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**7844/R7844
DUAL-BEAM
OSCILLOSCOPE**
WITH OPTIONS
OPERATOR

INSTRUCTION MANUAL

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


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Product Group

Serial Number _____

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Each instrument has a serial number on a panel insert, tag,
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of the serial number are assigned sequentially and are
unique to each instrument. Those manufactured in the
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