432-00	B090000		RES.,FXD,CMPSN:4.3K OHM,5%,0.5W	57668	TR50J-E 4K3
A2R364	311-1558-00	B020000		RES.,VAR,NONWIR:TRMR,20K OHM,0.5W	32997	3352T-1-203
A2R365	311-1555-00			RES.,VAR,NONWIR:TRMR,100K OHM,0.5W	32997	3352T-1-104
A2R366	315-0332-00	B020000		RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A2R368	315-0473-00	B010100	B089999	RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A2R370	311-1555-00			RES.,VAR,NONWIR:TRMR,100K OHM,0.5W	32997	3352T-1-104
A2R372	315-0272-00	B090000		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A2VR245	152-0427-00	B010100	B061999	SEMICONV DEVICE:ZENER,0.4W,100V,5%	80009	152-0427-00
A2VR245	152-0428-00	B062000	B089999	SEMICONV DEVICE:ZENER,0.4W,120V,5%	80009	152-0428-00
A2VR245	152-0357-00	B090000		SEMICONV DEVICE:ZENER,0.4W,82V,5%	04713	SZ12461KRL
A2VR252	152-0427-00			SEMICONV DEVICE:ZENER,0.4W,100V,5%	80009	152-0427-00
A2VR305	152-0217-00	B090000		SEMICONV DVC,DI:ZEN,SI,8.2V,5%,0.4W	04713	SZG20
A2VR365	152-0285-00	B010100	B089999	SEMICONV DEVICE:ZENER,0.4W,62V,5%	80009	152-0285-00
A2VR372	152-0127-00	B090000		SEMICONV DEVICE:ZENER,0.4W,7.5V,5%	04713	SZG35009K2

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A3	670-3514-00	B010100	B020484	CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-00
A3	670-3514-01	B020485	B089999	CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-01
A3	670-3514-02	B090000	B093224	CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-02
A3	670-3514-03	B093225		CKT BOARD ASSY:HIGH VOLTAGE	80009	670-3514-03
A3C395	290-0410-00	B010100	B093224	CAP.,FXD,ELCTLT:15UF,+50-10%,100V	56289	30D156F100DD4
A3C395	290-0768-00	B093225		CAP.,FXD,ELCTLT:10UF,+50-10%,100V	54473	ECE-A100V10L
A3C402	283-0249-00			CAP.,FXD,CER DI:0.068UF,10%,50V	04222	SR305C683KAA
A3C406	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	59821	2DDU69E104Z
A3C410	290-0525-00	B010100	B020963	CAP.,FXD,ELCTLT:4.7UF,20%,50V	56289	196D475X0050KA1
A3C410	290-0767-00	B020964		CAP.,FXD,ELCTLT:4.7UF,+75-10%,160V	56289	5020228
A3C412	283-0261-00	B010100	B093224	CAP.,FXD,CER DI:0.01UF,20%,4000V	04222	5742-0001
A3C412	283-0404-00	B093225		CAP.,FXD,CER DI:0.01UF,20%,4KV	51406	DHR28Z5U103M4KV
A3C414	283-0261-00	B010100	B093224	CAP.,FXD,CER DI:0.01UF,20%,4000V	04222	5742-0001
A3C415	283-0261-00	B010100	B093224	CAP.,FXD,CER DI:0.01UF,20%,4000V	04222	5742-0001
A3C415	283-0404-00	B093225		CAP.,FXD,CER DI:0.01UF,20%,4KV	51406	DHR28Z5U103M4KV
A3C417	283-0021-00			CAP.,FXD,CER DI:0.001UF,20%,5000V	59660	848-556-Y5S-102M
A3C418	283-0081-00	B010100	B093224	CAP.,FXD,CER DI:0.1UF,+80-20%,25V	59821	2DDU69E104Z
A3C418	283-0178-00	B093225		CAP.,FXD,CER DI:0.1UF,+80-20%,100V	72982	8131N145651 104Z
A3C422	283-0261-00	B010100	B093224	CAP.,FXD,CER DI:0.01UF,20%,4000V	04222	5742-0001
A3C422	283-0404-00	B093225		CAP.,FXD,CER DI:0.01UF,20%,4KV	51406	DHR28Z5U103M4KV
A3C425	283-0021-00			CAP.,FXD,CER DI:0.001UF,20%,5000V	59660	848-556-Y5S-102M
A3C427	281-0512-00	B010100	B093224	CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	59660	301-000-C0G0270K
A3C427	283-0076-00	B093225		CAP.,FXD,CER DI:27PF,10%,500V	59660	831-500S2L270K
A3C430	290-0159-00	B010100	B093224	CAP.,FXD,ELCTLT:2UF,+50-10%,150V	56289	30D205F150BB9
A3C430	290-0758-00	B093225		CAP.,FXD,ELCTLT:2.2UF,+50-10%,160V	56289	502D227
A3C440	283-0021-00	B010100	B089999	CAP.,FXD,CER DI:0.001UF,20%,5000V	59660	848-556-Y5S-102M
A3C450	281-0512-00	B090000	B093224	CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	59660	301-000-C0G0270K
A3C450	283-0076-00	B093225		CAP.,FXD,CER DI:27PF,10%,500V	59660	831-500S2L270K
A3C452	283-0002-00	B090000		CAP.,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z47Z5ULDCEX
A3C454	283-0021-00	B090000		CAP.,FXD,CER DI:0.001UF,20%,5000V	59660	848-556-Y5S-102M
A3C458	283-0021-00	B090000		CAP.,FXD,CER DI:0.001UF,20%,5000V	59660	848-556-Y5S-102M
A3C460	283-0261-00	B090000	B093224	CAP.,FXD,CER DI:0.01UF,20%,4000V	04222	5742-0001
A3C460	283-0021-00	B093225		CAP.,FXD,CER DI:0.001UF,20%,5000V	59660	848-556-Y5S-102M
A3CR390	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A3CR391	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A3CR395	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A3CR412	152-0409-00			SEMICON DEVICE:SILICON,12,000V,5MA	83003	VG12X-1
A3CR420	152-0242-00			SEMICON DVC:SIG,SI,225V,0.2A,D0-7	07263	FDH5004
A3CR422	152-0242-00			SEMICON DVC:SIG,SI,225V,0.2A,D0-7	07263	FDH5004
A3CR428	152-0242-00			SEMICON DVC:SIG,SI,225V,0.2A,D0-7	07263	FDH5004
A3CR430	152-0061-00	B010100	B089999	SEMICON DEVICE:SILICON,175V,100MA	07263	FDH2161
A3CR430	152-0242-00	B090000		SEMICON DVC:SIG,SI,225V,0.2A,D0-7	07263	FDH5004
A3DS400	150-0067-00	B093225		LAMP,GLOW:NEON	58224	5AG
A3DS401	150-0067-00	B093225		LAMP,GLOW:NEON	58224	5AG
A3DS402	150-0067-00	B093225		LAMP,GLOW:NEON	58224	5AG
A3F410	159-0029-00			FUSE,CARTRIDGE:3AG,0.3A,250V,SLOW-BLOW	71400	MDL3/10
A3Q390	151-0254-00			TRANSISTOR:SILICON,NPN	03508	X38L3118
A3Q400	151-0342-00			TRANSISTOR:SILICON,NPN	07263	S035928
A3Q410	151-0262-00			TRANSISTOR:SILICON,NPN	02735	62396
A3R390	316-0102-00	B010100	B089999	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A3R390	315-0102-00	B090000		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R392	316-0154-00	B010100	B089999	RES.,FXD,CMPSN:150K OHM,10%,0.25W	01121	CB1541
A3R392	315-0154-00	B090000		RES.,FXD,CMPSN:150K OHM,5%,0.25W	57668	NTR25J-E150K

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3R393	315-0300-02	B093225	RES.,FXD,CMPSN:30 OHM,5%,0.25W	01121	CB3005
A3R394	316-0472-00	B010100 B089999	RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
A3R394	315-0472-00	B090000	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A3R395	307-0458-00		RES.,FXD,FILM:HIGH VOLTAGE DIV	80009	307-0458-00
A3R396	311-1257-00	B090000	RES.,VAR,NONWIR:5M OHM,20%,0.50W	32997	3386F-T04-505
A3R397	316-0474-00	B010100 B089999	RES.,FXD,CMPSN:470K OHM,10%,0.25W	01121	CB4741
A3R397	315-0474-00	B090000	RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
A3R400	316-0101-00	B010100 B089999	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A3R400	315-0101-00	B090000	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A3R402	316-0102-00	B010100 B089999	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A3R402	315-0102-00	B090000	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R404	315-0270-00		RES.,FXD,CMPSN:27 OHM,5%,0.25W	57668	NTR25J-E 27E
A3R405	316-0273-00	B010100 B089999	RES.,FXD,CMPSN:27K OHM,10%,0.25W	01121	CB2731
A3R405	315-0273-00	B090000	RES.,FXD,CMPSN:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A3R406	316-0391-00	B010100 B021496	RES.,FXD,CMPSN:390 OHM,10%,0.25W	01121	CB3911
A3R406	316-0101-00	B021497 B089999	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A3R406	315-0101-00	B090000	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A3R408	316-0100-00	B010100 B089999	RES.,FXD,CMPSN:10 OHM,10%,0.25W	01121	CB1001
A3R408	315-0100-00	B090000	RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
A3R410	307-0053-00		RES.,FXD,CMPSN:3.3 OHM,5%,0.50W	01121	EB33G5
A3R411	304-0393-00	B020485	RES.,FXD,CMPSN:39K OHM,10%,1W	01121	GB3931
A3R412	316-0223-00	B010100 B089999	RES.,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
A3R412	315-0223-00	B090000	RES.,FXD,CMPSN:22K OHM,5%,0.25W	57668	NTR25J-E 22K
A3R415	316-0470-00	B010100 B089999	RES.,FXD,CMPSN:47 OHM,10%,0.25W	01121	CB4701
A3R415	315-0470-00	B090000	RES.,FXD,CMPSN:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A3R417	316-0104-00	B010100 B089999	RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
A3R417	315-0104-00	B090000 B093224	RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A3R417	315-0104-03	B093225	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A3R418	316-0104-00	B010100 B089999	RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
A3R418	315-0104-00	B090000 B093224	RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A3R418	315-0104-03	B093225	RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A3R420	316-0103-00	B010100 B089999	RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
A3R420	315-0103-00	B090000 B093224	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A3R420	315-0103-03	B093225	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A3R421	315-0181-02	B093225	RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A3R422	316-0106-00	B010100 B089999	RES.,FXD,CMPSN:10M OHM,10%,0.25W	01121	CB1061
A3R422	315-0106-00	B090000 B093224	RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
A3R422	315-0136-01	B093225	RES.,FXD,CMPSN:13M OHM,5%,0.25W	01121	CB1365
A3R425	316-0102-00	B010100 B089999	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A3R425	315-0102-00	B090000 B093224	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R425	315-0103-03	B093225	RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A3R427	316-0334-00	B010100 B089999	RES.,FXD,CMPSN:330K OHM,10%,0.25W	01121	CB3341
A3R427	315-0684-00	B090000	RES.,FXD,CMPSN:680K OHM,5%,0.25W	01121	CB6845
A3R428	316-0102-00	B010100 B089999	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A3R428	315-0102-00	B090000 B093224	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R428	315-0103-00	B093225	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A3R430	316-0473-00	B010100 B089999	RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121	CB4731
A3R430	315-0473-00	B090000	RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A3R433	316-0393-00	B010100 B089999	RES.,FXD,CMPSN:39K OHM,10%,0.25W	01121	CB3931
A3R433	315-0393-00	B090000	RES.,FXD,CMPSN:39K OHM,5%,0.25W	57668	NTR25J-E39K0
A3R435	311-1206-00		RES.,VAR,NONWIR:250K OHM,30%,0.25W	71450	201-YA5546
A3R450	315-0684-00	B090000	RES.,FXD,CMPSN:680K OHM,5%,0.25W	01121	CB6845
A3R452	315-0473-00	B090000	RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A3R454	315-0102-00	B090000 B093224	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R454	315-0103-00	B093225	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No.		Name & Description	Mfr Code	Mfr Part Number
		Eff	Dscont			
A3R456	315-0102-00	B090000	B093224	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A3R456	315-0103-03	B093225		RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A3R457	315-0203-02	B093225		RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A3R458	315-0106-00	B090000	B093224	RES.,FXD,CMPSN:10M OHM,5%,0.25W	01121	CB1065
A3R458	315-0136-01	B093225		RES.,FXD,CMPSN:13M OHM,5%,0.25W	01121	CB1365
A3R460	315-0181-02	B093225		RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A3R462	315-0823-00	B093225		RES.,FXD,CMPSN:82K OHM,5%,0.25W	57668	NTR25J-E82K
A3T410	120-0920-00			XFMR,PWR,STU:HV	80009	120-0920-00
A3U410	152-0584-00			SEMICOND DEVICE:V MULTR,7KV IN,7KV DC OUT	52306	CMX164
A3VR427	152-0669-00			SEMICOND DEVICE:ZENER,SI,5W,120V,5%	80009	152-0669-00
A3VR435	152-0427-00			SEMICOND DEVICE:ZENER,0.4W,100V,5%	80009	152-0427-00
A3VR452	152-0285-00	B090000		SEMICOND DEVICE:ZENER,0.4W,62V,5%	80009	152-0285-00

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4	670-2833-00	B010100	B061536	CKT BOARD ASSY:STORAGE	80009 670-2833-00
A4	670-2833-01	B061537	B089999	CKT BOARD ASSY:STORAGE	80009 670-2833-01
A4	670-2833-02	B090000	B095044	CKT BOARD ASSY:STORAGE	80009 670-2833-02
A4	670-2833-03	B095045		CKT BOARD ASSY:STORAGE	80009 670-2833-03
A4C500	290-0534-00	B010100	B089999	CAP.,FXD,ELCTLT:1UF,20%,35V	56289 196D105X0035HA1
A4C500	290-0778-00	B090000		CAP.,FXD,ELCTLT:1UF,+50-10%,50V	54473 ECE-A50N1
A4C505	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C507	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C512	283-0003-00	B061537		CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821 D103Z40Z5UJDCRX
A4C514	285-0628-00			CAP.,FXD,PLSTC:0.033UF,20%,300V	56289 192P33303
A4C520	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C528	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C534	285-0628-00			CAP.,FXD,PLSTC:0.033UF,20%,300V	56289 192P33303
A4C538	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C550	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C554	290-0267-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289 173D105X0035V
A4C564	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C610	285-0683-00			CAP.,FXD,PLSTC:0.022UF,5%,100V	56289 192P22352
A4C611	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4C614	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590 2DDU66B104Z
A4C625	285-0627-00			CAP.,FXD,PLSTC:0.0033UF,5%,100V	56289 192P33252
A4C704	290-0573-00	B010100	B089999	CAP.,FXD,ELCTLT:2.7UF,20%,50V	56289 196D275X0050JA1
A4C704	290-0758-00	B090000	B095044	CAP.,FXD,ELCTLT:2.2UF,+50-10%,160V	56289 502D227
A4C704	290-0782-00	B095045		CAP.,FXD,ELCTLT:4.7UF,+75-10%,35V	55680 ULA1V4R7TEA
A4C705	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660 831610Y5U0102P
A4CR560	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR562	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR564	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR570	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR580	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR582	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR583	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR595	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR600	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR614	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR622	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR628	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR629	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR640	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR650	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR655	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR672	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR674	152-0061-00	B010100	B089999	SEMICON DEVICE:SILICON,175V,100MA	07263 FDH2161
A4CR674	152-0629-00	B090000		SEMICON DEVICE:SILICON,225V,5UA	80009 152-0629-00
A4CR675	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4CR704	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969 NDP0263 (1N4152)
A4Q510	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713 SPS6919
A4Q515	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713 SPS6919
A4Q530	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713 SPS6919
A4Q535	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713 SPS6919
A4Q550	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713 SPS6919
A4Q555	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713 SPS6919
A4Q575	151-0292-00			TRANSISTOR:SILICON,NPN	56289 ORDER BY DESCR

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A4Q580	151-0292-00			TRANSISTOR:SILICON,NPN	56289	ORDER BY DESCR
A4Q585	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A4Q595	151-0292-00			TRANSISTOR:SILICON,NPN	56289	ORDER BY DESCR
A4Q600	151-0292-00			TRANSISTOR:SILICON,NPN	56289	ORDER BY DESCR
A4Q610	151-0508-00			TRANSISTOR:UJT,SI,2N6027,TO-98	03508	X13T520
A4Q625	151-0281-00			TRANSISTOR:SILICON,NPN	03508	X16P4039
A4Q635	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A4Q640	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A4Q655	151-0292-00			TRANSISTOR:SILICON,NPN	56289	ORDER BY DESCR
A4Q670	151-0292-00			TRANSISTOR:SILICON,NPN	56289	ORDER BY DESCR
A4Q672	151-0292-00			TRANSISTOR:SILICON,NPN	56289	ORDER BY DESCR
A4Q675	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A4Q680	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A4Q685	151-0292-00			TRANSISTOR:SILICON,NPN	56289	ORDER BY DESCR
A4Q690	151-0405-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE800	04713	SJE943
A4Q700	151-0192-00			TRANSISTOR:SELECTED	04713	SPS8801
A4Q703	151-0342-00	B021380		TRANSISTOR:SILICON,PNP	07263	S035928
A4Q705	151-0352-00			TRANSISTOR:SILICON,NPN	03508	X44C282
A4R331	315-0514-00	B090000		RES.,FXD,CMPSN:510K OHM,5%,0.25W	19701	5043CX510K0J
A4R332	311-1681-00	B010100	B089999	RES.,VAR,NONWIR:PNL,20K X 5M OHM,0.5W	01121	12M234
A4R332	311-1964-00	B090000		RES.,VAR,NONWIR:20K X 500K OHM,20%,0.5W	01121	17M186
A4R500	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	57668	NTR25J-E 33E
A4R503	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
A4R505	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A4R506	315-0332-00			RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A4R507	315-0475-00			RES.,FXD,CMPSN:4.7M OHM,5%,0.25W	01121	CB4755
A4R510	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	57668	NTR25J-E220K
A4R514	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A4R515	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	57668	NTR25J-E 22K
A4R518	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668	NTR25J-E 15K
A4R520	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	57668	NTR25J-E 18K
A4R524	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A4R526	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A4R530	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	57668	NTR255-E 1M
A4R534	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A4R535	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A4R538	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	57668	NTR25J-E220K
A4R540	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668	NTR25J-E 15K
A4R545	315-0155-00			RES.,FXD,CMPSN:1.5M OHM,5%,0.25W	57668	NTR25J-E 1M5
A4R550	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	57668	NTR25J-E220K
A4R552	315-0473-00			RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A4R554	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A4R555	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A4R558	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668	NTR25J-E 15K
A4R560	315-0244-00			RES.,FXD,CMPSN:240K OHM,5%,0.25W	57668	NTR25J-E 240K
A4R564	321-0295-00			RES.,FXD,FILM:11.5K OHM,1%,0.125W	91637	MFF1816G11501F
A4R565	321-0246-00			RES.,FXD,FILM:3.57K OHM,1%,0.125W	91637	CMF55116G35700F
A4R568	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	57668	NTR25J-E 30K
A4R570	315-0754-00			RES.,FXD,CMPSN:750K OHM,5%,0.25W	57668	NTR25J-E 750K
A4R572	311-1559-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91-81-0
A4R574	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A4R575	301-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.5W	01121	EB1545
A4R577	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A4R580	321-0452-00			RES.,FXD,FILM:499K OHM,1%,0.125W	91637	CMF55116G49902F

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4R581	315-0333-00	B061537	RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A4R582	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A4R584	315-0185-00		RES.,FXD,CMPSN:1.8M OHM,5%,0.25W	01121	CB1855
A4R585	311-1682-00		RES.,VAR,NONWIR:10K OHM,20% X 2.5M OHM,10%	01121	12M292
A4R587	315-0683-00		RES.,FXD,CMPSN:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A4R589	315-0154-00		RES.,FXD,CMPSN:150K OHM,5%,0.25W	57668	NTR25J-E150K
A4R590	311-1559-00		RES.,VAR,NONWIR:10K OHM,20%,0.50W	73138	91-81-0
A4595	315-0683-00		RES.,FXD,CMPSN:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A4R596	315-0124-00		RES.,FXD,CMPSN:120K OHM,5%,0.25W	57668	NTR25J-E 120K
A4R598	315-0473-00		RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A4R600	311-1555-00		RES.,VAR,NONWIR:TRMR,100K OHM,0.5W	32997	3352T-1-104
A4R602	315-0473-00		RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A4R604	315-0124-00		RES.,FXD,CMPSN:120K OHM,5%,0.25W	57668	NTR25J-E 120K
A4R608	315-0223-00		RES.,FXD,CMPSN:22K OHM,5%,0.25W	57668	NTR25J-E 22K
A4R609	315-0153-00		RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668	NTR25J-E 15K
A4R611	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A4R612	315-0824-00		RES.,FXD,CMPSN:820K OHM,5%,0.25W	57668	NTR25J-E 820K
A4R613	315-0101-00	B061537	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A4R614	315-0754-00		RES.,FXD,CMPSN:750K OHM,5%,0.25W	57668	NTR25J-E 750K
A4R616	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	57668	NTR255-E 1M
A4R622	315-0472-00	B010100	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A4R622	315-0911-00	B010165	RES.,FXD,CMPSN:910 OHM,5%,0.25W	57668	NTR25J-E910E
A4R625	315-0333-00		RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A4R627	315-0202-00		RES.,FXD,CMPSN:2K OHM,5%,0.25W	57668	NTR25J-E02K0
A4R629	315-0623-00		RES.,FXD,CMPSN:62K OHM,5%,0.25W	57668	NTR25J-E 62K
A4R632	315-0183-00		RES.,FXD,CMPSN:18K OHM,5%,0.25W	57668	NTR25J-E 18K
A4R634	315-0183-00		RES.,FXD,CMPSN:18K OHM,5%,0.25W	57668	NTR25J-E 18K
A4R636	315-0363-00		RES.,FXD,CMPSN:36K OHM,5%,0.25W	57668	NTR25J-E36K0
A4R640	315-0152-00		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A4R642	315-0164-00		RES.,FXD,CMPSN:160K OHM,5%,0.25W	57668	NTR25J-E160K
A4R643	315-0514-00		RES.,FXD,CMPSN:510K OHM,5%,0.25W	19701	5043CX510K0J
A4R645	315-0821-00		RES.,FXD,CMPSN:820 OHM,5%,0.25W	57668	NTR25J-E 820E
A4R646	315-0682-00		RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A4R650	315-0474-00		RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
A4R652	315-0562-00		RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A4R654	315-0114-00		RES.,FXD,CMPSN:110K OHM,5%,0.25W	57668	NTR25J-E 110K
A4R655	311-1555-00		RES.,VAR,NONWIR:TRMR,100K OHM,0.5W	32997	3352T-1-104
A4R657	315-0333-00		RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A4R659	315-0124-00		RES.,FXD,CMPSN:120K OHM,5%,0.25W	57668	NTR25J-E 120K
A4R662	321-0297-00		RES.,FXD,FILM:12.1K OHM,1%,0.125W	91637	MFF1816G12101F
A4R665	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	57668	NTR255-E 1M
A4R667	301-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.5W	01121	EB1045
A4R670	301-0184-00		RES.,FXD,CMPSN:180K OHM,5%,0.5W	01121	EB1845
A4R671	315-0103-00	B061537	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A4R672	315-0473-00	B010100	RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A4R672	315-0333-00	B082540	RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A4R673	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A4R674	315-0273-00		RES.,FXD,CMPSN:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A4R675	315-0102-00	B061537	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A4R676	315-0273-00		RES.,FXD,CMPSN:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A4R678	315-0104-00		RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668	NTR25J-E100K
A4R681	315-0222-00	B010100	RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A4R681	315-0122-00	B010280	RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
A4R690	301-0361-00		RES.,FXD,CMPSN:360 OHM,5%,0.5W	01121	EB3615

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A4R692	315-0103-00	B061537	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A4R700	311-1492-00		RES.,VAR,NONWIR:PNL,5 X 5K OHM,0.5W,W/SW	01121	11M136
A4R700	-----		(PART OF S700)		
A4R701	315-0621-00	B090000	RES.,FXD,CMPSN:620 OHM,5%,0.25W	57668	NTR25J-E620E
A4R702	315-0122-00	B021388	RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
A4R704	315-0274-00		RES.,FXD,CMPSN:270K OHM,5%,0.25W	57668	NTR25J-E270K
A4R706	315-0152-00	B021388	RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A4S335	260-1238-00	B010100	B089999 SWITCH,PUSH:0.5A AT 115VAC	81073	39YY2084
A4S335	260-1742-01	B090000	SWITCH,PUSH:1 BTN,2 POLE,ERASE	80009	260-1742-01
A4S500	260-1611-00	B010100	B021565 SWITCH,PUSH:1 STA,2 POLE,MOMENTARY	82104	1686PB402001
A4S500	260-1742-00	B021566	B082739 SWITCH,PUSH:	80009	260-1742-00
A4S500	260-1742-01	B082740	SWITCH,PUSH:1 BTN,2 POLE,ERASE	80009	260-1742-01
A4S610	260-1132-02		SWITCH,PUSH:DPDT,1A,28VDC,1 BUTTON	71590	2KAB010000-543
A4S675	260-1743-01		SWITCH,PUSH:1 BUTTON,2 POLE,SAVE	80009	260-1743-01
A4S700	-----		(PART OF R700)		
A4VR575	152-0247-00		SEMICONV DEVICE:ZENER,0.4W,150V,5%	04713	SZG275K1RL
A4VR595	152-0428-00		SEMICONV DEVICE:ZENER,0.4W,120V,5%	80009	152-0428-00
A4VR655	152-0285-00		SEMICONV DEVICE:ZENER,0.4W,62V,5%	80009	152-0285-00
A4VR690	152-0227-00		SEMICONV DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ13903
A4VR691	152-0127-00		SEMICONV DEVICE:ZENER,0.4W,7.5V,5%	04713	SZG35009K2

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A5	670-0702-05		CKT BOARD ASSY:GRATICULE LAMPS	80009	670-0702-05
A5DS705	150-0137-00		LAMP,CARTRIDGE:14V,100MA	71744	CM 8918
A5DS706	150-0137-00		LAMP,CARTRIDGE:14V,100MA	71744	CM 8918
A5DS707	150-0137-00		LAMP,CARTRIDGE:14V,100MA	71744	CM 8918
A6	670-2335-00	B010100 B053530	CKT BOARD ASSY:INTERFACE	80009	670-2335-00
A6	670-2335-01	B053531 B053858	CKT BOARD ASSY:INTERFACE	80009	670-2335-01
A6	670-2335-02	B053859 B055101	CKT BOARD ASSY:INTERFACE	80009	670-2335-02
A6	670-2335-03	B055102 B062199	CKT BOARD ASSY:INTERFACE	80009	670-2335-03
A6	670-2335-04	B062200 B094064	CKT BOARD ASSY:INTERFACE	80009	670-2335-04
A6	670-2335-05	B094065 B094584	CKT BOARD ASSY:INTERFACE	80009	670-2335-05
A6	670-2335-06	B094585 B094923	CKT BOARD ASSY:INTERFACE	80009	670-2335-06
A6	670-2335-08	B094924	CKT BOARD ASSY:INTERFACE	80009	670-2335-08
A6C608	283-0023-00		CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
A6C610	283-0003-00		CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A6C619	283-0023-00		CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
A6C620	283-0023-00		CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
A6C621	281-0534-00	B010100 B094584	CAP.,FXD,CER DI:3.3PF,+/-0.25PF,500V	04222	7001-COJ-3R3C
A6C622	290-0527-00		CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NFL
A6C624	290-0527-00		CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NFL
A6C626	290-0534-00		CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
A6C627	281-0547-00	B010100 B053799	CAP.,FXD,CER DI:2.7PF,10%,500V	04222	7001--COJ-2R7C
A6C627	281-0534-00	B053800 B094584	CAP.,FXD,CER DI:3.3PF,+/-0.25PF,500V	04222	7001-COJ-3R3C
A6C628	290-0534-00		CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
A6C629	290-0527-00		CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NFL
A6C630	283-0003-00		CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A6C636	281-0759-00		CAP.,FXD,CER DI:22PF,10%,100V	96733	R2735
A6C637	281-0503-00	B010100 B054023	CAP.,FXD,CER DI:8PF,+/-0.5PF,500V	59660	301-000-C0H0809D
A6C637	281-0604-00	B054024 B061532	CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V	04222	7001-COJ-2R2C
A6C637	281-0182-00	B061533 B094064	CAP.,VAR,PLSTC:1.8-10PF,500V	80031	2805D1R810BH02F0
A6C637	281-0626-00	B094065 B094584	CAP.,FXD,CER DI:3.3PF,1%,500V	59660	301000C0J0339B
A6C637	281-0182-00	B094585	CAP.,VAR,PLSTC:1.8-10PF,500V	80031	2805D1R810BH02F0
A6C639	283-0023-00		CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
A6C640	281-0546-00		CAP.,FXD,CER DI:330PF,10%,500V	59660	301000X5P331K
A6C652	283-0023-00		CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
A6C656	281-0759-00	B094065	CAP.,FXD,CER DI:22PF,10%,100V	96733	R2735
A6C660	281-0546-00		CAP.,FXD,CER DI:330PF,10%,500V	59660	301000X5P331K
A6C704	281-0604-00		CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V	04222	7001-COJ-2R2C
A6C724	281-0604-00		CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V	04222	7001-COJ-2R2C
A6C766	281-0509-00		CAP.,FXD,CER DI:15PF,+/-1.5PF,500V	59660	301-000-C0G0150K
A6C770	283-0023-00		CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
A6C775	283-0150-00	B010100 B055101	CAP.,FXD,CER DI:650PF,5%,200V	59660	0835030Z5E0 651J
A6C775	283-0065-01	B055102	CAP.,FXD,CER DI:0.001UF,5%,100V	59660	0835582Z5E00102J
A6C780	283-0150-00	B010100 B055101	CAP.,FXD,CER DI:650PF,5%,200V	59660	0835030Z5E0 651J
A6C780	283-0065-01	B055102	CAP.,FXD,CER DI:0.001UF,5%,100V	59660	0835582Z5E00102J
A6C784	283-0003-00	B010100 B061699	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A6C784	283-0164-00	B061700	CAP.,FXD,CER DI:2.2UF,20%,25V	04222	SR402E225MAA
A6C790	281-0524-00	B010100 B010180	CAP.,FXD,CER DI:150PF,+/-30PF,500V	59660	301000X5U151M
A6C790	283-0054-00	B010181	CAP.,FXD,CER DI:150PF,5%,200V	59660	855-535U2J0 151J
A6CR602	152-0141-02	B050000	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR608	152-0141-02	B050000	SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A6CR686	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR687	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR740	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR741	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR742	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR761	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR770	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6CR772	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A6J610	131-1078-00	B010100	B059999	CONNECTOR,RCPT,:28/56 CONTACT	95238	600-1156Y25GDF30
A6J610	131-1078-01	B060000	B094553	CONN,RCPT,ELEC:CKT CARD,28/56 CONTACT	31514	SAM28D/2-TX
A6J610	131-1078-00	B094554		CONNECTOR,RCPT,:28/56 CONTACT	95238	600-1156Y25GDF30
A6J620	131-1078-00	B010100	B059999	CONNECTOR,RCPT,:28/56 CONTACT	95238	600-1156Y25GDF30
A6J620	131-1078-01	B060000	B094553	CONN,RCPT,ELEC:CKT CARD,28/56 CONTACT	31514	SAM28D/2-TX
A6J620	131-1078-00	B094554		CONNECTOR,RCPT,:28/56 CONTACT	95238	600-1156Y25GDF30
A6J630	131-1078-00	B010100	B059999	CONNECTOR,RCPT,:28/56 CONTACT	95238	600-1156Y25GDF30
A6J630	131-1078-01	B060000	B094553	CONN,RCPT,ELEC:CKT CARD,28/56 CONTACT	31514	SAM28D/2-TX
A6J630	131-1078-00	B094554		CONNECTOR,RCPT,:28/56 CONTACT	95238	600-1156Y25GDF30
A6Q600	151-0192-00			TRANSISTOR:SELECTED	04713	SPS8801
A6Q604	151-0192-00			TRANSISTOR:SELECTED	04713	SPS8801
A6Q610	151-0192-00			TRANSISTOR:SELECTED	04713	SPS8801
A6Q614	151-0192-00			TRANSISTOR:SELECTED	04713	SPS8801
A6Q630	151-0220-00			TRANSISTOR:PNP,SI,TO-92	07263	S036228
A6Q640	151-0220-00			TRANSISTOR:PNP,SI,TO-92	07263	S036228
A6Q650	151-0220-00			TRANSISTOR:PNP,SI,TO-92	07263	S036228
A6Q660	151-0220-00			TRANSISTOR:PNP,SI,TO-92	07263	S036228
A6Q670	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A6Q674	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A6Q680	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
A6Q700	151-0223-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8026
A6Q708	151-0223-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8026
A6Q710	151-0325-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
A6Q715	151-0325-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
A6Q720	151-0223-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8026
A6Q728	151-0223-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8026
A6Q730	151-0325-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
A6Q735	151-0325-00			TRANSISTOR:SILICON,PNP,SEL FROM 2N4258	80009	151-0325-00
A6Q740	151-0192-00			TRANSISTOR:SELECTED	04713	SPS8801
A6Q744	151-0192-00			TRANSISTOR:SELECTED	04713	SPS8801
A6Q748	151-0333-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	04713	SPS1752
A6Q752	151-0333-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS918	04713	SPS1752
A6Q770	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A6R600	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A6R601	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
A6R602	315-0331-00	B050000		RES.,FXD,CMPSN:330 OHM,5%,0.25W	57668	NTR25J-E330E
A6R603	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A6R604	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A6R605	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
A6R607	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A6R608	315-0331-00	B050000		RES.,FXD,CMPSN:330 OHM,5%,0.25W	57668	NTR25J-E330E
A6R610	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A6R611	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
A6R613	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A6R614	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A6R615	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A6R617	315-0123-00		RES.,FXD,CMPSN:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A6R619	315-0182-00		RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A6R620	321-0091-03		RES.,FXD,FILM:86.6 OHM,0.25%,0.125W	91637	MFF1816D86R60C
A6R621	315-0222-00		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A6R622	315-0222-00		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A6R626	321-0091-03		RES.,FXD,FILM:86.6 OHM,0.25%,0.125W	91637	MFF1816D86R60C
A6R627	315-0222-00		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A6R628	315-0222-00		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A6R630	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A6R632	315-0392-00		RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A6R634	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	57668	NTR25J-E390E
A6R636	315-0390-00		RES.,FXD,CMPSN:39 OHM,5%,0.25W	57668	NTR25J-E39E0
A6R637	315-0680-00		RES.,FXD,CMPSN:68 OHM,5%,0.25W	57668	NTR25J-E68E0
A6R638	315-0470-00		RES.,FXD,CMPSN:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A6R640	315-0152-00		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A6R641	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A6R643	321-0097-00	B010100	RES.,FXD,FILM:100 OHM,1%,0.125W	91637	CMF55116G100R0F
A6R643	321-0114-00	B053531	RES.,FXD,FILM:150 OHM,1%,0.125W	91637	CMF55116G150R0F
A6R650	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A6R651	315-0101-00	B010100	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A6R652	315-0102-00	B053445	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R654	315-0391-00		RES.,FXD,CMPSN:390 OHM,5%,0.25W	57668	NTR25J-E390E
A6R656	315-0390-00		RES.,FXD,CMPSN:39 OHM,5%,0.25W	57668	NTR25J-E39E0
A6R660	315-0152-00		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A6R670	315-0562-00		RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A6R671	315-0154-00		RES.,FXD,CMPSN:150K OHM,5%,0.25W	57668	NTR25J-E150K
A6R672	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A6R673	315-0122-00		RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
A6R674	315-0122-00		RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	57668	NTR25J-E01K2
A6R677	315-0103-00	B010100	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A6R677	315-0102-00	B053859	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R680	315-0332-00		RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A6R681	315-0683-00		RES.,FXD,CMPSN:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A6R683	315-0133-00		RES.,FXD,CMPSN:13K OHM,5%,0.25W	57668	NTR25J-E 13K
A6R684	315-0103-00		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A6R686	315-0471-00		RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A6R688	315-0513-00		RES.,FXD,CMPSN:51K OHM,5%,0.25W	57668	NTR25J-E51K0
A6R689	315-0243-00		RES.,FXD,CMPSN:24K OHM,5%,0.25W	57668	NTR25J-E24K0
A6R700	315-0473-00		RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A6R702	315-0242-00		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A6R703	315-0302-00		RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A6R704	315-0222-00		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A6R705	321-0177-00		RES.,FXD,FILM:681 OHM,1%,0.125W	57668	RB14FXE681E
A6R706	315-0302-00		RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A6R708	315-0101-00		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A6R709	315-0242-00		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A6R710	321-0146-00		RES.,FXD,FILM:324 OHM,1%,0.125W	91637	MFF1816G324R0F
A6R712	315-0112-00		RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	57668	NTR25J-E 1K1
A6R713	321-0103-00		RES.,FXD,FILM:115 OHM,1%,0.125W	91637	MFF1816G115R0F
A6R714	315-0112-00		RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	57668	NTR25J-E 1K1
A6R715	315-0152-00		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A6R720	315-0473-00		RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A6R722	315-0242-00		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A6R723	315-0302-00		RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A6R724	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A6R725	321-0177-00			RES.,FXD,FILM:681 OHM,1%,0.125W	57668	RB14FXE681E
A6R726	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A6R728	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A6R729	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A6R730	321-0146-00			RES.,FXD,FILM:324 OHM,1%,0.125W	91637	MFF1816G324R0F
A6R732	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	57668	NTR25J-E 1K1
A6R733	321-0103-00			RES.,FXD,FILM:115 OHM,1%,0.125W	91637	MFF1816G115R0F
A6R734	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	57668	NTR25J-E 1K1
A6R735	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A6R737	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	57668	NTR25J-E 240E
3R738	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	57668	NTR25J-E 240E
A6R740	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A6R741	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A6R742	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A6R744	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
A6R746	315-0123-00			RES.,FXD,CMPSN:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A6R748	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	57668	NTR25J-E330E
A6R750	321-0069-00			RES.,FXD,FILM:51.1 OHM,1%,0.125W	91637	CMF55116G51R10F
A6R752	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	57668	NTR25J-E330E
A6R754	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	57668	NTR25J-E910E
A6R756	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	57668	NTR25J-E750E
A6R757	315-0911-00			RES.,FXD,CMPSN:910 OHM,5%,0.25W	57668	NTR25J-E910E
A6R760	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	57668	NTR25J-E 18K
A6R761	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668	NTRERJ-E 560E
A6R763	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	57668	NTR25J-E 22K
A6R764	321-0291-00			RES.,FXD,FILM:10.5K OHM,1%,0.125W	91637	MFF1816G10501F
A6R766	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R768	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R770	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R772	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	57668	NTR25J-E390E
A6R773	315-0103-00	B055102		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A6R774	315-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.25W	57668	NTR25J-E220K
A6R775	315-0622-00			RES.,FXD,CMPSN:6.2K OHM,5%,0.25W	57668	NTR25J-E 6K2
A6R776	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R777	315-0103-00	B055102		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A6R778	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A6R779	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R781	315-0472-00	B010100	B055101	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A6R781	315-0102-00	B055102		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R782	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R784	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R786	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R787	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R789	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A6R790	315-0201-00			RES.,FXD,CMPSN:200 OHM,5%,0.25W	57668	NTR25J-E200E
A6RT754	307-0125-00			RES.,THERMAL:500 OHM,10%,25 DEG C	50157	2D1595
A6U620	155-0022-00			MICROCIRCUIT,DI:ML,CHANNEL SWITCH	80009	155-0022-00
A6U770	156-0057-02			MICROCIRCUIT,DI:QUAD 2-INP NAND GATE,SCRN	01295	SN7401(NP3 OR JP
A6U780	156-0039-02			MICROCIRCUIT,DI:DUAL J-K MA-SLAVE FF,SCRN	01295	SN7473(NP3 OR JP

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A7	670-2336-00	B010100	B094622	CKT BOARD ASSY:POWER SUPPLY	80009	670-2336-00
A7	670-2336-01	B094623		CKT BOARD ASSY:LV SUPPLY & CAL	80009	670-2336-01
A7C800	290-0587-00			CAP.,FXD,ELCTLT:170UF,+50-10%,250VDC	56289	68D10496
A7C820	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
A7C821	283-0167-00	B040000		CAP.,FXD,CER DI:0.1UF,10%,100V	72982	8131N145X5R0104K
A7C822	283-0114-00	B010100	B039999	CAP.,FXD,CER DI:0.0015UF,5%,200V	59660	805534Y5D0152J
A7C825	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
A7C832	283-0000-00	B010100	B039999	CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
A7C834	281-0550-00	B010100	B039999	CAP.,FXD,CER DI:120PF,10%,500V	59660	301000X5P121K
A7C834	281-0501-00	B040000		CAP.,FXD,CER DI:4.7PF,+/-1PF,500V	59660	301-000S2H0479F
A7C836	281-0546-00	B010100	B039999	CAP.,FXD,CER DI:330PF,10%,500V	59660	301000X5P331K
A7C836	283-0000-00	B040000		CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
A7C845	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A7C848	290-0645-00			CAP.,FXD,ELCTLT:10000UF,+100-10%,12V	56289	68D10548
A7C850	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NFL
A7C860	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A7C867	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A7C871	281-0580-00			CAP.,FXD,CER DI:470PF,10%,500V	04222	7001-1374
A7C875	290-0636-00			CAP.,FXD,ELCTLT:7500UF,+100-10%,25V	56289	68D10501
A7C876	290-0636-00			CAP.,FXD,ELCTLT:7500UF,+100-10%,25V	56289	68D10501
A7C880	290-0527-00			CAP.,FXD,ELCTLT:15UF,20%,20V	90201	TDC156M020NFL
A7C890	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A7C897	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A7C901	281-0623-00			CAP.,FXD,CER DI:650PF,5%,500V	59660	301000Y5D651J
A7C910	290-0528-00			CAP.,FXD,ELCTLT:15UF,20%,50V	56289	196D156X0050PE4
A7C920	283-0010-00			CAP.,FXD,CER DI:0.05UF,+100-20%,50V	56289	1C10Z5U503Z050B
A7C925	281-0589-00			CAP.,FXD,CER DI:170PF,5%,500V	72982	301000Z5D0171J
A7C930	290-0637-00			CAP.,FXD,ELCTLT:5000UF,+45-10%,50V	56289	68D10527
A7C932	290-0509-00			CAP.,FXD,ELCTLT:3000UF,+100-10%,50V	56289	68D10454
A7C935	285-0629-00			CAP.,FXD,PLSTC:0.047UF,20%,100V	56289	192P47302R467
A7C944	290-0528-00			CAP.,FXD,ELCTLT:15UF,20%,50V	56289	196D156X0050PE4
A7C948	283-0003-00			CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	D103Z40Z5UJDCEX
A7C950	290-0517-00			CAP.,FXD,ELCTLT:6.8UF,20%,35V	90201	TDC685M035FL
A7C953	281-0504-00			CAP.,FXD,CER DI:10PF,+/-1PF,500V	59660	301000C0G0100F
A7C955	281-0546-00			CAP.,FXD,CER DI:330PF,10%,500V	59660	301000X5P331K
A7C981	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
A7C982	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
A7C984	281-0549-00			CAP.,FXD,CER DI:68PF,10%,500V	59660	301-000U2J0680K
A7CR800	152-0107-00			SEMICONV DEVICE:SILICON,400V,400MA	12969	G727
A7CR801	152-0107-00			SEMICONV DEVICE:SILICON,400V,400MA	12969	G727
A7CR802	152-0107-00			SEMICONV DEVICE:SILICON,400V,400MA	12969	G727
A7CR803	152-0107-00			SEMICONV DEVICE:SILICON,400V,400MA	12969	G727
A7CR820	152-0066-00			SEMICONV DVC DI:RECT,SI,400V,1A,D0-41	05828	GP10G-020
A7CR821	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR825	152-0066-00			SEMICONV DVC DI:RECT,SI,400V,1A,D0-41	05828	GP10G-020
A7CR832	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR838	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR839	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR848	152-0556-00	B010100	B072326	SEMICONV DEVICE:BRIDGE,50V,2.5A	14936	KBU4A
A7CR848	152-0556-01	B072327		SEMICONV DEVICE:RECT BRIDGE,SI,50V,2.5A	80009	152-0556-01
A7CR850	152-0066-00			SEMICONV DVC DI:RECT,SI,400V,1A,D0-41	05828	GP10G-020
A7CR851	152-0066-00			SEMICONV DVC DI:RECT,SI,400V,1A,D0-41	05828	GP10G-020
A7CR863	152-0141-02			SEMICONV DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A7CR864	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR875	152-0556-00			SEMICON DVC,DI:RECT,SI,400V,1A,DO-41	14936	KBU4A
A7CR880	152-0066-00			SEMICON DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A7CR881	152-0066-00			SEMICON DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A7CR893	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR894	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR903	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR910	152-0066-00			SEMICON DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A7CR911	152-0066-00			SEMICON DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A7CR925	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR927	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR930	152-0488-00			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	04713	SDA317
A7CR944	152-0066-00			SEMICON DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A7CR950	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR955	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR980	152-0107-00			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	G727
A7CR981	152-0107-00			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	G727
A7CR982	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7CR986	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A7F800	159-0028-00			FUSE,CARTRIDGE:3AG,0.25A,250V,FAST-BLOW	71400	ABC-1/4
A7LR1100	108-0212-00			COIL,RF:FIXED,495NH	80009	108-0212-00
A7Q820	151-0405-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE800	04713	SJE943
A7Q824	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
A7Q830	151-0188-00			TRANSISTOR:PNP,SI,TO-92	T0058	2N3906
A7Q832	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7Q838	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
A7Q850	151-0405-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE800	04713	SJE943
A7Q855	151-0190-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS7969
A7Q864	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7Q866	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7Q870	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7Q880	151-0405-00			TRANSISTOR:SILICON,NPN,SEL FROM MJE800	04713	SJE943
A7Q885	151-0190-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS7969
A7Q894	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
A7Q896	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
A7Q900	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7Q910	151-0331-00	B010100	B049999	TRANSISTOR:SILICON,NPN	03508	X40CR115
A7Q910	151-0496-00	B050000		TRANSISTOR:SILICON,NPN	80009	151-0496-00
A7Q915	151-0190-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS7969
A7Q925	151-0190-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS7969
A7Q940	151-0331-00	B010100	B049999	TRANSISTOR:SILICON,NPN	03508	X40CR115
A7Q940	151-0496-00	B050000		TRANSISTOR:SILICON,NPN	80009	151-0496-00
A7Q950	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
A7Q955	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
A7Q958	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7Q982	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7Q984	151-0341-00			TRANSISTOR:PNP,SI,TO-106	04713	SPS6919
A7R800	302-0150-00			RES.,FXD,CMPSN:15 OHM,10%,0.50W	01121	EB1501
A7R802	304-0683-00			RES.,FXD,CMPSN:68K OHM,10%,1W	01121	GB6831
A7R820	316-0471-00	B010100	B093174	RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A7R820	315-0471-00	B093175		RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
A7R822	316-0822-00	B010100	B039999	RES.,FXD,CMPSN:8.2K OHM,10%,0.25W	01121	CB8221
A7R822	316-0472-00	B040000	B093174	RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
A7R822	315-0472-00	B093175		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A7R823	315-0150-00	B040000	RES.,FXD,CMPSN:15 OHM,5%,0.25W	57668	NTR25J-E 15E
A7R824	316-0271-00	B010100 B093174	RES.,FXD,CMPSN:270 OHM,10%,0.25W	01121	CB2711
A7R824	315-0271-00	B093175	RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A7R827	308-0742-00		RES.,FXD,WW:0.24 OHM,5%,2W	75042	BWH-R2400J
A7R829	316-0101-00	B010100 B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A7R829	315-0101-00	B093175	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A7R832	316-0102-00	B010100 B039999	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A7R832	315-0271-00	B040000	RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A7R833	315-0102-00	B040000	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A7R834	315-0162-00	B010100 B039999	RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	57668	NTR25J-E 1K6
A7R834	316-0472-00	B040000 B093174	RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
A7R834	315-0472-00	B093175	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A7R836	316-0682-00	B010100 B093174	RES.,FXD,CMPSN:6.8K OHM,10%,0.25W	01121	CB6821
A7R836	315-0682-00	B093175	RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A7R838	316-0682-00	B010100 B093174	RES.,FXD,CMPSN:6.8K OHM,10%,0.25W	01121	CB6821
A7R838	315-0682-00	B093175	RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A7R839	315-0432-00		RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A7R840	316-0101-00	B010100 B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A7R840	315-0101-00	B093175	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A7R842	316-0101-00	B010100 B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A7R842	315-0101-00	B093175	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A7R845	321-0764-01	B010100 B072290	RES.,FXD,FILM:5.09K OHM,0.5%,0.125W	91637	MFF1816G50900D
A7R845	321-0629-00	B072291	RES.,FXD,FILM:5.11K OHM,0.5%,0.125W	91637	MFF1816G51100D
A7R846	321-0685-00		RES.,FXD,FILM:30K OHM,0.5%,0.125W	91637	MFF1816D30001D
A7R850	307-0405-00		RES.,FXD,FILM:82 OHM,5%,7W	24546	FP5G82R00J
A7R851	308-0679-00		RES.,FXD,WW:0.51 OHM,5%,2W	75042	BWH-R5100J
A7R853	316-0470-00	B010100 B093174	RES.,FXD,CMPSN:47 OHM,10%,0.25W	01121	CB4701
A7R853	315-0470-00	B093175	RES.,FXD,CMPSN:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A7R855	316-0101-00	B010100 B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A7R855	315-0101-00	B093175	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A7R856	316-0153-00	B010100 B093174	RES.,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
A7R856	315-0153-00	B093175	RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668	NTR25J-E 15K
A7R860	321-0816-03		RES.,FXD,FILM:5K OHM,0.25%,0.125W	91637	MFF1816D50000C
A7R861	321-0289-00		RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A7R863	316-0101-00	B010100 B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A7R863	315-0101-00	B093175	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A7R866	315-0113-00		RES.,FXD,CMPSN:11K OHM,5%,0.25W	57668	NTR25J-E 11K
A7R867	316-0101-00	B010100 B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A7R867	315-0101-00	B093175	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A7R870	316-0392-00	B010100 B093174	RES.,FXD,CMPSN:3.9K OHM,10%,0.25W	01121	CB3921
A7R870	315-0392-00	B093175	RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A7R871	316-0471-00	B010100 B010250	RES.,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A7R871	315-0271-00	B010251	RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A7R873	315-0133-00		RES.,FXD,CMPSN:13K OHM,5%,0.25W	57668	NTR25J-E 13K
A7R880	307-0404-00		RES.,FXD,FILM:51 OHM,5%,10W	24546	FP105100J
A7R881	308-0679-00		RES.,FXD,WW:0.51 OHM,5%,2W	75042	BWH-R5100J
A7R883	316-0470-00	B010100 B093174	RES.,FXD,CMPSN:47 OHM,10%,0.25W	01121	CB4701
A7R883	315-0470-00	B093175	RES.,FXD,CMPSN:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A7R885	316-0101-00	B010100 B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A7R885	315-0101-00	B093175	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A7R886	316-0153-00	B010100 B093174	RES.,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
A7R886	315-0153-00	B093175	RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668	NTR25J-E 15K
A7R890	321-0816-03		RES.,FXD,FILM:5K OHM,0.25%,0.125W	91637	MFF1816D50000C
A7R891	321-0289-03		RES.,FXD,FILM:10K OHM,0.25%,0.125W	91637	MFF1816D10001C

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A7R893	316-0101-00	B010100	B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121 CB1011
A7R893	315-0101-00	B093175		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668 NTR25J-E 100E
A7R896	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	57668 NTR25J-E 13K
A7R897	316-0101-00	B010100	B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121 CB1011
A7R897	315-0101-00	B093175		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668 NTR25J-E 100E
A7R900	316-0392-00	B010100	B093174	RES.,FXD,CMPSN:3.9K OHM,10%,0.25W	01121 CB3921
A7R900	315-0392-00	B093175		RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	57668 NTR25J-E03K9
A7R901	315-0561-00	B010100	B010250	RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668 NTRERJ-E 560E
A7R901	315-0271-00	B010251		RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121 CB2715
A7R903	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668 NTRERJ-E 560E
A7R910	308-0686-00			RES.,FXD,WW:2.2 OHM,5%,2W	75042 BWH-2R200J
7R911	307-0301-00			RES.,FXD,FILM:120 OHM,5%,10W	24546 FP10 120 OHM 5%
A7R913	316-0391-00	B010100	B093174	RES.,FXD,CMPSN:390 OHM,10%,0.25W	01121 CB3911
A7R913	315-0391-00	B093175		RES.,FXD,CMPSN:390 OHM,5%,0.25W	57668 NTR25J-E390E
A7R915	316-0153-00	B010100	B093174	RES.,FXD,CMPSN:15K OHM,10%,0.25W	01121 CB1531
A7R915	315-0153-00	B093175		RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668 NTR25J-E 15K
A7R917	321-0268-00			RES.,FXD,FILM:6.04K OHM,1%,0.125W	91637 CMF55116G60400F
A7R920	311-1120-00			RES.,VAR,NONWIR:100 OHM,30%,0.25W	71450 201-YA5531
A7R922	321-0268-00			RES.,FXD,FILM:6.04K OHM,1%,0.125W	91637 CMF55116G60400F
A7R924	315-0101-00	B010100	B093174	RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668 NTR25J-E 100E
A7R924	315-0101-00	B093175		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668 NTR25J-E 100E
A7R925	315-0331-00			RES.,FXD,CMPSN:330 OHM,5%,0.25W	57668 NTR25J-E330E
A7R927	316-0103-00	B010100	B093174	RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121 CB1031
A7R927	315-0103-00	B093175		RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668 NTR25J-E10K0
A7R929	316-0823-00	B010100	B093174	RES.,FXD,CMPSN:82K OHM,10%,0.25W	01121 CB8231
A7R929	315-0823-00	B093175		RES.,FXD,CMPSN:82K OHM,5%,0.25W	57668 NTR25J-E82K
A7R930	302-0333-00			RES.,FXD,CMPSN:33K OHM,10%,0.50W	01121 EB3331
A7R935	316-0104-00	B010100	B093174	RES.,FXD,CMPSN:100K OHM,10%,0.25W	01121 CB1041
A7R935	315-0104-00	B093175		RES.,FXD,CMPSN:100K OHM,5%,0.25W	57668 NTR25J-E100K
A7R936	316-0473-00	B010100	B093174	RES.,FXD,CMPSN:47K OHM,10%,0.25W	01121 CB4731
A7R936	315-0473-00	B093175		RES.,FXD,CMPSN:47K OHM,5%,0.25W	57668 NTR25J-E47K0
A7R937	316-0183-00	B010100	B093174	RES.,FXD,CMPSN:18K OHM,10%,0.25W	01121 CB1831
A7R937	315-0183-00	B093175		RES.,FXD,CMPSN:18K OHM,5%,0.25W	57668 NTR25J-E 18K
A7R940	307-0007-00	B010100	B049999	RES.,FXD,CMPSN:2.7 OHM,10%,2W	01121 GB27G1
A7R940	308-0703-00	B050000		RES.,FXD,WW:1.8 OHM,5%,2W	75042 BWH-1R800J
A7R942	316-0101-00	B010100	B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121 CB1011
A7R942	315-0101-00	B093175		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668 NTR25J-E 100E
A7R943	316-0472-00	B010100	B093174	RES.,FXD,CMPSN:4.7K OHM,10%,0.25W	01121 CB4721
A7R943	315-0472-00	B093175		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	57668 NTR25J-E04K7
A7R944	307-0384-00	B010100	B049999	RES.,FXD,FILM:270 OHM,2%,4W	24546 FP-4 G270R0G
A7R944	308-0110-00	B050000		RES.,FXD,WW:100 OHM,5%,8W	56289 283EX100R0JQ24
A7R948	321-0256-00			RES.,FXD,FILM:4.53K OHM,1%,0.125W	91637 MFF1816G45300F
A7R949	316-0101-00	B010100	B093174	RES.,FXD,CMPSN:100 OHM,10%,0.25W	01121 CB1011
A7R949	315-0101-00	B093175		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668 NTR25J-E 100E
A7R950	311-1124-00			RES.,VAR,NONWIR:TRMR,250 OHM,0.25W	71450 201-YA5533
A7R951	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668 NTR25J-E05K6
A7R952	321-0202-00			RES.,FXD,FILM:1.24K OHM,1%,0.125W	91637 CMF55116G12400F
A7R953	316-0221-00	B010100	B093174	RES.,FXD,CMPSN:220 OHM,10%,0.25W	01121 CB2211
A7R953	315-0221-00	B093175		RES.,FXD,CMPSN:220 OHM,5%,0.25W	57668 NTR25J-E220E
A7R954	316-0102-00	B010100	B093174	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121 CB1021
A7R954	315-0102-00	B093175		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668 NTR25JE01K0
A7R955	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	57668 NTR25J-E300E
A7R956	316-0273-00	B010100	B093174	RES.,FXD,CMPSN:27K OHM,10%,0.25W	01121 CB2731
A7R956	315-0273-00	B093175		RES.,FXD,CMPSN:27K OHM,5%,0.25W	57668 NTR25J-E27K0

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A7R957	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	57668	NTR25J-E620E
A7R980	316-0272-00	B010100	B093174	RES.,FXD,CMPSN:2.7K OHM,10%,0.25W	01121	CB2721
A7R980	315-0272-00	B093175		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A7R981	316-0562-00	B010100	B093174	RES.,FXD,CMPSN:5.6K OHM,10%,0.25W	01121	CB5621
A7R981	315-0562-00	B093175		RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A7R982	316-0102-00	B010100	B093174	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A7R982	315-0102-00	B093175		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A7R984	316-0153-00	B010100	B093174	RES.,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
A7R984	315-0153-00	B093175		RES.,FXD,CMPSN:15K OHM,5%,0.25W	57668	NTR25J-E 15K
A7R986	322-0686-03			RES.,FXD,FILM:7.23K OHM,0.25%,0.25W	24546	NC60 7.23K 0.25%
A7R987	321-0097-03			RES.,FXD,FILM:100 OHM,0.25%,0.125W	91637	MFF1816D100R0C

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A8	670-2413-00	B010100	B094301	CKT BOARD ASSY:READOUT	80009	670-2413-00
A8	670-2413-01	B094302		CKT BOARD ASSY:READOUT	80009	670-2413-01
A8C1010	283-0103-00			CAP.,FXD,CER DI:180PF,5%,500V	59660	831-518-Z5D0181J
A8C1021	285-0698-00			CAP.,FXD,PLSTC:0.0082UF,5%,100V	84411	TEK44-82251
A8C1024	281-0511-00	B030000		CAP.,FXD,CER DI:22PF,+/-2.2PF,500V	59660	301-000C0G0220K
A8C1027	281-0501-00			CAP.,FXD,CER DI:4.7PF,+/-1PF,500V	59660	301-000S2H0479F
A8C1032	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	59660	301000X5U471M
A8C1041	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	59660	301000X5U471M
A8C1065	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
A8C1073	283-0095-00			CAP.,FXD,CER DI:56PF,10%,200V	59660	855-536-COG0560K
A8C1080	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
A8C1083	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	59660	855-547-E-502Z
A8C1100	283-0110-00			CAP.,FXD,CER DI:0.005UF,+80-20%,150V	59660	855-547-E-502Z
A8C1120	283-0116-00			CAP.,FXD,CER DI:820PF,5%,500V	59660	801547B821J
A8C1134	281-0541-00			CAP.,FXD,CER DI:6.8PF,10%,500V	59660	301-000C0H0689D
A8C1140	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
A8C1150	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
A8C1180	290-0534-00			CAP.,FXD,ELCTL:1UF,20%,35V	56289	196D105X0035HA1
A8C1181	290-0534-00			CAP.,FXD,ELCTL:1UF,20%,35V	56289	196D105X0035HA1
A8C1182	290-0534-00			CAP.,FXD,ELCTL:1UF,20%,35V	56289	196D105X0035HA1
A8CR1002	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1003	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1004	152-0141-02	B094302		SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1005	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1010	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1012	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1013	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1018	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1024	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1025	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1040	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1041	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8CR1052	152-0141-02			SEMICON DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
A8LR1100	108-0212-00			COIL,RF:FIXED,495NH	80009	108-0212-00
A8Q1010	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
A8Q1015	151-0220-00			TRANSISTOR:PNP,SI,TO-92	07263	S036228
A8Q1018	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
A8Q1040	151-0232-00			TRANSISTOR:SILICON,NPN,DUAL	07263	SP12141
A8Q1048	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A8Q1050	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A8Q1052	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
A8Q1056	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A8Q1100	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
A8Q1110	151-0410-00			TRANSISTOR:SILICON,PNP	04713	SPS6765
A8Q1140	153-0597-00			SEMICON DVC SE:SILICON,PNP	80009	153-0597-00
A8Q1150	-----			(PART OF Q1140)		
A8R1001	317-0153-00	B093985		RES.,FXD,CMPSN:15K OHM,5%,0.125W	01121	BB1535
A8R1002	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A8R1003	315-0623-00			RES.,FXD,CMPSN:62K OHM,5%,0.25W	57668	NTR25J-E 62K
A8R1004	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A8R1005	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A8R1006	311-1572-00			RES.,VAR,NONWIR:TRMR,1K OHM,0.5W	73138	91-92-0
A8R1007	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	57668	NTR25J-E 18K

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A8R1010	315-0752-00		RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A8R1012	315-0242-00		RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A8R1015	315-0752-00		RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A8R1016	316-0102-00	B010100 B092939	RES.,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A8R1016	315-0102-00	B092940	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A8R1018	316-0561-00	B010100 B092939	RES.,FXD,CMPSN:560 OHM,10%,0.25W	01121	CB5611
A8R1018	315-0561-00	B092940	RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668	NTRERJ-E 560E
A8R1019	316-0103-00	B010100 B092939	RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
A8R1019	315-0103-00	B092940	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A8R1020	316-0103-00	B010100 B092939	RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
A8R1020	315-0103-00	B092940	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A8R1021	316-0393-00	B010100 B092939	RES.,FXD,CMPSN:39K OHM,10%,0.25W	01121	CB3931
A8R1021	315-0393-00	B092940	RES.,FXD,CMPSN:39K OHM,5%,0.25W	57668	NTR25J-E39K0
A8R1023	316-0103-00	B010100 B092939	RES.,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
A8R1023	315-0103-00	B092940	RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
A8R1024	316-0391-00	B010100 B092939	RES.,FXD,CMPSN:390 OHM,10%,0.25W	01121	CB3911
A8R1024	315-0391-00	B092940	RES.,FXD,CMPSN:390 OHM,5%,0.25W	57668	NTR25J-E390E
A8R1025	315-0152-00		RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A8R1027	321-0385-00		RES.,FXD,FILM:100K OHM,1%,0.125W	91637	MFF1816G10002F
A8R1030	315-0154-00		RES.,FXD,CMPSN:150K OHM,5%,0.25W	57668	NTR25J-E150K
A8R1032	321-0262-00		RES.,FXD,FILM:5.23K OHM,1%,0.125W	91637	MFF1816G52300F
A8R1040	321-0277-00	B010100 B010199	RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A8R1040	321-0269-00	B010200	RES.,FXD,FILM:6.19K OHM,1%,0.125W	91637	MFF1816G61900F
A8R1041	321-0261-00		RES.,FXD,FILM:5.11K OHM,1%,0.125W	91637	MFF1816G51100F
A8R1043	315-0154-00		RES.,FXD,CMPSN:150K OHM,5%,0.25W	57668	NTR25J-E150K
A8R1044	315-0133-00		RES.,FXD,CMPSN:13K OHM,5%,0.25W	57668	NTR25J-E 13K
A8R1046	321-0181-00		RES.,FXD,FILM:750 OHM,1%,0.125W	91637	CMF55116G750R0F
A8R1047	321-0294-00		RES.,FXD,FILM:11.3K OHM,1%,0.125W	91637	CMF55116G11301F
A8R1048	321-0222-00		RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A8R1050	315-0332-00		RES.,FXD,CMPSN:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A8R1052	315-0222-00		RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A8R1053	321-0268-00		RES.,FXD,FILM:6.04K OHM,1%,0.125W	91637	CMF55116G60400F
A8R1056	321-0329-00		RES.,FXD,FILM:26.1K OHM,1%,0.125W	91637	MFF1816G26101F
A8R1060	315-0303-00		RES.,FXD,CMPSN:30K OHM,5%,0.25W	57668	NTR25J-E 30K
A8R1062	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	57668	NTR25J-E20K0
A8R1063	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	57668	NTR25J-E20K0
A8R1064	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	57668	NTR25J-E20K0
A8R1065	315-0203-00		RES.,FXD,CMPSN:20K OHM,5%,0.25W	57668	NTR25J-E20K0
A8R1070	316-0561-00	B010100 B092939	RES.,FXD,CMPSN:560 OHM,10%,0.25W	01121	CB5611
A8R1070	315-0561-00	B092940	RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668	NTRERJ-E 560E
A8R1071	316-0561-00	B010100 B092939	RES.,FXD,CMPSN:560 OHM,10%,0.25W	01121	CB5611
A8R1071	315-0561-00	B092940	RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668	NTRERJ-E 560E
A8R1072	316-0561-00	B010100 B092939	RES.,FXD,CMPSN:560 OHM,10%,0.25W	01121	CB5611
A8R1072	315-0561-00	B092940	RES.,FXD,CMPSN:560 OHM,5%,0.25W	57668	NTRERJ-E 560E
A8R1073	316-0563-00	B010100 B092939	RES.,FXD,CMPSN:56K OHM,10%,0.25W	01121	CB5631
A8R1073	315-0563-00	B092940	RES.,FXD,CMPSN:56K OHM,5%,0.25W	57668	NTR25J-E 56K
A8R1080	316-0823-00	B010100 B092939	RES.,FXD,CMPSN:82K OHM,10%,0.25W	01121	CB8231
A8R1080	315-0823-00	B092940	RES.,FXD,CMPSN:82K OHM,5%,0.25W	57668	NTR25J-E82K
A8R1082	315-0272-00		RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A8R1083	315-0512-00		RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A8R1084	315-0822-00		RES.,FXD,CMPSN:8.2K OHM,5%,0.25W	57668	NTR25J-E 8K2
A8R1086	321-0296-00		RES.,FXD,FILM:11.8K OHM,1%,0.125W	91637	MFF1816G11801F
A8R1088	315-0102-00		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A8R1092	321-0146-00		RES.,FXD,FILM:324 OHM,1%,0.125W	91637	MFF1816G324R0F

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff	Discont	Name & Description	Mfr Code	Mfr Part Number
A8R1093	321-0250-00			RES.,FXD,FILM:3.92K OHM,1%,0.125W	91637	MFF1816G39200F
A8R1095	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	57668	NTR25J-E 22K
A8R1097	321-0207-00			RES.,FXD,FILM:1.4K OHM,1%,0.125W	91637	CMF55116G14000F
A8R1098	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A8R1101	321-0167-00			RES.,FXD,FILM:536 OHM,1%,0.125W	91637	CMF55116G536R0F
A8R1103	321-0255-00			RES.,FXD,FILM:4.42K OHM,1%,0.125W	91637	MFF1816G44200F
A8R1105	321-0230-00			RES.,FXD,FILM:2.43K OHM,1%,0.125W	24546	CT552431F
A8R1106	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	57668	NTR25J-E02K0
A8R1110	311-1571-00			RES.,VAR,NONWIR:500 OHM,0.50W	73138	91WR500-91A
A8R1111	316-0681-00	B010100	B092939	RES.,FXD,CMPSN:680 OHM,10%,0.25W	01121	CB6811
A8R1111	315-0681-00	B092940		RES.,FXD,CMPSN:680 OHM,5%,0.25W	57668	NTR25J-E680E
A8R1113	321-0125-00			RES.,FXD,FILM:196 OHM,1%,0.125W	91637	CMF55116G196R0F
A8R1115	321-0242-00			RES.,FXD,FILM:3.24K OHM,1%,0.125W	24546	CT55 3241 F
A8R1117	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
A8R1118	311-1571-00			RES.,VAR,NONWIR:500 OHM,0.50W	73138	91WR500-91A
A8R1120	315-0512-00	B010100	B010250	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A8R1120	315-0432-00	B010251		RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A8R1122	321-0152-00	B010100	B054731	RES.,FXD,FILM:374 OHM,1%,0.125W	91637	CMF55116G374R0F
A8R1122	321-0155-00	B054732		RES.,FXD,FILM:402 OHM,1%,0.125W	91637	CMF55116G402R0F
A8R1124	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	24546	CT552321F
A8R1125	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	24546	CT552321F
A8R1127	321-0141-00			RES.,FXD,FILM:287 OHM,1%,0.125W	91637	CMF55116G287R0F
A8R1129	315-0220-00	B030000		RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A8R1130	321-0069-00			RES.,FXD,FILM:51.1 OHM,1%,0.125W	91637	CMF55116G51R10F
A8R1131	321-0069-00			RES.,FXD,FILM:51.1 OHM,1%,0.125W	91637	CMF55116G51R10F
A8R1132	315-0220-00	B030000		RES.,FXD,CMPSN:22 OHM,5%,0.25W	57668	NTR25J-E 22E
A8R1133	321-0143-00	B010100	B010250	RES.,FXD,FILM:301 OHM,1%,0.125W	91637	CMF55116G301R0F
A8R1133	321-0141-00	B010251		RES.,FXD,FILM:287 OHM,1%,0.125W	91637	CMF55116G287R0F
A8R1134	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	57668	NTR25J-E180E
A8R1136	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	24546	CT552321F
A8R1137	321-0228-00			RES.,FXD,FILM:2.32K OHM,1%,0.125W	24546	CT552321F
A8R1140	315-0910-00	B010100	B010250	RES.,FXD,CMPSN:91 OHM,5%,0.25W	57668	NTR25J-E 91E
A8R1140	315-0121-00	B010251		RES.,FXD,CMPSN:120 OHM,5%,0.25W	57668	NTR25J-E 120E
A8R1141	321-0178-00			RES.,FXD,FILM:698 OHM,1%,0.125W	91637	CMF55116G698R0F
A8R1142	321-0187-00			RES.,FXD,FILM:866 OHM,1%,0.125W	91637	MFF1816G866R0F
A8R1143	321-0157-00	B010100	B010250	RES.,FXD,FILM:422 OHM,1%,0.125W	91637	CMF55116G422R0F
A8R1143	321-0126-00	B010251	B054739	RES.,FXD,FILM:200 OHM,1%,0.125W	91637	CMF55116G200R0F
A8R1143	321-0128-00	B054740		RES.,FXD,FILM:210 OHM,1%,0.125W	91637	CMF55116G210R0F
A8R1144	321-0187-00			RES.,FXD,FILM:866 OHM,1%,0.125W	91637	MFF1816G866R0F
A8R1146	322-0159-00			RES.,FXD,FILM:442 OHM,1%,0.25W	24546	NA60D4420F
A8R1147	321-0099-00	B010100	B010250	RES.,FXD,FILM:105 OHM,1%,0.125W	91637	CMF55116G105R0F
A8R1147	321-0069-00	B010251		RES.,FXD,FILM:51.1 OHM,1%,0.125W	91637	CMF55116G51R10F
A8R1148	322-0159-00			RES.,FXD,FILM:442 OHM,1%,0.25W	24546	NA60D4420F
A8R1150	315-0910-00	B010100	B010250	RES.,FXD,CMPSN:91 OHM,5%,0.25W	57668	NTR25J-E 91E
A8R1150	315-0121-00	B010251		RES.,FXD,CMPSN:120 OHM,5%,0.25W	57668	NTR25J-E 120E
A8R1151	323-0178-00			RES.,FXD,FILM:698 OHM,1%,0.50W	91637	MFF1226G698R0F
A8R1155	316-0681-00	B010100	B095939	RES.,FXD,CMPSN:680 OHM,10%,0.25W	01121	CB6811
A8R1155	315-0681-00	B095940		RES.,FXD,CMPSN:680 OHM,5%,0.25W	57668	NTR25J-E680E
A8R1156	316-0333-00	B010100	B095939	RES.,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
A8R1156	315-0333-00	B095940		RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A8R1157	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A8U1000	155-0021-00	B010100	B020733	MICROCIRCUIT,DI:ML,TIMING GENERATOR	80009	155-0021-00
A8U1000	155-0021-01	B020734		MICROCIRCUIT,DI:SCAN OSCILLATOR & LOGIC	80009	155-0021-01
A8U1025	155-0017-00			MICROCIRCUIT,DI:ML,ZERO LOGIC COUNTER	80009	155-0017-00

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A8U1035	155-0014-01		MICROCIRCUIT,DI:ML,ANALOG TO DECIMAL CONV	80009	155-0014-01
A8U1060	155-0018-00		MICROCIRCUIT,DI:ML,ZERO LOGIC	80009	155-0018-00
A8U1070	155-0014-01		MICROCIRCUIT,DI:ML,ANALOG TO DECIMAL CONV	80009	155-0014-01
A8U1075	156-0032-03		MICROCIRCUIT,DI:4 BIT BINARY COUNTER,SCRN	07263	7493(PCQR)
A8U1080	155-0019-00		MICROCIRCUIT,DI:ML,DECIMAL POINT AND SPACE	80009	155-0019-00
A8U1090	155-0023-00		MICROCIRCUIT,DI:ML,CHAR GEN NUMERALS	80009	155-0023-00
A8U1092	155-0024-00		MICROCIRCUIT,DI:ML,CHAR GEN SPCL SYMBOLS	80009	155-0024-00
A8U1094	155-0025-00		MICROCIRCUIT,DI:ML,CHAR GEN PREFIXES	80009	155-0025-00
A8U1096	155-0026-00		MICROCIRCUIT,DI:ML,CHAR GEN LETTERS	80009	155-0026-00
A8U1098	155-0027-00		MICROCIRCUIT,DI:ML,CHAR GEN SPCL ALPHA	80009	155-0027-00
A8U1100	155-0020-00		MICROCIRCUIT,DI:ML,CHANNEL SW OUTPUT ASSY	80009	155-0020-00
A8U1130	155-0022-00		MICROCIRCUIT,DI:ML,CHANNEL SWITCH	80009	155-0022-00
A8VR1080	152-0243-00		SEMICONV DEVICE:ZENER,0.4W,15V,5%	14552	TD3810983
A8VR1081	152-0243-00		SEMICONV DEVICE:ZENER,0.4W,15V,5%	14552	TD3810983
A8VR1082	152-0243-00		SEMICONV DEVICE:ZENER,0.4W,15V,5%	14552	TD3810983

Replaceable Electrical Parts—5441/R5441

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A9	670-5035-00	B062200	CKT BOARD ASSY:READOUT PROTECTION	80009	670-5035-00
A9CR1060	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1061	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1062	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1063	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1064	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1065	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1066	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1067	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1068	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
9CR1069	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1070	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1071	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1072	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1073	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1074	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1075	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1076	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1077	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1078	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1079	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1080	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1081	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1082	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9CR1083	152-0333-00	B062200	SEMICON DVC DI:SW,SI,55V,200MA,D0-35	03508	DJ2011
A9U1030	155-0015-01	B062200	MICROCIRCUIT,DI:ML,ANALOG DATA SWITCH	80009	155-0015-01
A9U1040	155-0015-01	B062200	MICROCIRCUIT,DI:ML,ANALOG DATA SWITCH	80009	155-0015-01

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
CHASSIS PARTS					
B300	119-0830-00	B070000	FAN,TUBEAXIAL:12 VDC,2.4W,5250 RPM,47 CFM	000AX	69.11.2
DL100	119-0486-00	B010100	DELAY LINE,ELEC:140NS,150 OHM	80009	119-0486-00
DL100	119-0693-00	B061967	DELAY LINE,ELEC:140NSEC,150 OHM IMPEDANCE	80009	119-0693-00
F300	159-0041-00		FUSE,CARTRIDGE:3AG,1.25A,250V,SLOW-BLOW	71400	MDX 1 25/100
F300	-----		(120V NOMINAL LINE DOMESTIC)		
F300	159-0040-00		FUSE,CARTRIDGE:3AG,0.7A,SLOW-BLOW	71400	MDL 7/10
F300	-----		(240V NOMINAL LINE EXPORT)		
J300	131-0955-00		CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
L365	108-0714-00		COIL,TUBE DEFLE:Y AXIS ALIGNMENT	80009	108-0714-00
L375	108-0792-00		COIL,TUBE DEFLE:TRACE ROTATION	80009	108-0792-00
R375	311-1558-00	B010100	RES.,VAR,NONWIR:TRMR,20K OHM,0.5W	32997	3352T-1-203
R375	311-1524-00	B020000	RES.,VAR,NONWIR:20K OHM,10%,1W	01121	73A1G040L203U
R1000	311-1492-00		RES.,VAR,NONWIR:PNL,5 X 5K OHM,0.5W,W/SW	01121	11M136
R1000	-----		(PART OF S1000,STANDARD ONLY)		
S300	260-0618-00	B010100	SWITCH,THRMSTC:NC,OPEN 60,CL 48.9,10A,24OV	93410	430-362
S300	260-0071-00	B061810	SWITCH,THRMSTC:NC,OPEN 68.3,CL 48.9,10V	93410	430-353
S302	260-1222-00		SWITCH,PUSH-PUL:10A,250VAC	91929	2DM301
S1000	-----		(PART OF R1000)		
T800	120-0821-00		XFMR,PWR,SDN&SU:	80009	120-0821-00
V400	154-0670-10		ELECTRON TUBE:CRT,P31	80009	154-0670-10

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

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

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

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

Abbreviations are based on ANSI Y1.1-1972.

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

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

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

Component Values

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

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

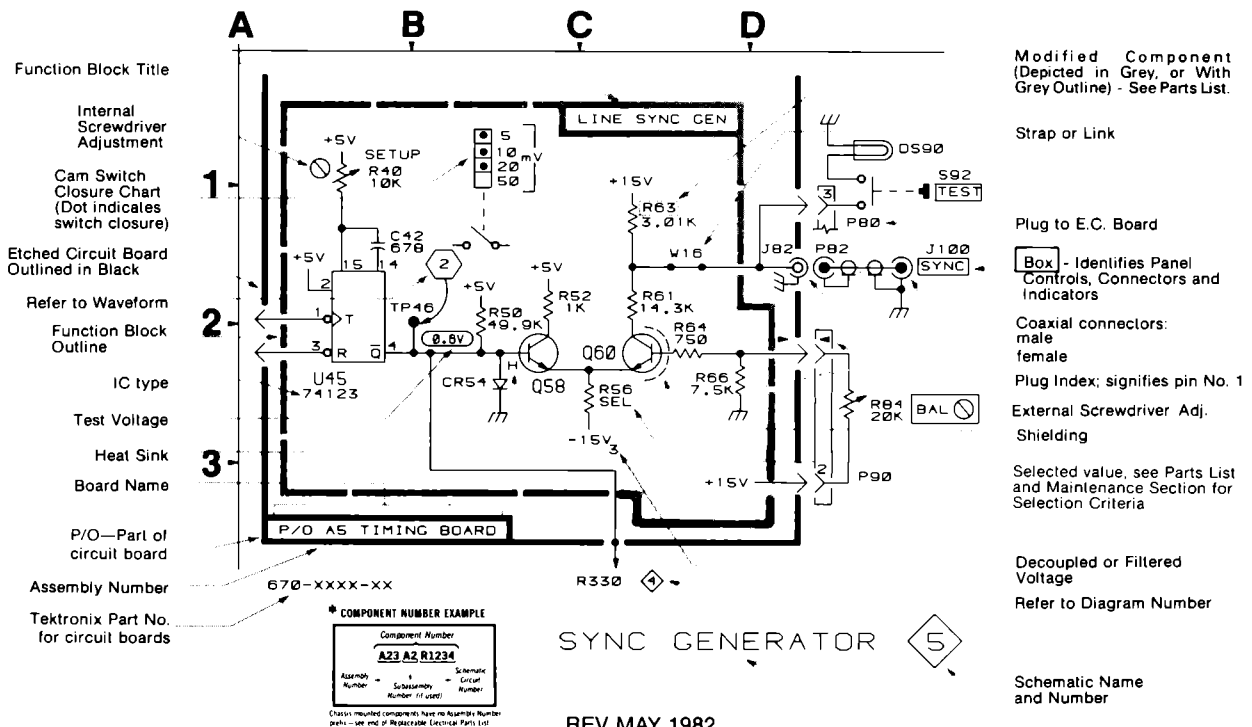
Resistors = Ohms (Ω).

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

Assembly Numbers and Grid Coordinates

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

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



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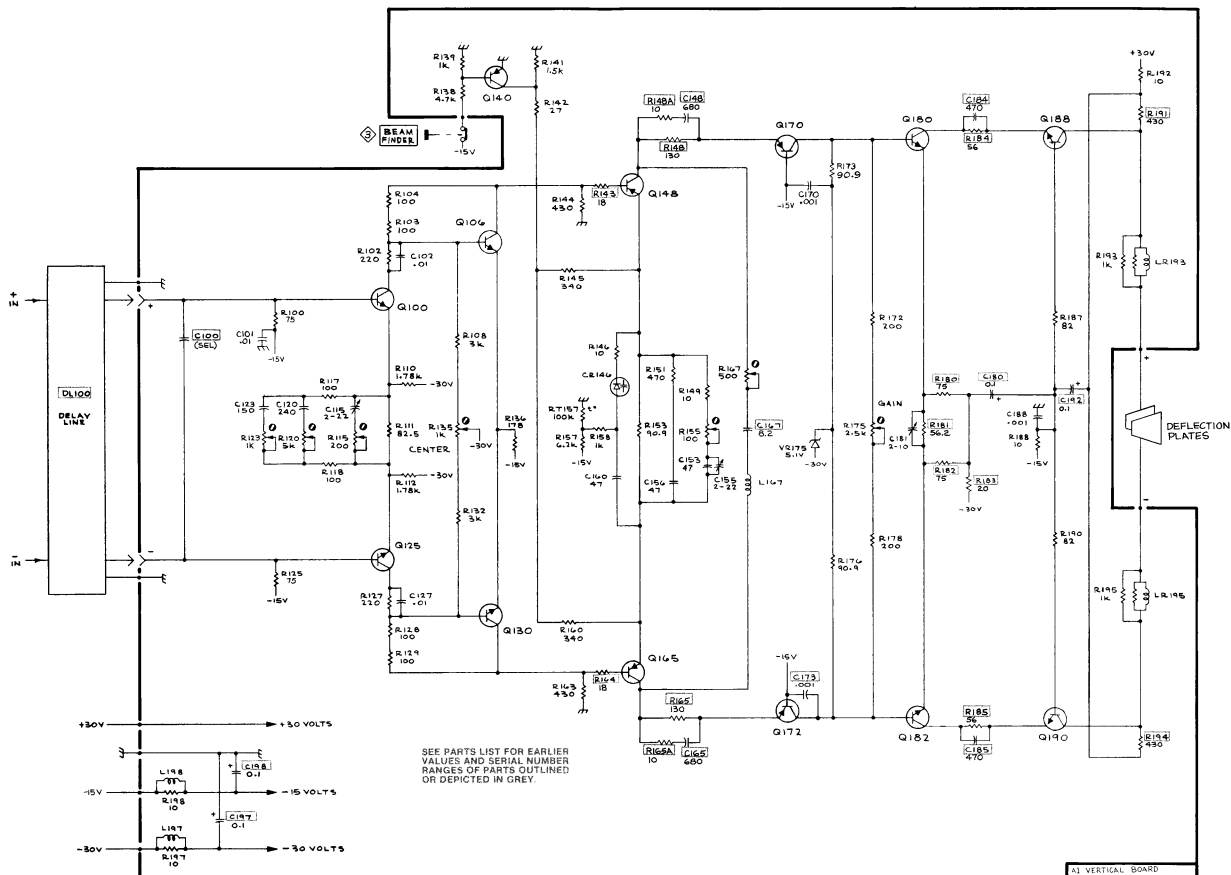




Fig. 8-2A. Horizontal Amplifier circuit board assembly A-2 (SN B092860 & up).

CXT	NO	LOC	CXT	NO	LOC	CXT	NO	LOC	CXT	NO	LOC
C210	C3	P200	A6	R240	C4	R320	B1				
C211	C3	P200	A4	R242	C5	R322	B1				
C235	C5	P365	D4	R244	C4	R324	B3				
C240	C5			R245	D5	R326	B3				
C242	D5	Q200	C4	R246	D5	R327	B2				
C244	D5	Q215	C4	R247	D5	R328	B2				
C250	D5	Q240	C5	R248	B4	R330	B3				
C252	D5	Q244	D5	R250	C6	R332	C2				
C266	D4	Q250	D6	R252	D5	R335	B3				
C272	C6	Q255	A5	R255	B5	R336	B2				
C280	C5	Q270	S5	R256	D5	R337	B2				
C282	B6	Q270	B5	R257	A5	R338	A3				
C286	D4	Q280	B6	R258	A5	R342	B3				
C302	C2	Q312	C2	R260	D6	R343	B3				
C312	D3	Q305	D2	R265	D4	R344	B2				
C314	D2	Q312	D2	R266	D4	R345	A3				
C316	D3	Q316	D2	R268	C5	R347	A3				
C318	D3	Q320	B2	R270	C4	R350	A2				
C319	B3	Q330	B2	R272	C5	R352	A2				
C354	A2	Q340	B2	R274	B5	R356	B1				
C358	B1	Q345	B3	R276	B5	R358	B1				
C360	A2	Q352	A3	R280	B5	R359	B1				
				R282	B5	R360	A2				
RC204	C4			R284	C5	R362	A1				
RC206	C4	R200	C4	R286	B5	R365	D3				
RC208	B5	R201	C4	R289	C6	R366	D6				
RC240	C4	R202	C4	R300	C2	R370	D4				
RC242	D5	R203	D4	R301	C2	R372	D4				
RC246	D5	R205	C3	R302	C2	R375	D6				
RC247	B5	R207	C2	R303	C2						
RC272	B5	R208	D4	R304	C2	VR245	D5				
RC274	B5	R210	D3	R305	C2	VR252	A5				
RC303	C2	R211	C4	R306	C2	VR305	C2				
RC313	D3	R212	C3	R307	C2	VR372	D4				
RC324	D3	R215	B4	R311	C2						
RC328	D3	R215	C5	R312	C2						
RC332	C2	R216	C4	R313	D1						
RC345	A2	R217	C4	R314	D2						
RC356	A2	R220	B4	R315	D2						
				R316	D3						
J300	B1	R222	C4	R317	D1						
				R318	D3						
L300	A4	R224	C5	R319	D3						

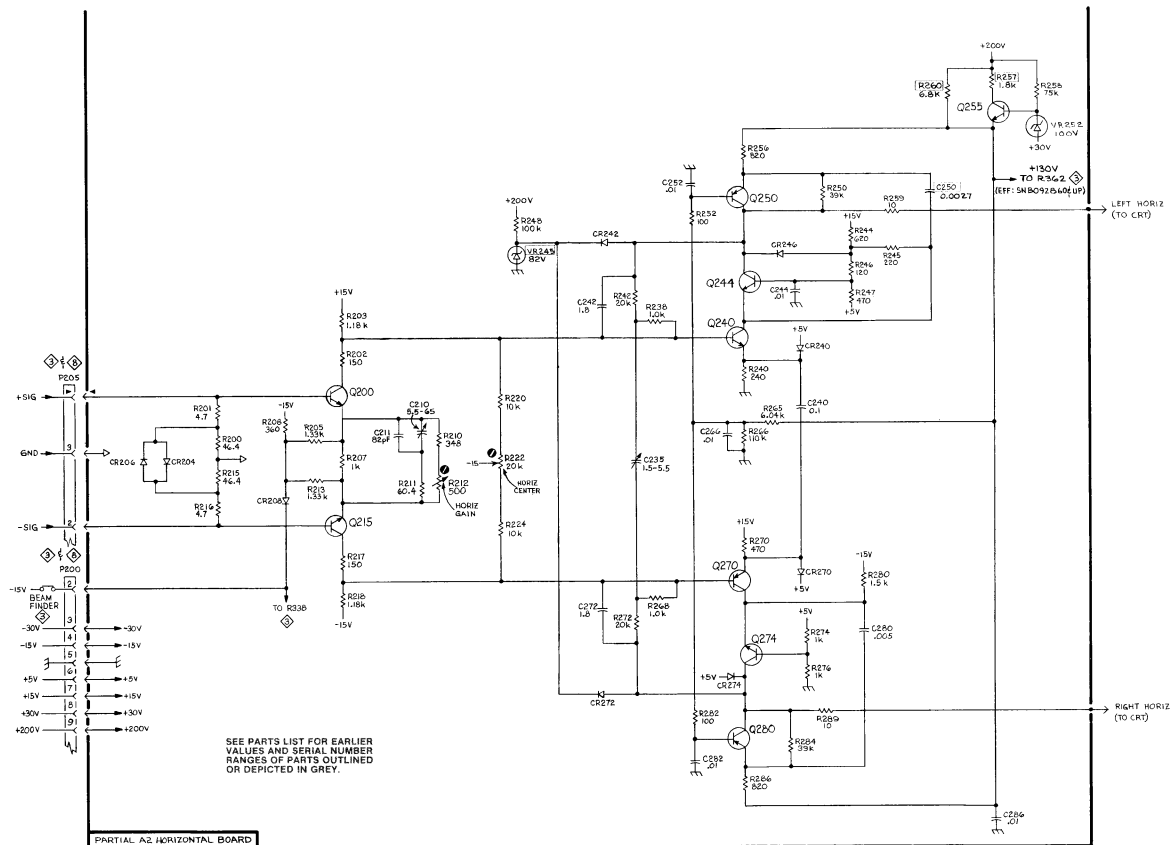
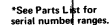




Fig. 8-3A. High Voltage circuit board assembly A-3 (SN B092860-up).

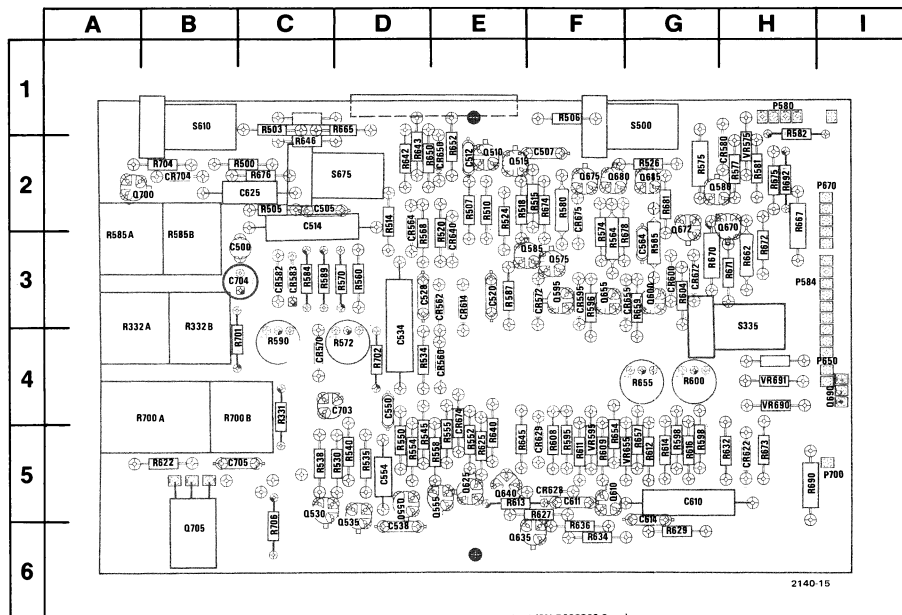
CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C395	B3	CR390	B3	DS400	A9	R390	A4	R412	B6	R456	A6		
C402	B4	CR391	B3	DS402	A8	R392	B3	R415	B8	R457	B6		
C406	D9	CR395	A3			R383	B4	R417	B9	R458	A6		
C410	D9	CR412	C6	F410	D1	R394	A4	R418	A9	R460	A7		
C412	B6	CR420	A8			R395	A5	R421	B8	R462	C8		
C416	B8	CR427	C8	P300	B1	R396	A5	R423	B9				
C418	A4	CR428	C9	P302	C1	R400	A4	R422	A8	T410	C7		
C422	B9	CR430	C8	P304	C1	R402	A4	R425	B9				
C426	C9	CR452	B4	P310	A1	R404	B4	R427	C8	U410	C5		
C427	C8	CR453	B7	P410	A8	R405	B4	R430	B3	VR427	C8		
C450	C4	CR454	B4	P413	D1	R406	B4	R433	B3	VR435	A3		
C452	B3	CR456	A7			R408	D8	R435	A3	VR452	B4		
C454	B5	CR457	A6			R410	D2	R450	C5				
C458	A5			Q400	B4	R411	D6	R452	B4	W410	D8		
C460	A7			Q410	D8			R454	C4				



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CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C395	D-3	CR390	D-2	F410	B-4	Q390	D-2	R390	E-2	R420	I-1	T410	H-4	U410	E-4	VR435	D-1
C402	E-2	CR395	D-1			Q400	E-3	R392	D-2	R422	J-2						
C405	J-4	CR420	J-2					R394	E-2	R425	J-1						
C410	L-5	CR422	J-1					R395	F-1	R427	J-3						
C412	H-2	CR428	J-3					R397	D-2	R428	J-3						
C414	H-2	CR430	J-3					R400	E-2	R430	D-2						
C415	I-2							R402	E-2	R433	D-2						
C417	F-2							R404	E-2	R435	D-1						
C418	E-1							R405	F-2								
C422	I-2							R406	E-3								
C425	J-2							R408	J-4								
C427	J-3							R410	C-5								
C430	J-4							R412	G-1								
C440	I-2							R417	J-2								
								R418	J-1								

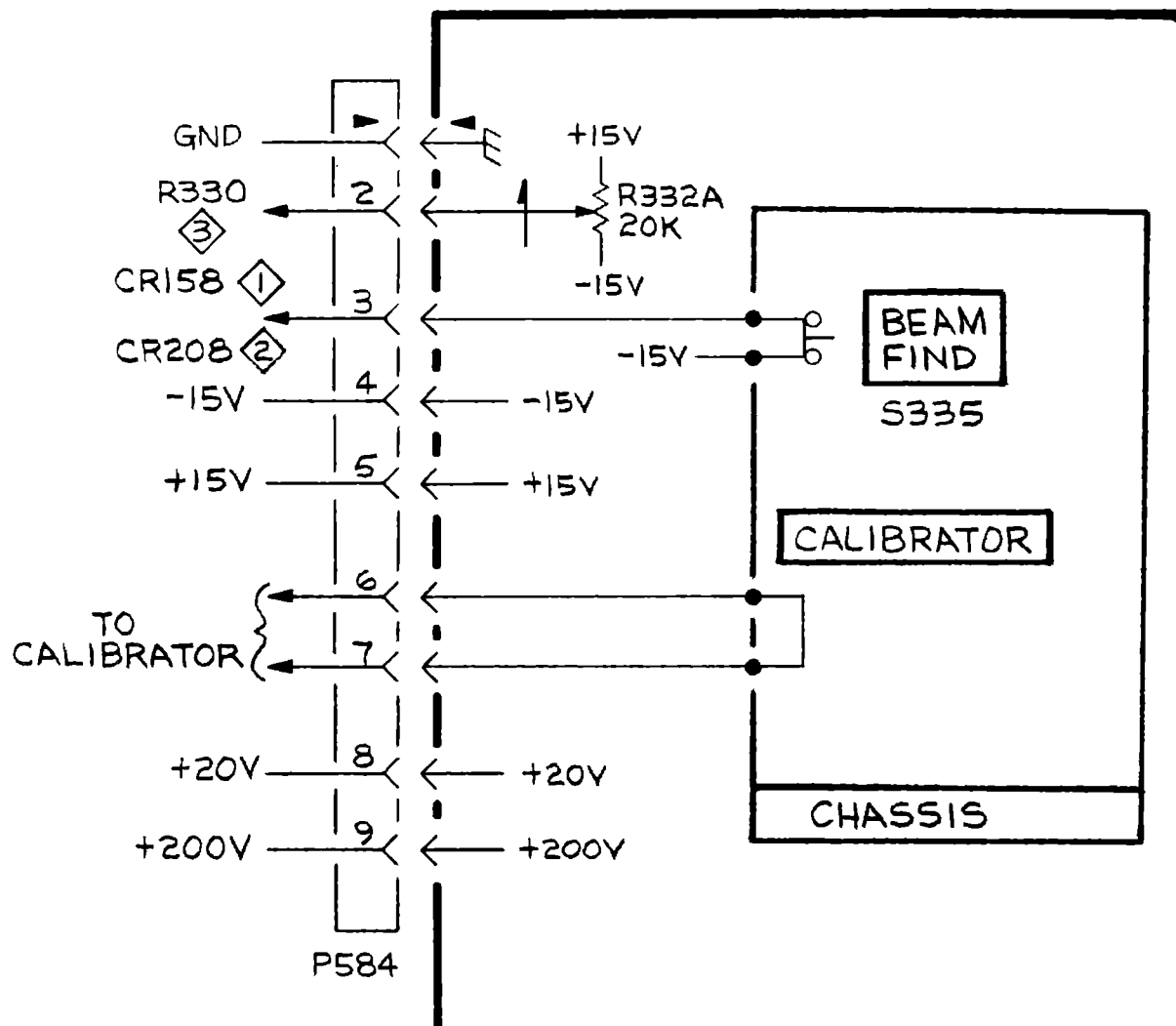




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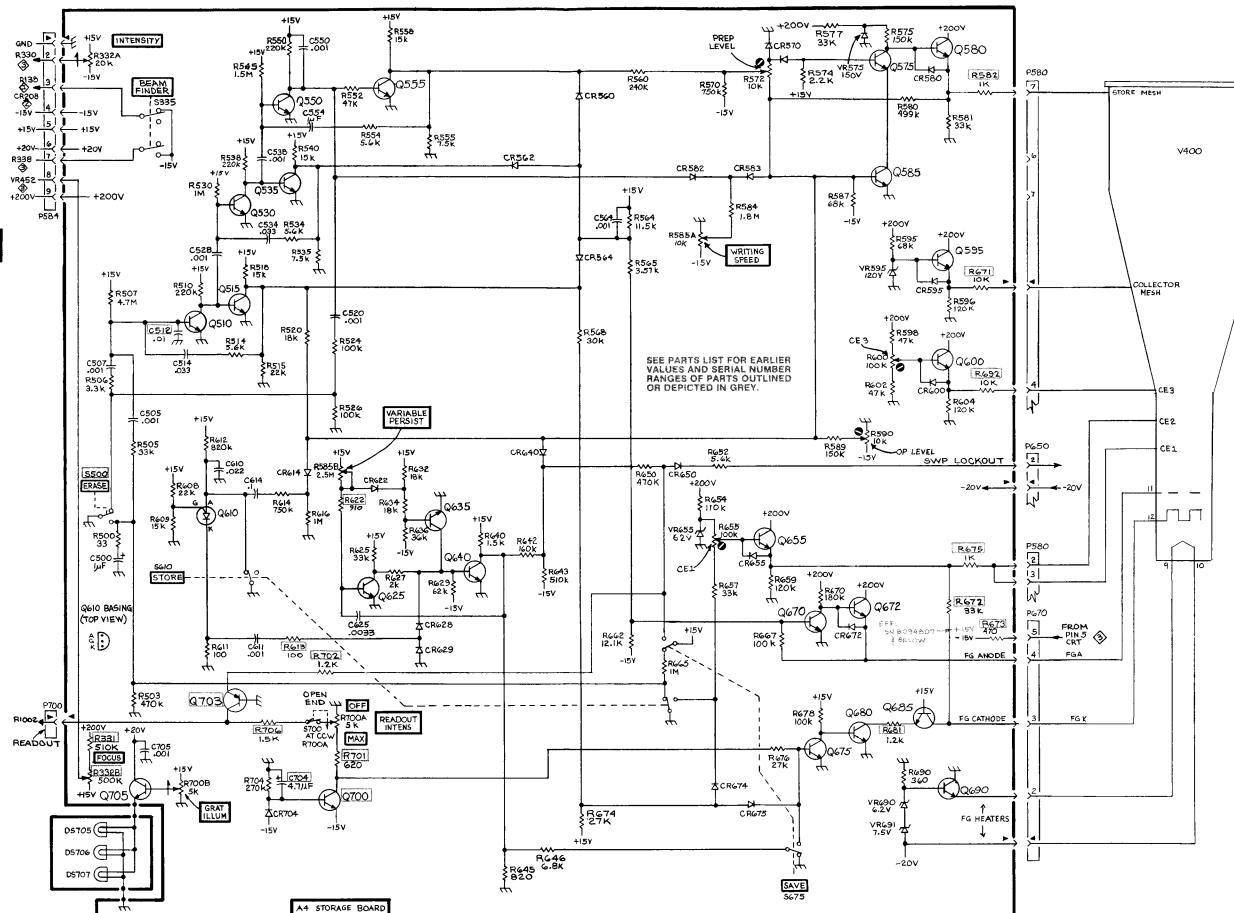
Fig. 8-4A. Storage circuit board assembly A-4 (SN B092860 & up).

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C500	B3	C705	B3	CR640	E3	Q535	D5	Q685	G2	R520	E3	R568	D3	R598	G5	R640	E5
C505	C2	C704	B5	CR650	E2	Q550	D5	Q690	I4	R524	E2	R570	D3	R600	G4	R642	D2
C507	F2			CR655	F3	Q555	E5	Q700	A2	R526	G2	R572	D4	R604	G3	R643	D2
C512	E2	CR560	E4	CR672	G3	Q575	F3	Q705	B6	R530	C5	R574	F3	R608	F5	R645	E5
C514	C2	CR562	E3	CR674	E5	Q580	G2			R532	D4	R575	G2	R609	F5	R646	C2
C520	E3	CR564	D3	CR675	F2	Q585	E3	R331	C4	R535	D5	R577	H2	R611	F5	R650	D2
C528	D3	CR570	C4	CR704	B2	Q595	F3	R332A	A3	R538	C5	R580	F2	R612	G5	R652	E2
C534	D4	CR572	F3			Q600	G3	R332B	B3	R540	D5	R581	H2	R613	E5	R654	F5
C538	D6	CR580	H2	P580	H1	Q610	F5	R500	C2	R545	D5	R582	H1	R614	G5	R655	G4
C550	D4	CR582	C3	P584	H3	Q625	E5	R503	C1	R550	D5	R584	C3	R616	G5	R657	G5
C554	D5	CR583	C3	P650	I4	Q635	E6	R505	C2	R552	E5	R585A	A3	R622	B5	R659	G3
C564	G3	CR595	F3	P670	I2	Q640	E5	R506	F1	R554	D5	R585B	B3	R625	E5	R662	H3
C610	G5	CR600	G3	P700	I5	Q655	F3	R507	E2	R555	E5	R587	E3	R627	F5	R665	D1
C611	F5	CR614	E3			Q670	H2	R510	E2	R558	E5	R589	C3	R629	G6	R667	H2
C614	G5	CR622	H5	Q510	E2	Q672	G2	R514	D2	R560	D3	R590	C4	R632	H5	R670	G3
C626	C2	CR628	F5	Q515	E2	Q675	F2	R515	F2	R564	F3	R595	F5	R634	F6	R671	H3
C703	D4	CR629	F5	Q530	C5	Q680	F2	R518	E2	R565	G3	R596	F3	R636	F6	R672	H3
																S335	H3
																S500	G1



PARTIAL STORAGE CKT 4
(EFF. SN B092859 - BELOW)

HISTORY INFORMATION



STORAGE CIRCUIT

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STORAGE CRT 12-75

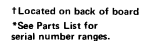


Fig. 8-5. Readout circuit board assembly A-8.

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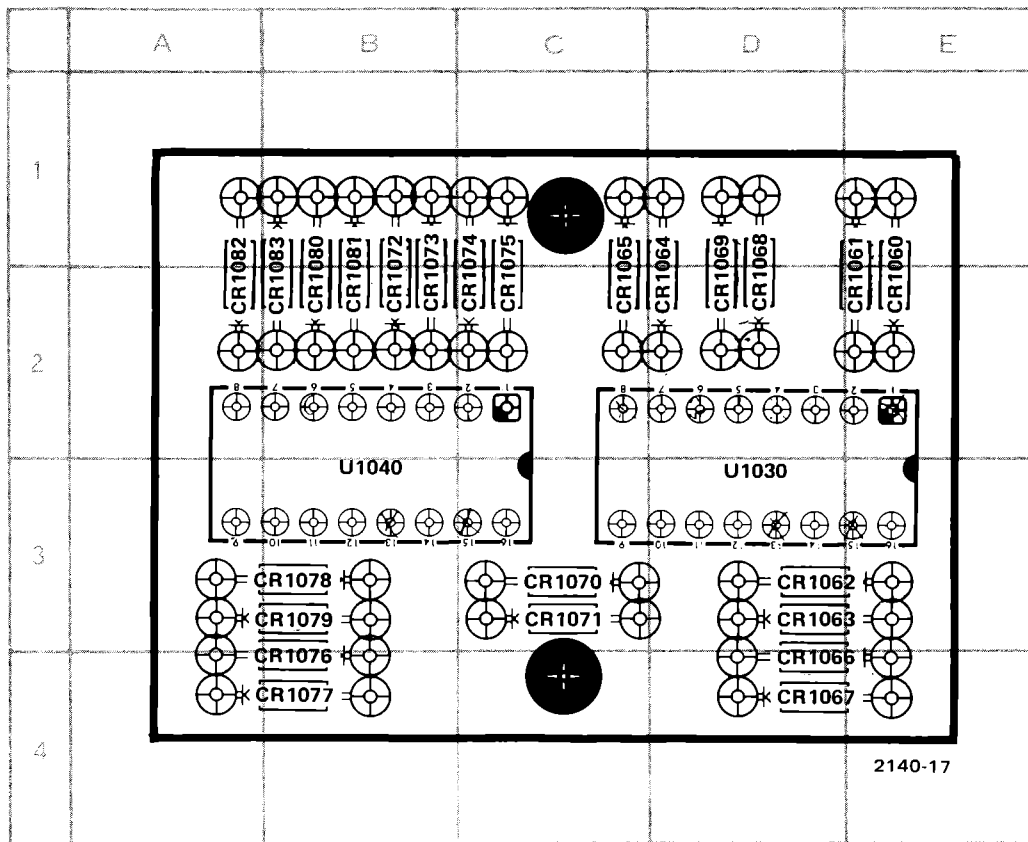


Fig. 8-6. Readout Protection board assembly A-9.

Added to Main Interface circuit board and connected through U1030 - U1040 sockets, SN B074125 & up.

CKT NO	GRID LOC	CKT NO	GRID LOC
CR1060	E2	CR1074	C2
CR1061	E2	CR1075	C2
CR1062	D3	CR1076	B4
CR1063	D3	CR1077	B4
CR1064	D2	CR1078	B3
CR1065	C2	CR1079	B3
CR1066	D4	CR1080	B2
CR1067	D4	CR1081	B2
CR1068	D2	CR1082	A2
CR1069	D2	CR1083	B2
CR1070	C3		
CR1071	C3	U1030	D3
CR1072	B2	U1040	B3
CR1073	B2		



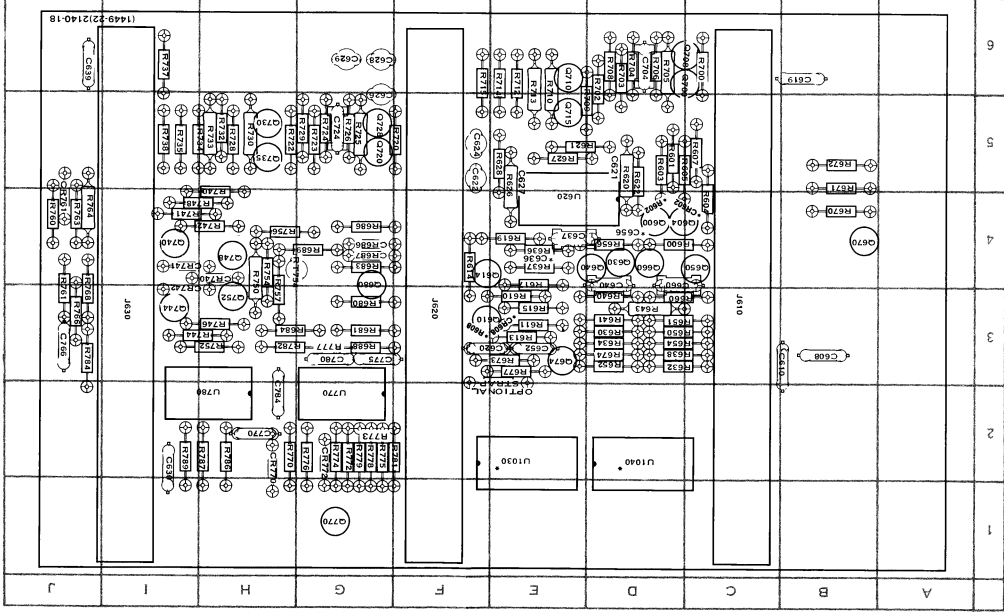
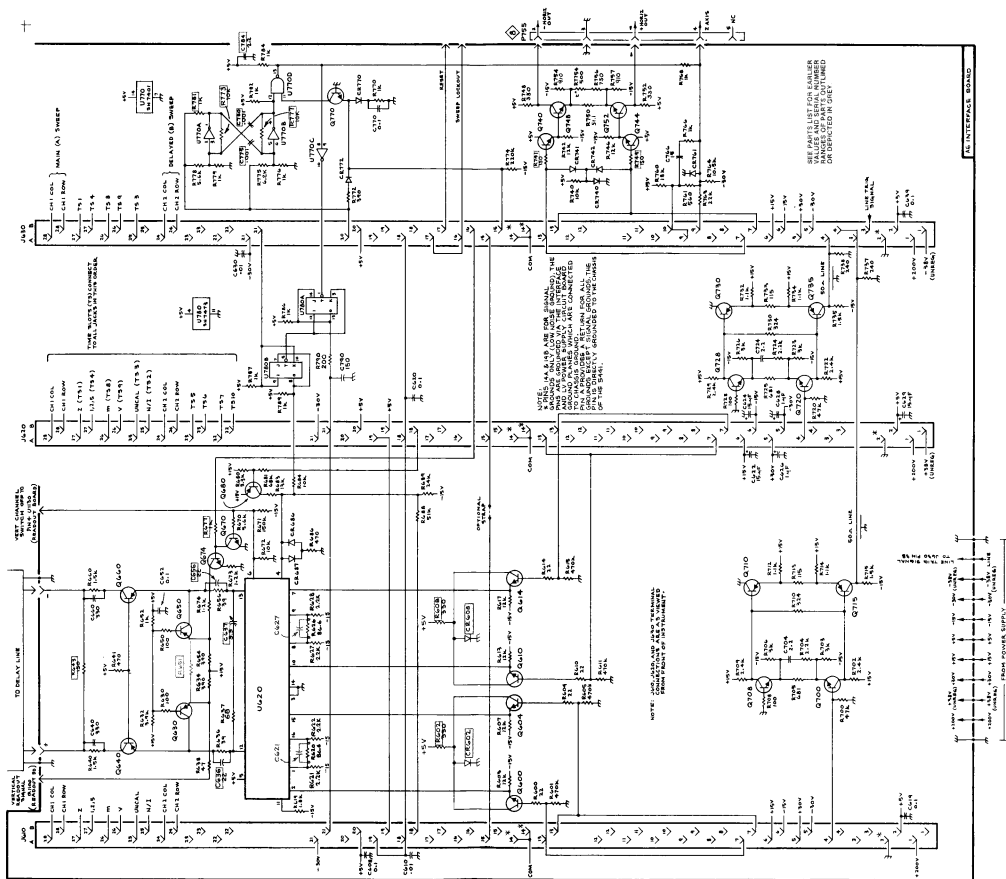


Fig. 8-7. Main interface board assembly A-6.

D-4	C660	C659	C658	C657	C656
D-4	C655	C654	C653	C652	C651
D-4	C650	C649	C648	C647	C646
D-4	C645	C644	C643	C642	C641
D-4	C640	C639	C638	C637	C636
D-4	C635	C634	C633	C632	C631
D-4	C630	C629	C628	C627	C626
D-4	C625	C624	C623	C622	C621
D-4	C620	C619	C618	C617	C616
D-4	C615	C614	C613	C612	C611
D-4	C610	C609	C608	C607	C606
D-4	C605	C604	C603	C602	C601
D-4	C600	C599	C598	C597	C596
D-4	C595	C594	C593	C592	C591
D-4	C590	C589	C588	C587	C586
D-4	C585	C584	C583	C582	C581
D-4	C580	C579	C578	C577	C576
D-4	C575	C574	C573	C572	C571
D-4	C570	C569	C568	C567	C566
D-4	C565	C564	C563	C562	C561
D-4	C560	C559	C558	C557	C556
D-4	C555	C554	C553	C552	C551
D-4	C550	C549	C548	C547	C546
D-4	C545	C544	C543	C542	C541
D-4	C540	C539	C538	C537	C536
D-4	C535	C534	C533	C532	C531
D-4	C530	C529	C528	C527	C526
D-4	C525	C524	C523	C522	C521
D-4	C520	C519	C518	C517	C516
D-4	C515	C514	C513	C512	C511
D-4	C510	C509	C508	C507	C506
D-4	C505	C504	C503	C502	C501
D-4	C500	C499	C498	C497	C496
D-4	C495	C494	C493	C492	C491
D-4	C490	C489	C488	C487	C486
D-4	C485	C484	C483	C482	C481
D-4	C480	C479	C478	C477	C476
D-4	C475	C474	C473	C472	C471
D-4	C470	C469	C468	C467	C466
D-4	C465	C464	C463	C462	C461
D-4	C460	C459	C458	C457	C456
D-4	C455	C454	C453	C452	C451
D-4	C450	C449	C448	C447	C446
D-4	C445	C444	C443	C442	C441
D-4	C440	C439	C438	C437	C436
D-4	C435	C434	C433	C432	C431
D-4	C430	C429	C428	C427	C426
D-4	C425	C424	C423	C422	C421
D-4	C420	C419	C418	C417	C416
D-4	C415	C414	C413	C412	C411
D-4	C410	C409	C408	C407	C406
D-4	C405	C404	C403	C402	C401
D-4	C400	C399	C398	C397	C396
D-4	C395	C394	C393	C392	C391
D-4	C390	C389	C388	C387	C386
D-4	C385	C384	C383	C382	C381
D-4	C380	C379	C378	C377	C376
D-4	C375	C374	C373	C372	C371
D-4	C370	C369	C368	C367	C366
D-4	C365	C364	C363	C362	C361
D-4	C360	C359	C358	C357	C356
D-4	C355	C354	C353	C352	C351
D-4	C350	C349	C348	C347	C346
D-4	C345	C344	C343	C342	C341
D-4	C340	C339	C338	C337	C336
D-4	C335	C334	C333	C332	C331
D-4	C330	C329	C328	C327	C326
D-4	C325	C324	C323	C322	C321
D-4	C320	C319	C318	C317	C316
D-4	C315	C314	C313	C312	C311
D-4	C310	C309	C308	C307	C306
D-4	C305	C304	C303	C302	C301
D-4	C300	C299	C298	C297	C296
D-4	C295	C294	C293	C292	C291
D-4	C290	C289	C288	C287	C286
D-4	C285	C284	C283	C282	C281
D-4	C280	C279	C278	C277	C276
D-4	C275	C274	C273	C272	C271
D-4	C270	C269	C268	C267	C266
D-4	C265	C264	C263	C262	C261
D-4	C260	C259	C258	C257	C256
D-4	C255	C254	C253	C252	C251
D-4	C250	C249	C248	C247	C246
D-4	C245	C244	C243	C242	C241
D-4	C240	C239	C238	C237	C236
D-4	C235	C234	C233	C232	C231
D-4	C230	C229	C228	C227	C226
D-4	C225	C224	C223	C222	C221
D-4	C220	C219	C218	C217	C216
D-4	C215	C214	C213	C212	C211
D-4	C210	C209	C208	C207	C206
D-4	C205	C204	C203	C202	C201
D-4	C200	C199	C198	C197	C196
D-4	C195	C194	C193	C192	C191
D-4	C190	C189	C188	C187	C186
D-4	C185	C184	C183	C182	C181
D-4	C180	C179	C178	C177	C176
D-4	C175	C174	C173	C172	C171
D-4	C170	C169	C168	C167	C166
D-4	C165	C164	C163	C162	C161
D-4	C160	C159	C158	C157	C156
D-4	C155	C154	C153	C152	C151
D-4	C150	C149	C148	C147	C146
D-4	C145	C144	C143	C142	C141
D-4	C140	C139	C138	C137	C136
D-4	C135	C134	C133	C132	C131
D-4	C130	C129	C128	C127	C126
D-4	C125	C124	C123	C122	C121
D-4	C120	C119	C118	C117	C116
D-4	C115	C114	C113	C112	C111
D-4	C110	C109	C108	C107	C106
D-4	C105	C104	C103	C102	C101
D-4	C100	C99	C98	C97	C96
D-4	C95	C94	C93	C92	C91
D-4	C90	C89	C88	C87	C86
D-4	C85	C84	C83	C82	C81
D-4	C80	C79	C78	C77	C76
D-4	C75	C74	C73	C72	C71
D-4	C70	C69	C68	C67	C66
D-4	C65	C64	C63	C62	C61
D-4	C60	C59	C58	C57	C56
D-4	C55	C54	C53	C52	C51
D-4	C50	C49	C48	C47	C46
D-4	C45	C44	C43	C42	C41
D-4	C40	C39	C38	C37	C36
D-4	C35	C34	C33	C32	C31
D-4	C30	C29	C28	C27	C26
D-4	C25	C24	C23	C22	C21
D-4	C20	C19	C18	C17	C16
D-4	C15	C14	C13	C12	C11
D-4	C10	C9	C8	C7	C6
D-4	C5	C4	C3	C2	C1

*See Parts List for serial number ranges.



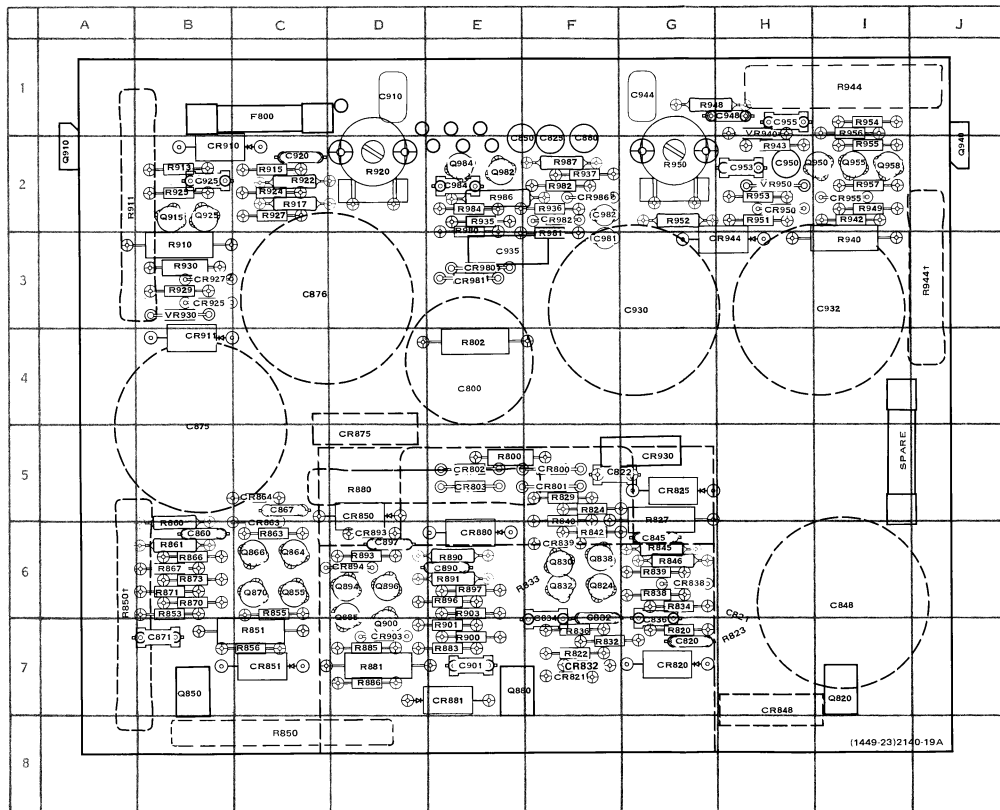


Fig. 8-8. Low Voltage and Calibrator circuit board assembly A-7.

†Earlier version.

*See Parts List for
serial number ranges.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C800	E-4	C981	F-3	C800	F-5	C982	F-2
C820	G-7	C982	F-2	C801	F-5	C986	F-2
C821*	H-7	C984	E-2	C802	E-5		
C822*	F-5			C803	E-5	F800	C-1
C825	F-2			C820	G-7		
C832*	F-6			CR821	F-7		
CR34	F-6			CR825	G-5		
CR36	F-6			CR832	F-7		
CR45	G-6			CR838	G-6		
CR48	I-6			CR839	F-6		
CR50	F-2			CR848	H-7		
CR60	B-6			CR850	D-5		
CR67	C-5			CR851	C-7		
CR71	B-7			CR863	C-5		
CR75	B-4			CR864	C-5		
CR76	C-3			CR875	D-4		
CR80	F-2			CR880	E-6		
CR90	E-6			CR881	E-7		
CR97	D-6			CR893	D-6		
C901	E-7			CR903	D-7		
C910	D-1			CR910	B-2		
C920	C-2			CR911	B-4		
C925	B-2			CR925	B-3		
C930	G-3			CR927	C-2		
C932	I-3			CR930	G-5		
C935	E-3			CR944	H-3		
C944	G-1			CR950	H-2		
C948	H-1			CR955	I-2		
C950	H-2			CR980	E-3		
C955	H-1			CR981	E-3		

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
Q820	I-7	R800	E-5	R883	E-7	R944*	I-1
Q824	F-6	R802	E-4	R885	D-7	R948	G-1
Q830	F-6	R820	G-7	R886	D-7	R949	I-2
Q832	F-6	R822	F-7	R890	E-7	R950	G-2
Q838	F-6	R823*	H-7	R891	E-6	R951	H-2
Q850	B-7	R824	F-5	R893	D-6	R952	G-2
Q855	C-6	R827	G-5	R894	D-6	R953	H-2
Q864	C-6	R832	F-6	R896	E-6	R954	I-1
Q866	C-6	R837	F-7	R897	E-6	R955	I-2
Q870	C-6	R833*	F-6	R900	E-7	R956	I-1
Q880	E-7	R834	G-6	R901	E-7	R957	I-2
Q885	F-7	R836	F-7	R902	C-2	R980	E-2
Q884	D-6	R838	G-6	R910	B-3	R981	F-2
Q896	D-6	R839	G-6	R911	B-2	R982	F-2
Q900	D-6	R840	F-5	R913	B-2	R984	E-2
Q910	A-2	R842	F-6	R915	C-2	R986	E-2
Q915	B-2	R845	G-6	R917	C-2	R987	F-2
Q925	B-2	R846	G-6	R920	D-2		
Q940	J-2	R850*	B-5	R922	C-2		
Q950	I-2	R851	F-7	R924	C-2	VR930	B-3
Q955	I-2	R853	B-6	R925	B-2	VR940	H-1
Q958	I-2	R855	C-6	R927	C-2		
Q982	E-2	R856	C-7	R929	B-3		
Q984	E-2	R861	B-6	R930	B-3		
		R863	C-6	R935	E-2		
		R866	B-6	R936	F-2		
		R867	B-6	R937	F-2		
		R870	B-6	R940	I-3		
		R871	B-6	R942	I-2		
		R873	B-6	R943	H-2		
		R880	D-5				
		R881	D-7				

[illegible]



 0609

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

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000BK	STAUFFER SUPPLY	105 SE TAYLOR	PORTLAND, OR 97214
00779	AMP, INC.	P.O. BOX 3608	HARRISBURG, PA 17105
05820	WAKEFIELD ENGINEERING, INC.	AUDUBON ROAD	WAKEFIELD, MA 01880
06383	PANDUIT CORPORATION	17301 RIDGELAND	TINLEY PARK, IL 60477
06666	GENERAL DEVICES CO., INC.	525 S. WEBSTER AVE.	INDIANAPOLIS, IN 46219
07416	NELSON NAME PLATE CO.	3191 CASITAS	LOS ANGELES, CA 90039
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
09922	BURNDY CORPORATION	RICHARDS AVENUE	NORWALK, CT 06852
12136	PHILADELPHIA HANDLE COMPANY, INC.	1643 HADDON AVENUE	CAMDEN, NJ 08103
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
16428	BELDEN CORP.	P. O. BOX 1331	RICHMOND, IN 47374
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
23880	STANFORD APPLIED ENGINEERING, INC.	340 MARTIN AVE.	SANTA CLARA, CA 95050
28520	HEYMAN MFG. CO.	147 N. MICHIGAN AVE.	KENILWORTH, NJ 07033
31514	STANFORD APPLIED ENGINEERING, INC.		
	ADVANCED PACKAGING DIV.	3080 AIRWAY DRIVE	COSTA MESA, CA 92626
55285	BERGQUIST CO. INC.	5300 EDINA INDUSTRIAL BLVD	MINNEAPOLIS, MN 55435
70485	ATLANTIC INDIA RUBBER WORKS, INC.	571 W. POLK ST.	CHICAGO, IL 60607
71159	BRISTOL SOCKET SCREW, DIV. OF		
	AMERICAN CHAIN AND CABLE CO., INC.	P O BOX 2244, 40 BRISTOL ST.	WATERBURY, CT 06720
71590	CENTRALAB ELECTRONICS, DIV. OF		
	GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
71785	TRW, CINCH CONNECTORS	1501 MORSE AVENUE	ELK GROVE VILLAGE, IL 60007
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
74921	ITEN FIBRE CO.,	4001 BENEFIT AVE., P O BOX 9	ASHTABULA, OH 44004
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
76854	OAK INDUSTRIES, INC., SWITCH DIV.	S. MAIN ST.	CRYSTAL LAKE, IL 60014
77250	PHEOLL MANUFACTURING CO., DIVISION		
	OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
77900	SHAKEPROOF		
	DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN, IL 60120
78189	ILLINOIS TOOL WORKS, INC.		
	SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
83903	ACCURATE DIE AND STAMPING DIV., ALLIED		
	PRODUCTS CORP.	1947 N. MAUD AVE.	CHICAGO, IL 60614
85480	MICRODOT MFG. INC., CENTRAL SCREW DIV.	31275 N. WESTERN HIGHWAY	FARMINGTON HILLS, MI 48024
86445	PENN FIBRE AND SPECIALTY CO., INC.	2032 E. WESTMORELAND ST.	PHILADELPHIA, PA 19134
86928	SEASTROM MFG. COMPANY, INC.	701 SONORA AVENUE	GLENDALE, CA 91201
93907	TEXTRON INC. CAMCAR DIV	600 18TH AVE	ROCKFORD, IL 61101
95987	WECKESSER CO., INC.	4444 WEST IRVING PARK RD.	CHICAGO, IL 60641
98278	MALCO A MICRODOT COMPANY, INC.		
	CONNECTOR AND CABLE DIVISION	220 PASADENA AVE.	SOUTH PASADENA, CA 91030
T0435	LEWIS SCREW CO.	4114 SOUTH PERORIA AVE.	CHICAGO, IL 60609

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	200-1661-00		1		RTNR,CRT SCALE: ***** (ATTACHING PARTS) *****	80009	200-1661-00
-2	211-0188-00		2		SCREW,MACHINE:4-40 X 0.30 INCH,SST ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-3	337-1674-01		1		SHLD,IMPLOSION: CLEAR	80009	337-1674-01
-4	386-2340-00		4		SUPPORT,CRT: FRONT	80009	386-2340-00
-5	386-2899-00		1		SUPPORT,CRT: FRONT	80009	386-2899-00
-6	366-1391-02		3		KNOB:GY,0.081 ID,0.28 OD,0.32 L	80009	366-1391-02
	213-0075-00		3		.SETSCREW:4-40 X 0.094,STL BK OXD,HEX	000BK	ORD BY DESCR
-7	366-1077-00		3		KNOB: GRAY	80009	366-1077-00
	213-0246-00		3		.SETSCREW:5-40 X 0.093 ITL BK OXD,HEX	71159	ORD BY DESCR
-8	384-1161-00		1		EXTENSION SHAFT:	80009	384-1161-00
-9	358-0216-00		1		BUSHING,PLASTIC:0.257 ID X 0.412 INCH OD	80009	358-0216-00
-10	119-0238-00	B010100	1	B020839	COIL,CAL:	80009	119-0238-00
	119-0373-00	B020840	1		COIL,CAL: ***** (ATTACHING PARTS) *****	80009	119-0373-00
-11	210-0593-00		2		NUT,FINISHING:0.25 HEX X 0.312" LONG,BRS	80009	210-0593-00
-12	210-0442-00		2		NUT,PLAIN,HEX.:3-48 X 0.187 INCH,CD PL BRS	73743	3014-402
-13	210-0004-00		2		WASHER,LOCK:#4 INTL,0.015 THK,STL CD PL	77900	1204-00-000541C
-14	210-0994-00		2		WASHER,FLAT:0.125 ID X 0.25" OD,STL	86928	5702-201-20
-15	210-0935-00		2		WASHER,NONMETAL:FIBER,0.14 ID X 0.375" OD ***** (END ATTACHING PARTS) *****	74921	ORD BY DESCR
-16	361-0059-01		1		INSULATOR,PLATE:1.093 X 0.343 X 0.125 INC	80009	361-0059-01
-17	426-0681-00		1		FR,PUSH BUTTON:	80009	426-0681-00
-18	333-1779-00	B010100	1	B019999	PANEL,FRONT:	80009	333-1779-00
	333-1779-02	B020000	1	B059999	PANEL,FRONT:	80009	333-1779-02
	333-1779-03	B060000	1		PANEL,FRONT:	80009	333-1779-03
-19	214-2112-00	B010100	1	B010107	SPRING REFL MT:	80009	214-2112-00
-20	378-0732-00		1		DIFFUSER,LIGHT:	80009	378-0732-00
-21	-----		1		CKT BOARD ASSY:GRAT LAMPS(SEE A5 REPL) ***** (ATTACHING PARTS) *****		
-22	211-0062-00		2		SCREW,MACHINE:2-56 X 0.312,PNH,STL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
	-----		-		CKT BOARD ASSY INCLUDES:		
-23	361-0158-00		2		.SPACER,SLEEVE:0.093 L X 0.116 ID BRS CD	76854	3-5115-105
-24	131-0704-00		3		.CONTACT,ELEC:SCALE LIGHTS,CU BE	80009	131-0704-00
-25	210-0759-00		3		.EYELET,METALLIC:0.61 OD X 0.192 INCH L,BR	71590	30818-11
-26	210-0957-00		3		.WASHER,FLAT:0.0625 ID X 0.125" OD,STL	83903	ORD BY DESCR
-27	-----		1		SWITCH,PUSH:(SEE S335 REPL)		
-28	386-2876-00		1		SUPPORT,CRT: CENTER	80009	386-2876-00
-29	-----		1		COIL,TUBE DEFLE:(SEE L375 REPL)		
-30	334-1379-00		1		MARKER,IDENT: MARKED HI VACUUM	80009	334-1379-00
-31	334-2273-00		1		MARKER,IDENT: MKD DANGER HIGH VOLTAGE	80009	334-2273-00
-32	348-0253-00		1		GROMMET,PLASTIC: BLACK,OBLONG,3.0 X 0.925	80009	348-0253-00
-33	348-0064-00	B010100	1	B061718	GROMMET,PLASTIC: GRAY,ROUND,0.582 ID	80009	348-0064-00
	348-0518-00	B061719	1		GROMMET,PLASTIC: BLACK,ROUND,0.5 ID	28520	2073SB-625-8BLK
-34	337-2081-00		1		SHIELD,CRT: FRONT	80009	337-2081-00
-35	343-0015-00	B010100	1	B020924	CLAMP,MTG STRAP:	80009	343-0015-00
	343-0006-00	B020925	1		CLAMP,LOOP:0.50 INCH DIAMETER,PLSTC ***** (ATTACHING PARTS) *****	95987	1-2-6B
-36	211-0507-00		1		SCREW,MACHINE:6-32 X 0.312,PNH STL,CD PL	83385	ORD BY DESCR
-37	210-0803-00		1		WASHER,FLAT:0.15 ID X 0.032 THK,STL CD ***** (END ATTACHING PARTS) *****	12327	ORD BY DESCR
-38	441-1244-00		1		CHASSIS,SCOPE: . ***** (ATTACHING PARTS) *****	80009	441-1244-00
-39	211-0008-00		1		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ	83385	ORD BY DESCR
-40	210-0586-00		3		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL ***** (END ATTACHING PARTS) *****	T0435	ORD BY DESCR
-41	348-0145-00		1		GROMMET,PLASTIC:U-SHP,1.0 X 0.42 INCH	80009	348-0145-00
-42	-----	B020000	1		COIL,TUBE DEFLE:(SEE L365 REPL)		
-43	343-0217-00		1		CLAMP,COIL:Y-AXIS ***** (ATTACHING PARTS) *****	80009	343-0217-00
-44	211-0147-00		2		SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR

Replaceable Mechanical Parts—5441/R5441

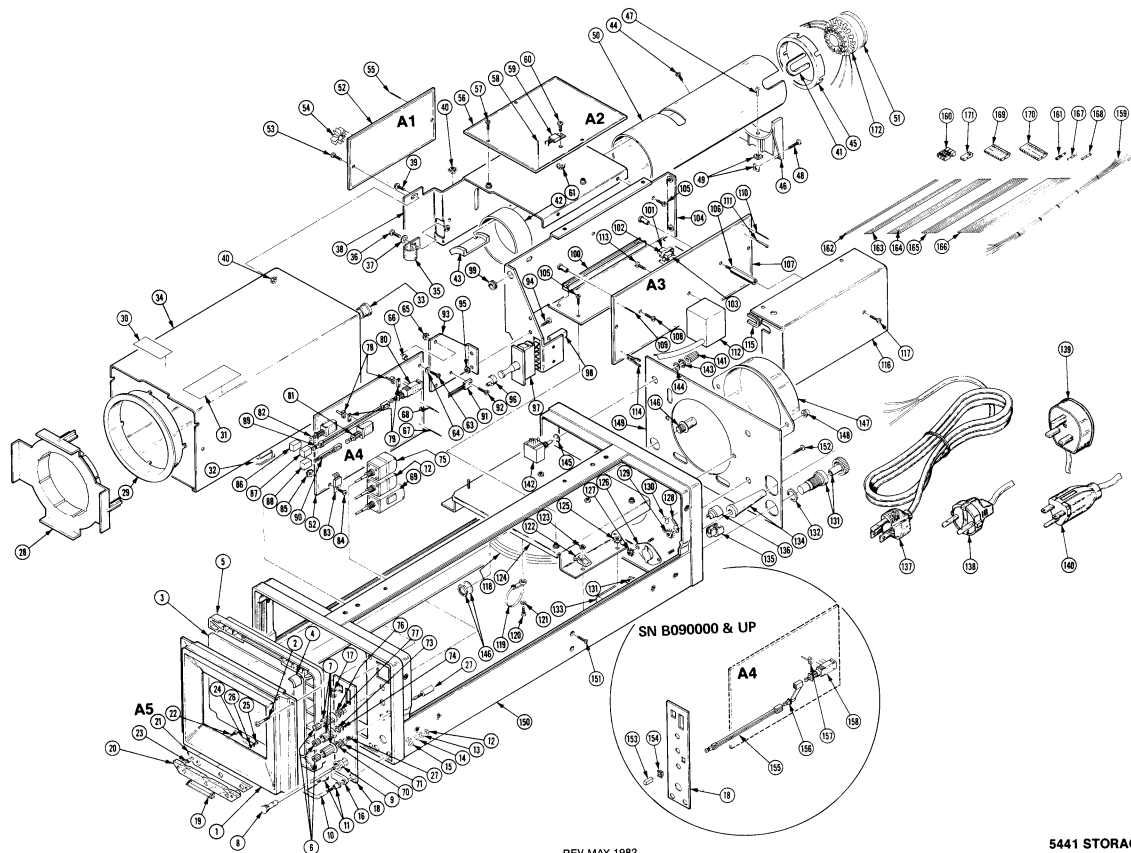
Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-45	386-2246-00			1		SUPPORT,CRT:REAR	80009	386-2246-00
-46	407-1128-00			1		BRKT,CRT SHIELD:REAR,NYLON ***** (ATTACHING PARTS) *****	80009	407-1128-00
-47	211-0590-00			1		SCREW,MACHINE:6-32 X 0.250,PNH,BRS,CD PL	83385	ORD BY DESCR
-48	211-0507-00			2		SCREW,MACHINE:6-32 X 0.312,PNH STL,CD PL	83385	ORD BY DESCR
-49	220-0419-00			3		NUT,PLAIN,SQ:6-32 X 0.312 INCH,STL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-50	337-1986-00			1		SHLD,ELECTRN TUB:REAR	80009	337-1986-00
-51	200-0616-01			1		COV,ELECTRON TU:	80009	200-0616-01
-52	-----			1		CKT BOARD ASSY:VERTICAL(SEE A1 REPL) ***** (ATTACHING PARTS) *****		
-53	211-0008-00			2		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-54	214-1291-00			2		CKT BOARD ASSY INCLUDES: .HEAT SINK,ELEC:XSTR,0.72 OD X 0.375"H	05820	207SB
-55	131-0608-00			5		.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
-56	-----			1		CKT BOARD ASSY:HORIZONTAL(SEE A2 REPL) ***** (ATTACHING PARTS) *****		
-57	211-0008-00			3		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-58	131-0608-00	BC /0100	B089999	17		CKT BOARD ASSY INCLUDES: .TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
	131-0608-00	B090000		18		.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
	136-0252-07	B010100	B094589	6		.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-59	-----			1		.TRANSISTOR:(SEE Q255 REPL) ***** (ATTACHING PARTS) *****		
-60	211-0504-00	B094590		1		.SCREW,MACHINE:6-32 X 0.250,PNH STL,CD PL	83385	ORD BY DESCR
-61	210-0457-00	B094590		1		.NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-62	-----			1		CKT BOARD ASSY:STORAGE(SEE A4 REPL) ***** (ATTACHING PARTS) *****		
-63	211-0012-00			2		SCREW,MACHINE:4-40 X 0.375,PNH STL CD PL	83385	ORD BY DESCR
-64	210-0994-00			2		WASHER,FLAT:0.125 ID X 0.25" OD,STL	86928	5702-201-20
-65	210-0586-00			4		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	T0435	ORD BY DESCR
-66	361-0122-00			2		SPACER,SLEEVE:0.125 L X 0.12 ID BRS ***** (END ATTACHING PARTS) *****	80009	361-0122-00
-67	131-0589-00	B090000	B094806	1		CKT BOARD ASSY INCLUDES: .TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
	131-0589-00	B094807		2		.TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-68	131-0608-00	B010100	B089999	22		.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
	131-0608-00	B090000		21		.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
-69	-----			1		.RES.,VAR:(SEE R700 REPL) ***** (ATTACHING PARTS) *****		
-70	210-0583-00			1		.NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-71	210-0940-00			1		.WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL ***** (END ATTACHING PARTS) *****	79807	ORD BY DESCR
-72	-----			1		.RES.,VAR:(SEE R332 REPL) ***** (ATTACHING PARTS) *****		
-73	210-0583-00			1		.NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-74	210-0940-00			1		.WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL ***** (END ATTACHING PARTS) *****	79807	ORD BY DESCR
-75	-----			1		.RES.,VAR:(SEE R585 REPL) ***** (ATTACHING PARTS) *****		
-76	210-0583-00			1		.NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-77	210-0940-00			1		.WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL ***** (END ATTACHING PARTS) *****	79807	ORD BY DESCR
-78	361-0383-00			6		.SPACER,PB SW:CHARCOAL,0.33 INCH LONG	80009	361-0383-00
-79	361-0542-00			6		.SPACER,PUSH SW:0.078 L,POLYPROPYLENE	71590	J-64281
-80	-----			1		.SWITCH,PUSH:(SEE S500 REPL)		
-81	-----			1		.SWITCH,PUSH:(SEE S675 REPL)		
-82	-----			1		.SWITCH,PUSH:(SEE S610 REPL)		
-83	-----			1		.TRANSISTOR:(SEE Q705 REPL) ***** (ATTACHING PARTS) *****		
-84	211-0507-00			1		.SCREW,MACHINE:6-32 X 0.312,PNH STL,CD PL	83385	ORD BY DESCR
-85	210-0457-00			1		.NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-86	366-1489-71		1		PUSH BUTTON:SIL GY,STORE	80009	366-1489-71
-87	366-1257-46		1		PUSH BUTTON:SIL GRAY,ERASE	80009	366-1257-46
-88	366-1489-70		1		PUSH BUTTON:SAVE	80009	366-1489-70
-89	384-1101-00		1		EXTENSION SHAFT:4.14 INCH LONG	80009	384-1101-00
-90	384-1099-00		1		EXTENSION SHAFT:PUSH BUTTON,1.54 INCH LONG	80009	384-1099-00
-91	-----		1		TRANSISTOR:(SEE Q690 REPL) ***** (ATTACHING PARTS) *****		
-92	211-0008-00		1		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
	342-0355-00	B094623	1		INSULATOR,PLATE:TRANSISTOR,SILICONE RUBBER	55285	7403-09FR-51
-93	407-1348-00		1		BRACKET,ANGLE: ***** (ATTACHING PARTS) *****	80009	407-1348-00
-94	211-0008-00		2		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ	83385	ORD BY DESCR
-95	210-0586-00		2		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL ***** (END ATTACHING PARTS) *****	T0435	ORD BY DESCR
-96	376-0127-00		1		COUPLER,SHAFT:PLASTIC	80009	376-0127-00
-97	-----		1		SWITCH,PUSH-PULL:(SEE S302 REPL)		
-98	200-1075-00		1		COVER,TERM:QUICK DISCONNECT	00779	1-480435-0
-99	348-0003-00	B010100	1	B089999	GROMMET,RUBBER:0.312 INCH DIAMETER	70485	1411B6040
-100	351-0087-00		1		GUIDE,CKT BOARD:4.75 INCH LONG,PLASTIC	80009	351-0087-00
-101	-----		1		TRANSISTOR:(SEE Q410 REPL) ***** (ATTACHING PARTS) *****		
-102	344-0236-00		1		CLIP,SPR TNSN: ***** (END ATTACHING PARTS) *****	80009	344-0236-00
-103	342-0082-00		1		INSULATOR,PLATE:0.52 SQ X 0.015 INCH THK,A	80009	342-0082-00
-104	441-1177-00		1		CHASSIS,SCOPE:HIGH VOLTAGE ***** (ATTACHING PARTS) *****	80009	441-1177-00
-105	211-0008-00		6		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-106	129-0467-00		1		SPACER,POST:	80009	129-0467-00
-107	-----		1		CKT BOARD ASSY:HIGH VOLTAGE(SEE A3 REPL) ***** (ATTACHING PARTS) *****		
-108	211-0008-00		1		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-109	131-0608-00	B010100	35	B089999	.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
	131-0608-00	B090000	38		.TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
-110	131-0589-00		2		.TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-111	214-0579-00		1		.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-112	-----		1		.SEMICON DVC,DI:(SEE U410 REPL) ***** (ATTACHING PARTS) *****		
-113	211-0008-00		2		.SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-114	344-0154-00		2		.CLIP,ELECTRICAL:FUSE,CKT BD MT	80009	344-0154-00
-115	348-0239-00		1		GROMMET,PLASTIC:DK GRAY,U-SHAPE,0.27 ID	80009	348-0239-00
-116	337-1864-00		3		SHIELD,ELEC:HIGH VOLTAGE ***** (ATTACHING PARTS) *****	80009	337-1864-00
-117	211-0008-00		3		SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-118	-----		1		DELAY LINE:(SEE DL100 REPL)		
-119	346-0121-00		3		STRAP,ELEC COMP:TIE DOWN,5.0 LONG ***** (ATTACHING PARTS) *****	06383	PLC1.5I-S8
-120	211-0012-00		3		SCREW,MACHINE:4-40 X 0.375,PNH STL CD PL	83385	ORD BY DESCR
-121	210-0994-00		3		WASHER,FLAT:0.125 ID X 0.25" OD,STL ***** (END ATTACHING PARTS) *****	86928	5702-201-20
-122	343-0081-00		1		STRAP,RETAINING: ***** (ATTACHING PARTS) *****	85480	CPNY-1728K
-123	210-0407-00		1		NUT,PLAIN,HEX:6-32 X 0.25 INCH,BRS ***** (END ATTACHING PARTS) *****	73743	3038-0228-402
-124	380-0342-00		1		HOUSING,DEL LINE: ***** (ATTACHING PARTS) *****	80009	380-0342-00
-125	210-0457-00		3		NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR

Replaceable Mechanical Parts—5441/R5441

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-126	-----		1		SWITCH,THERM:(SEE S300 REPL) ***** (ATTACHING PARTS) *****		
-127	210-0586-00		2		NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL ***** (END ATTACHING PARTS) *****	T0435	ORD BY DESCR
-128	210-0201-00	B010100	B062242	1	TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL	86928	A373-157-2
	210-0202-00	B062243		1	TERMINAL,LUG:0.146 ID,LOCKING,BRZ,TIN PL ***** (ATTACHING PARTS) *****	78189	2104-06-00-2520N
-129	210-0586-00	B010100	B062242	1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	T0435	ORD BY DESCR
	210-0457-00	B062243		1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-130	334-3379-01			1	MARKER,IDENT:MARKED GROUND SYMBOL	80009	334-3379-01
-131	352-0076-00	B010100	B062224	1	FUSEHOLDER:W/HARDWARE	75915	342012-L
	352-0362-00	B062225		1	FUSEHOLDER:W/MOUNTING HARDWARE ***** (ATTACHING PARTS) *****	75915	345603
-132	210-0873-00			1	WASHER,NONMETAL:0.5 ID X 0.688 INCH OD,NPR ***** (END ATTACHING PARTS) *****	70485	ORD BY DESCR
-133	200-0237-01	B010100	B062224	1	COVER,FUSE HLDR:BLACK PLASTIC	80009	200-0237-01
	200-1388-01	B062225	B093294	1	COVER,FUSE:	80009	200-1388-01
	200-1388-03	B093295		1	COVER,FUSE,LEAD:POLYURETHANE	80009	200-1388-03
-134	200-1646-00	B010100	B093454	1	CABLE NIP,PWR:1.500 X 0.625 ID W/FLANGE	80009	200-1646-00
	200-1004-00	B093455		1	CABLE,NIP,ELEC:0.265 ID X 0.38"OD W/FLG	80009	200-1004-00
-135	358-0516-00	B010100	B093454	1	BSHG,STRAIN RLF:BOTTOM	80009	358-0516-00
	358-0366-00	B093455		1	BSHG,STRAIN RLF:	80009	358-0366-00
-136	358-0515-00	B010100	B093454	1	BSHG,STRAIN RLF:TOP	80009	358-0515-00
	358-0365-00	B093455		1	BSHG,STRAIN RLF:	80009	358-0365-00
-137	161-0033-12			1	CABLE ASSY,PWR:3,18 AWG,125V,96.0 L	16428	ORD BY DESCR
-138	161-0033-47			1	CABLE ASSY,PWR:3,0.75MM SQ,220V,98.0 L (OPTION A1 EUROPEAN)	80009	161-0033-47
-139	161-0033-45			1	CABLE ASSY,PWR:3,0.75MM SQ,240V,98.0 L (OPTION A2 UNITED KINGDOM)	80009	161-0033-45
-140	161-0033-48			1	CABLE ASSY,PWR:3,18 AWG,240V,98.0 L (OPTION A4 NORTH AMERICAN)	80009	161-0033-48
-141	366-1023-01	B061639		1	KNOB:GY,0.127 ID X 0.392 OD X 0.	80009	366-1023-01
	213-0246-00	B061639		1	.SETSCREW:5-40 X 0.093 ITL BK OXD,HEX	71159	ORD BY DESCR
-142	-----	B020000		1	RES.,VAR:(SEE R375 REPL) ***** (ATTACHING PARTS) *****		
-143	210-0583-00	B020000		1	NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-144	210-0940-00	B020000		1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	ORD BY DESCR
-145	210-0046-00	B020000		1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS ***** (END ATTACHING PARTS) *****	77900	1214-05-00-0541C
-146	131-0955-00			1	CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
-147	200-1204-01			1	COVER,CRT:REAR ALUMINUM,PTD BLUE ***** (ATTACHING PARTS) *****	80009	200-1204-01
-148	210-0401-00			2	NUT,PLAIN,HEX:6-32 X 0.312 INCH,BRS CD PL ***** (END ATTACHING PARTS) *****	73743	93262-02
-149	333-1827-00	B010100	B019999	1	PANEL,REAR:	80009	333-1827-00
	333-1827-02	B020000	B092909	1	PANEL,REAR:	80009	333-1827-02
	333-1827-03	B092910		1	PANEL,REAR:	80009	333-1827-03
-150	426-1126-00	B010100	B062242	1	FR ASSY,DSPL UN:	80009	426-1126-00
	426-1126-01	B062243	B089999	1	FR ASSY,DSPL UN:	80009	426-1126-01
	426-1126-02	B090000		1	FR ASSY,DSPL UN: ***** (ATTACHING PARTS) *****	80009	426-1126-02
-151	211-0101-00			2	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL	83385	ORD BY DESCR
-152	211-0008-00			2	SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-153	366-1559-00	B090000		1	PUSH BUTTON:SIL GY,0.18 SQ X 0.43	80009	366-1559-00
-154	426-1072-00	B090000		1	FRAME,PUSH BTN:PLASTIC	80009	426-1072-00
-155	384-1061-00	B090000		1	EXTENSION SHAFT:4.357L INCH LONG	80009	384-1061-00
-156	384-1354-00	B090000		1	EXTENSION SHAFT:1.585 INCH LONG,OFFSET,NYL	80009	384-1354-00
-157	361-0383-00	B090000		1	SPACER,PB SW:CHARCOAL,0.33 INCH LONG	80009	361-0383-00
-158	-----			1	SWITCH,PUSH:(SEE S335 REPL)		
-159	179-1969-00	B010100	B094811	1	WIRING HARNESS:MAIN	80009	179-1969-00
	179-1969-01	B094812		1	WIRING HARNESS:MAIN	80009	179-1969-01
-160	352-0199-00	B094811		1	.CONN BODY,PL,EL:3 WIRE BLACK	80009	352-0199-00

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-	198-1688-00		1		.WIRE SET,ELEC:	80009	198-1688-00
-161	131-0621-00		2		.CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOL	22526	46231-000
	131-2065-00		3		.TERM, QIK DISC:18-22 AWG,BRASS TIN PLATED	00779	2-520181-2
	198-2240-00	B010100	1		WIRE SET,ELEC:	80009	198-2240-00
	198-2240-01	B090000	1		WIRE SET,ELEC:	80009	198-2240-01
	198-2240-02	B094807	1		WIRE SET,ELEC:	80009	198-2240-02
	131-1538-00	B010100	4		.CONTACT,ELEC:CRIMP-ON,22-26 AWG WIRE	22526	75369-002
	131-1963-00	B061784	4		.TERM, QIK DISC.:FOR 0.038 DIA CRT PIN	00779	42428-9
-162	175-0825-00	B090000	FT		.WIRE,ELECTRICAL:2 WIRE RIBBON	80009	175-0825-00
-163	175-0826-00		FT		.WIRE,ELECTRICAL:3 WIRE RIBBON	80009	175-0826-00
-164	175-0828-00		FT		.WIRE,ELECTRICAL:5 WIRE RIBBON	08261	111-2699-955
-165	175-0832-00		FT		.WIRE,ELECTRICAL:2 WIRE RIBBON	08261	111-2699-956
	175-0833-00		FT		.WIRE,ELECTRICAL:10 WIRE RIBBON	08261	111-2699-970
-166	175-0855-00		FT		.WIRE,ELECTRICAL:10 WIRE RIBBON	08261	SS-1022(1061)OC
	175-0860-00		FT		.WIRE,ELECTRICAL:5 WIRE RIBBON	08261	SS-0522-7(1061)
	175-0863-00		FT		.WIRE,ELECTRICAL:9 WIRE RIBBON	08261	SS-0222-7(1061)
-167	131-0371-00		2		.CONTACT,ELEC:FOR NO.26 AWG WIRE	98278	122-0182-019
-168	131-0707-00		67		.CONTACT,ELEC:22-26 AWG,BRS & CU BE GOLD	22526	47439-000
	131-1810-00	B090000	1		.CONTACT,ELEC:FEMALE,FOR 0.025 SQ PIN	00779	87124-1
	131-0621-00		20		.CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD	22526	46231-000
	204-0675-00	B090000	1		.CONN BODY,PLUG:1 FEMALE CONTACT	00779	87175-2
	352-0161-00		1		.HLDR,TERM CONN:3 WIRE,BLACK	80009	352-0161-00
	352-0163-00		1		.HLDR,TERM CONN:5 WIRE,BLACK	80009	352-0163-00
	352-0163-04		1		.HLDR,TERM CONN:5 WIRE,YELLOW	80009	352-0163-04
	352-0163-05		1		.HLDR,TERM CONN:5 WIRE,GREEN	80009	352-0163-05
-169	352-0167-00	B010100	2		.HLDR,TERM CONN:9 WIRE,BLACK	80009	352-0167-00
	352-0167-04		1		.HLDR,TERM CONN:9 WIRE,YELLOW	80009	352-0167-04
	352-0168-00	B090000	2		.HLDR,TERM CONN:10 WIRE,BLACK	80009	352-0168-00
-170	352-0168-02		1		.HLDR,TERM CONN:10 WIRE,RED	80009	352-0168-02
-171	352-0169-03		1		.HLDR,TERM CONN:2 WIRE,ORANGE	80009	352-0169-03
	352-0169-04		1		.HLDR,TERM CONN:2 WIRE,YELLOW	80009	352-0169-04
	352-0169-06	B090000	1		.HLDR,TERM CONN:2 WIRE,BLUE	80009	352-0169-06
	352-0171-04	B010100	1		.HLDR,TERM CONN:1 WIRE,YELLOW	80009	352-0171-04
	352-0197-00		1		.CONN BODY,PL,EL:1 WIRE BLACK	80009	352-0197-00
	352-0198-00		1		.HLDR,TERM CONN:2 WIRE BLACK	80009	352-0198-00
	352-0199-03		1		.CONN BODY,PL,EL:3 WIRE ORANGE	80009	352-0199-03
	352-0201-05		1		.CONN BODY,PL,EL:5 WIRE GREEN	80009	352-0201-05
	352-0206-02		1		.CONN BODY,PL,EL:10 WIRE RED	80009	352-0206-02
-172	136-0301-01	B010100	1		.SKT,PL-IN ELEK:ELCTN TUBE,14 CONTACT	80009	136-0301-01
	-----		-		(.5441 ONLY)		
	136-0202-04	B093565	1		.SKT,PL-IN ELEK:ELECTRON TUBE,14 CONT	80009	136-0202-04
	-----		-		(.5441 ONLY)		
	136-0301-01	B010100	1		.SKT,PL-IN ELEK:ELCTN TUBE,14 CONTACT	80009	136-0301-01
	-----		-		(.R5441 ONLY)		
	136-0202-04	B093571	1		.SKT,PL-IN ELEK:ELECTRON TUBE,14 CONT	80009	136-0202-04
	-----		-		(.R5441 ONLY)		
	198-2870-00		1		WIRE SET,ELEC:	80009	198-2870-00
	175-5863-00		1		.CA,ASSY,SP,ELEC:6,22 AWG,3.0 L	80009	175-5863-00
	175-5864-00		1		.CA,ASSY,SP,ELEC:5,22 AWG,3.0 L	80009	175-5864-00
	198-2975-01	B010100	1		WIRE SET,ELEC:	80009	198-2975-01
	175-8163-00	B094812	1		CABLE ASSY,RF:50 OHM COAX,8.0 L	80009	175-8163-00
	198-2978-01	B010100	1		WIRE SET,ELEC:	80009	198-2978-01
	175-5844-00	B094812	1		CA ASSY,SP,ELEC:5,26 AWG,12.0 L	80009	175-5844-00



REV MAY 1982

5441 STORAGE OSCILLOSCOPE

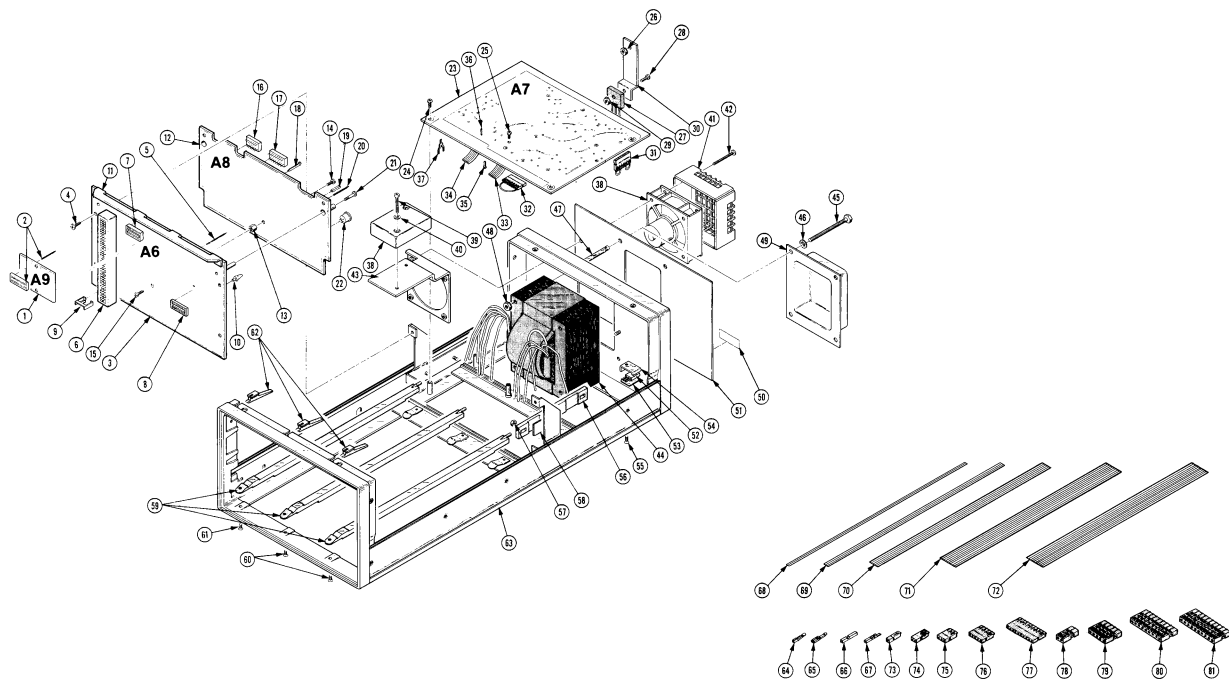


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-	672-0642-00	B062200	B094064	1	CKT BOARD ASSY:INTFC/RDOUT PROT	80009	672-0642-00
	672-0642-01	B094065	B094584	1	CKT BOARD ASSY:INTFC/RDOUT PROT	80009	672-0642-01
	672-0642-02	B094585		1	CKT BOARD ASSY:INTFC/RDOUT PROT	80009	672-0642-02
-1	-----	B062200		1	CKT BOARD ASSY:RDOUT PROT,(SEE A9 REPL)		
-2	136-0682-00			2	..SKT,PL-IN ELEK:MICROCIRCUIT,16 CONTACTS	23880	CWH4000-16B-2L
-3	-----			1	CKT BOARD ASSY:INTERFACE(SEE A6 REPL)		
					***** (ATTACHING PARTS) *****		
-4	213-0146-00			4	..SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	ORD BY DESCR
	-----			-	***** (END ATTACHING PARTS) *****		
					CKT BOARD ASSY INCLUDES:		
-5	131-0590-00			27	..CONTACT,ELEC:0.71 INCH LONG	22526	47351
-6	-----			3	..CONNECTOR,RCPT:(SEE J610,J620,J630 REPL)		
-7	136-0260-02	B010100	B094622	3	..SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW C	09922	DILB16P-108T
	136-0729-00	B094623		3	..SKT,PL-IN ELEK:MICROCKT,16 CONTACT	09922	DILB16P-108T
-8	136-0269-02	B010100	B094622	2	..SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP	09922	DILB14P-108T
	136-0728-00	B094623		2	..SKT,PL-IN ELEK:MICROCKT,14 CONTACT	09922	DILB14P-108
-9	214-1593-02	B010100	B062234	3	..KEY,CONN PLZN:CKT BD CONN	80009	214-1593-02
	214-2627-00	B062235	B082362	3	..KEY,CONN PLZN:CIRCUIT CARD CONNECTOR	31514	Q07900
	214-1593-02	B082363	B094923	3	..KEY,CONN PLZN:CKT BD CONN	80009	214-1593-02
	214-2601-00	B094924		3	..CONDUCTOR,INNER:18-26.5 GHZ MIXER	80009	214-2601-00
-10	386-1557-00			3	..SPACER,CKT BD:0.29 H,ACETAL	80009	386-1557-00
-11	386-1938-00			1	..REINF,CKT BD:INTERFACE	80009	386-1938-00
-12	-----			1	CKT BOARD ASSY:READOUT(SEE A8 REPL)		
-13	129-0285-00			1	..POST,ELEC-MECH:0.281 L X 0.188 HEX BRS	80009	129-0285-00
					***** (ATTACHING PARTS) *****		
-14	211-0007-00			1	..SCREW,MACHINE:4-40 X 0.188,PNH STL,CD PL	83385	ORD BY DESCR
-15	211-0008-00			1	..SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ	83385	ORD BY DESCR
					***** (END ATTACHING PARTS) *****		
-16	136-0269-02	B010100	B094622	1	..SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP	09922	DILB14P-108T
	136-0728-00	B094623		1	..SKT,PL-IN ELEK:MICROCKT,14 CONTACT	09922	DILB14P-108
-17	136-0260-02	B010100	B094622	13	..SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW CL	09922	DILB16P-108T
	136-0729-00	B094623		13	..SKT,PL-IN ELEK:MICROCKT,16 CONTACT	09922	DILB16P-108T
-18	214-0579-00			1	..TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-19	136-0263-07			25	..SOCKET,PIN TERM:U/W 0.025 SQ PIN	22526	ORD BY DESCR
-20	131-0589-00			1	..TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-21	211-0155-00			2	..SCREW,EXT,RLV B:4-40 X 0.375 INCH,SST	80009	211-0155-00
-22	136-0235-00			1	..SOCKET,PLUG-IN:6 CONTACT,ROUND	71785	133-96-12-062
-23	-----			1	CKT BOARD ASSY:POWER SUPPLY(SEE A7 REPL)		
					***** (ATTACHING PARTS) *****		
-24	211-0504-00			6	..SCREW,MACHINE:6-32 X 0.250,PNH STL,CD PL	83385	ORD BY DESCR
-25	211-0008-00			1	..SCREW,MACHINE:4-40 X 0.250,PNH,STL,POZ	83385	ORD BY DESCR
-26	210-0457-00			1	..NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
					***** (END ATTACHING PARTS) *****		
					CKT BOARD ASSY INCLUDES:		
-27	-----			1	..SEMICONV DEVICE:(SEE CR848 REPL)		
	-----				***** (ATTACHING PARTS) *****		
-28	211-0578-00			1	..SCREW,MACHINE:6-32 X 0.438 1NCH,PNH STL	83385	ORD BY DESCR
-29	210-0457-00			1	..NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	83385	ORD BY DESCR
					***** (END ATTACHING PARTS) *****		
-30	214-1804-00			1	..HEAT SINK,ELEC:RECTIFIER	80009	214-1804-00
-31	131-1896-00			1	..LINK,TERM. CONN:8,22 AWG,1.5 L	80009	131-1896-00
-32	131-1895-00			1	..LEAD,ELECTRICAL:22 AWG,1.5 L,8-2	80009	131-1895-00
	198-2870-00			1	..WIRE SET,ELEC:	80009	198-2870-00
-33	175-0859-00			1	..WIRE,ELECTRICAL:6 WIRE RIBBON	08261	SS-0622-7(1061)
-34	175-0860-00			1	..WIRE,ELECTRICAL:5 WIRE RIBBON	08261	SS-0522-7(1061)
-35	214-0579-00			7	..TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	131-0608-00			23	..TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
-36	131-0589-00			16	..TERMINAL,PIN:0.46 L X 0.025 SQ	22526	48283-029
-37	344-0154-00			4	..CLIP,ELECTRICAL:FUSE,CKT BD MT	80009	344-0154-00
-38	-----	B070000		1	..FAN,TUBEAXIAL:(SEE B300 REPL)		
					***** (ATTACHING PARTS) *****		
-39	211-0018-00	B070000		2	..SCREW,MACHINE:4-40 X 0.875 PNH,STL	83385	ORD BY DESCR
-40	210-0994-00	B070000		2	..WASHER,FLAT:0.125 ID X 0.25" OD,STL	86928	5702-201-20
					***** (END ATTACHING PARTS) *****		

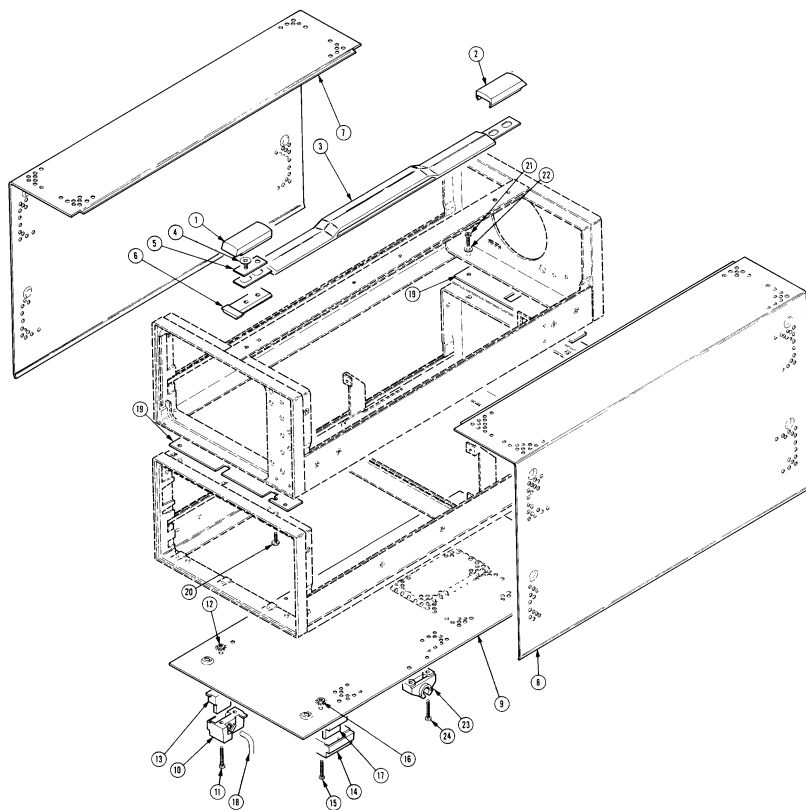
Replaceable Mechanical Parts—5441/R5441

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-41	380-0490-00 380-0545-00	B070000 B082526	B082525 1	1	HOUSING,FAN: HOUSING,FAN:ALUMINUM ***** (ATTACHING PARTS) *****	80009 80009	380-0490-00 380-0545-00
-42	211-0144-00 211-0027-00 210-0994-00	B070000 B082526 B070000	B082525 4 4 4	4	SCREW,MACHINE:4-40 X 1.312 INCH,PNH STL SCREW,MACHINE:4-40 X 1.50 INCH,PNH STL WASHER,FLAT:0.125 ID X 0.25" OD,STL ***** (END ATTACHING PARTS) *****	83385 83385 86928	ORD BY DESCR ORD BY DESCR 5702-201-20
-43	407-1889-00	B070000		1	BRACKET,FAN:ALUMINUM	80009	407-1889-00
-44	-----			1	TRANSFORMER:(SEE T800 REPL) ***** (ATTACHING PARTS) *****		
-45	212-0515-00			4	SCREW,MACHINE:10-32 X 2.250" HEX.HD STL	83385	ORD BY DESCR
-46	210-0812-00			4	WASHER,NONMETAL:#10,FIBER	86445	ORD BY DESCR
-47	166-0227-00			4	INS SLV,ELEC:0.187 ID X 1.50 INCH LONG	80009	166-0227-00
-48	220-0410-00			4	NUT,EXTENDED WA:10-32 X 0.375 INCH,STL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-49	200-0772-02			1	COVER,ELEC XFMR:3.125 X 3.75 X 0.875	80009	200-0772-02
-50	334-2154-01			1	MARKER,IDENT:MKD CAUTION	07416	ORD BY DESCR
-51	333-1682-00 333-1682-05 333-1833-05	B010100 B020000 B070000	B019999 B069999 1	1	PANEL,REAR: PANEL,REAR: PANEL,REAR:	80009 80009 80009	333-1682-00 333-1682-05 333-1833-05
-52	-----			3	TRANSISTOR:(SEE Q820,Q850,Q880 REPL)		
-53	342-0082-00			3	INSULATOR,PLATE:0.52 SQ X 0.015 INCH THK,A	80009	342-0082-00
-54	343-0403-00			3	CLAMP,RIM,CLENC:TRANSISTOR ***** (ATTACHING PARTS) *****	80009	343-0403-00
-55	211-0025-00			3	SCREW,MACHINE:4-40 X 0.375 100 DEG,FLH ST ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-56	343-0315-00			2	CLAMP,XSTR: ***** (ATTACHING PARTS) *****	80009	343-0315-00
-57	210-0407-00			6	NUT,PLAIN,HEX:6-32 X 0.25 INCH,BRS ***** (END ATTACHING PARTS) *****	73743	3038-0228-402
-58	342-0082-00			5	INSULATOR,PLATE:0.52 SQ X 0.015 INCH THK,A	80009	342-0082-00
-59	351-0286-01 351-0286-02 351-0286-07	B010100 B010444 B041136	B010443 B041135 3	3	GUIDE,PL-IN UNI: GUIDE,PL-IN UNI: GUIDE,PL-IN UNI:LOWER,NYLON ***** (ATTACHING PARTS) *****	80009 80009 80009	351-0286-01 351-0286-02 351-0286-07
-60	213-0813-00			2	SCREW,TPG,TR:4-20,0.312 L,PLASTITE	93907	ORD BY DESCR
-61	213-0814-00			1	SCREW,TPG,TR:4-20,0.25 L,PLASTITE ***** (END ATTACHING PARTS) *****	93907	ORD BY DESCR
-62	351-0293-00			3	GUIDE,SLIDE:BLUE	80009	351-0293-00
-63	426-0934-00 426-0934-01 198-2240-01 198-2240-02	B010100 B070000 B010100 B094806 B094807	B069999 1 1 1	1	FRAME ASSY,CAB.: FRAME ASSY,CAB.: WIRE SET,ELEC: WIRE SET,ELEC:	80009 80009 80009 80009	426-0934-00 426-0934-01 198-2240-01 198-2240-02
-64	131-0707-00			67	.CONTACT,ELEC:22-26 AWG,BRS & CU BE GOLD	22526	47439-000
-65	131-0621-00			20	.CONNECTOR,TERM:22-26 AWG,BRS & CU BE GOLD	22526	46231-000
-66	131-0371-00			2	.CONTACT,ELEC:FOR NO.26 AWG WIRE	98278	122-0182-019
-67	131-1538-00 131-1963-00 131-1810-00	B010100 B061784	B061783 4 4 1	4	.CONTACT,ELEC:CRIMP-ON,22-26 AWG WIRE .TERM.,QIK DISC.:FOR 0.038 DIA CRT PIN .CONTACT,ELEC:FEMALE,FOR 0.025 SQ PIN	22526 00779 00779	75369-002 42428-9 87124-1
-68	175-0863-00 175-0825-00			FT FT	.WIRE,ELECTRICAL:2 WIRE RIBBON .WIRE,ELECTRICAL:2 WIRE RIBBON	08261 80009	SS-0222-7(1061) 175-0825-00
-69	175-0826-00			FT	.WIRE,ELECTRICAL:3 WIRE RIBBON	80009	175-0826-00
-70	175-0860-00			FT	.WIRE,ELECTRICAL:5 WIRE RIBBON	08261	SS-0522-7(1061)
-71	175-0832-00			FT	.WIRE,ELECTRICAL:9 WIRE RIBBON	08261	111-2699-956
-72	175-0833-00 175-0855-00			FT FT	.WIRE,ELECTRICAL:10 WIRE RIBBON .WIRE,ELECTRICAL:10 WIRE RIBBON	08261 08261	111-2699-970 SS-1022(1061)OC
-73	352-0197-00 204-0675-00			1 1	.CONN BODY,PL,EL:1 WIRE BLACK .CONN BODY,PLUG:1 FEMALE CONTACT	80009 00779	352-0197-00 87175-2
-74	352-0169-03 352-0169-04 352-0169-06			1 1 1	.HLDR,TERM CONN:2 WIRE,ORANGE .HLDR,TERM CONN:2 WIRE,YELLOW .HLDR,TERM CONN:2 WIRE,BLUE	80009 80009 80009	352-0169-03 352-0169-04 352-0169-06
-75	352-0161-00 352-0199-03			1 1	.HLDR,TERM CONN:3 WIRE,BLACK .CONN BODY,PL,EL:3 WIRE ORANGE	80009 80009	352-0161-00 352-0199-03

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
2-76	352-0163-00		1						.HLDR,TERM CONN:5 WIRE,BLACK	80009	352-0163-00
	352-0163-04		1						.HLDR,TERM CONN:5 WIRE,YELLOW	80009	352-0163-04
	352-0163-05		1						.HLDR,TERM CONN:5 WIRE,GREEN	80009	352-0163-05
-77	352-0168-00		2						.HLDR,TERM CONN:10 WIRE,BLACK	80009	352-0168-00
	352-0168-02		1						.HLDR,TERM CONN:10 WIRE,RED	80009	352-0168-02
-78	352-0198-00		1						.HLDR,TERM CONN:2 WIRE BLACK	80009	352-0198-00
-79	352-0201-05		1						.CONN BODY,PL,EL:5 WIRE GREEN	80009	352-0201-05
-80	352-0167-04		2						.HLDR,TERM CONN:9 WIRE,YELLOW	80009	352-0167-04
-81	352-0206-02		1						.CONN BODY,PL,EL:10 WIRE RED	80009	352-0206-02

Replaceable Mechanical Parts—5441/R5441

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-1	200-0728-04	B010100	B019999	1	COVER,HDL END:BLUE ACETAL	80009	200-0728-04
	200-0728-06	B060000		1	COVER,HDL END:	80009	200-0728-06
-2	200-0728-00			1	COV,HANDLE END:	80009	200-0728-00
-3	367-0116-00			1	HANDLE,CARRYING:16.54 L,BLUE VINYL ***** (ATTACHING PARTS) *****	12136	ORD BY DESCR
-4	212-0597-00			4	SCREW,MACHINE:10-32 X 0.50 INCH,STL ***** (END ATTACHING PARTS) *****	93907	ORD BY DESCR
-5	386-1624-00			2	PLATE,HDL RTNG:STAINLESS STEEL	80009	386-1624-00
-6	386-1283-00			2	PLATE,HDL MTG:FRONT	80009	386-1283-00
-7	390-0193-00	B010100	B062072	1	COVER,SCOPE:LEFT SIDE	80009	390-0193-00
	390-0469-00	B062073	B069999	1	CAB.SIDE,DSPL:SIDE	80009	390-0469-00
	390-0469-01	B070000		1	CAB.SIDE DSPL:	80009	390-0469-01
-8	390-0192-00	B010100	B062072	1	COVER,SCOPE:RIGHT SIDE	80009	390-0192-00
	390-0469-00	B062073	B069999	1	CAB.SIDE,DSPL:SIDE	80009	390-0469-00
	390-0469-01	B070000		1	CAB.SIDE DSPL:	80009	390-0469-01
-9	390-0190-00	B010100	B062072	1	COVER,SCOPE:BOTTOM	80009	390-0190-00
	390-0470-00	B062073	B069999	1	CAB.BOT,DSPL:BOTTOM	80009	390-0470-00
	390-0470-01	B070000		1	CAB.BOT,DISPLAY:	80009	390-0470-01
-10	348-0073-00			2	.HINGE BLOCK,STA:L FR,R REAR,BLACK ACETAL ***** (ATTACHING PARTS) *****	80009	348-0073-00
-11	211-0532-00			4	.SCREW,MACHINE:6-32 X 0.75 INCH,FILH STL	83385	ORD BY DESCR
-12	210-0457-00			4	.NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-13	348-0208-00			2	.FOOT,CABINET:LEFT FRONT AND RIGHT REAR	80009	348-0208-00
-14	348-0074-00			2	.HINGE BLOCK,STA:R FR,L REAR,BLACK ACETAL ***** (ATTACHING PARTS) *****	80009	348-0074-00
-15	211-0532-00			4	.SCREW,MACHINE:6-32 X 0.75 INCH,FILH STL	83385	ORD BY DESCR
-16	210-0457-00			4	.NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-17	348-0207-00			2	.FOOT,CABINET:RIGHT FRONT AND LEFT REAR	80009	348-0207-00
-18	348-0275-00			1	FLIPSTAND,CAB.:	80009	348-0275-00
-19	361-0388-00			2	SPACER,PLATE: ***** (ATTACHING PARTS) *****	80009	361-0388-00
-20	212-0105-00			2	SCREW,EXT RLV:8-32 X 0.312 INCH,HEX HD ST	80009	212-0105-00
-21	212-0008-00			2	SCREW,MACHINE:8-32 X 0.500 INCH,PNH STL	83385	ORD BY DESCR
-22	210-0008-00			2	WASHER,LOCK:INTL,0.02 THK ***** (END ATTACHING PARTS) *****	77900	1208-00-00-0541C
-23	343-0256-00			2	RTNR BLK,SCOPE: ***** (ATTACHING PARTS) *****	80009	343-0256-00
-24	211-0531-00			4	SCREW,MACHINE:6-32 X 0.375,FIL,STL ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR



REV MAY 1982

5441 STORAGE OSCILLOSCOPE

Fig. 4 RACKMOUNT CABINET

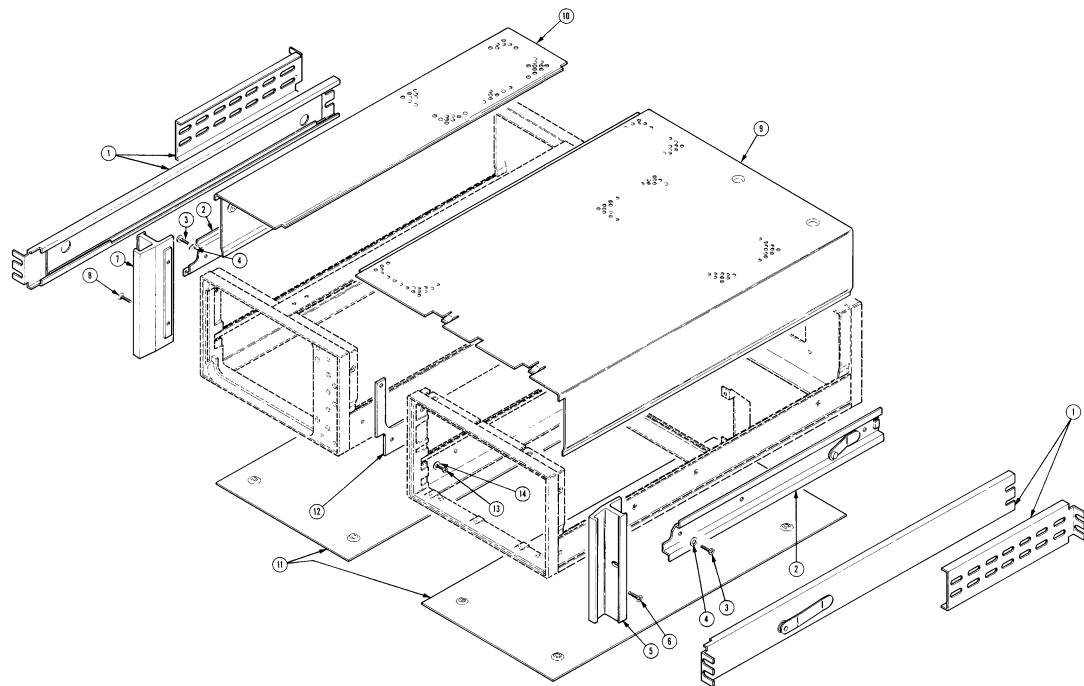


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
4-1	351-0195-00	B010100	B093896	1		SLIDE,DWR,EXT:SLIDE,PAIR (RACKMOUNT ONLY)	06666	C719
	-----			-				
	351-0195-01	B093897		1		SLIDE,DWR,EXT:W/CLOSED MOUNTING SLOTS (RACKMOUNT ONLY)	80009	351-0195-01
	-----			-				
-2	351-0104-00			1		SLIDE SECT,DWR:12.625 X 2.25 ***** (ATTACHING PARTS) *****	06666	C-1353
-3	212-0004-00			6		SCREW,MACHINE:8-32 X 0.312 INCH,PNH STL	83385	ORD BY DESCR
-4	210-0858-00			6		WASHER,FLAT:0.500 OD X 0.171 ID X 0.063 ***** (END ATTACHING PARTS) *****	80009	210-0858-00
-5	407-0899-03	B010000	B019999	1		BRACKET,RACK MT:RIGHT	80009	407-0899-03
	407-0899-00	B060000		1		BRACKET,RACK MT:ALUMINUM ***** (ATTACHING PARTS) *****	80009	407-0899-00
-6	212-0040-00			2		SCREW,MACHINE:8-32 X 0.375 100 DEG,FLH ST ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-7	407-0899-00			1		BRACKET,RACK MT:ALUMINUM ***** (ATTACHING PARTS) *****	80009	407-0899-00
-8	212-0040-00			2		SCREW,MACHINE:8-32 X 0.375 100 DEG,FLH ST ***** (END ATTACHING PARTS) *****	83385	ORD BY DESCR
-9	390-0191-00	B010100	B062072	1		COVER,SCOPE:RIGHT SIDE	80009	390-0191-00
	390-0502-00	B062073	B069999	1		CAB.SIDE,DSPL:RIGHT,RACK	80009	390-0502-00
	390-0502-01	B070000		1		CAB.SIDE,DSPL:RIGHT	80009	390-0502-01
-10	390-0194-00	B010100	B062072	1		COVER,SCOPE:LEFT SIDE	80009	390-0194-00
	390-0503-00	B062073	B069999	1		CAB.SIDE,DSPL:LEFT,RACK	80009	390-0503-00
	390-0503-01	B070000		1		CAB.SIDE,DSPL:LEFT	80009	390-0503-01
-11	390-0222-00	B010100	B062072	2		COVER,SCOPE:BOTTOM	80009	390-0222-00
	390-0505-00	B062073	B069999	1		CAB.BOT,SCOPE:	80009	390-0505-00
	390-0505-01	B070000		1		CAB.BOT,SCOPE:	80009	390-0505-01
-12	361-0389-00			1		SPACER,PLATE:0.125 AL,L-SHAPE ***** (ATTACHING PARTS) *****	80009	361-0389-00
-13	212-0103-00			6		SCREW,MACHINE:8-32 X 0.375 HEX HD,STL	77250	ORD BY DESCR
-14	210-0008-00			10		WASHER,LOCK:INTL,0.02 THK ***** (END ATTACHING PARTS) *****	77900	1208-00-00-0541C

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
	070-2140-01			1						MANUAL, TECH: INSTRUCTION	80009	070-2140-01

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.

Date: 8-28-86

Change Reference: C9/0886

Product: 5441/R5441 Storage Oscilloscope

Manual Part No.: 070-2140-01

DESCRIPTION

PG 52

Effective at all Serial Numbers

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

ADD:

A7VR930	152-0357-00	SEMICON DVC,DI,ZEN,SI,82V,5%,0.4W,DO-7
A7VR940	152-0243-00	SEMICON DVC,DI,ZEN,SI,15V,5%,0.4W,DO-7
A7VR950	152-0227-00	SEMICON DVC,DI,ZEN,SI,6.2V,5%,0.4W,DO-7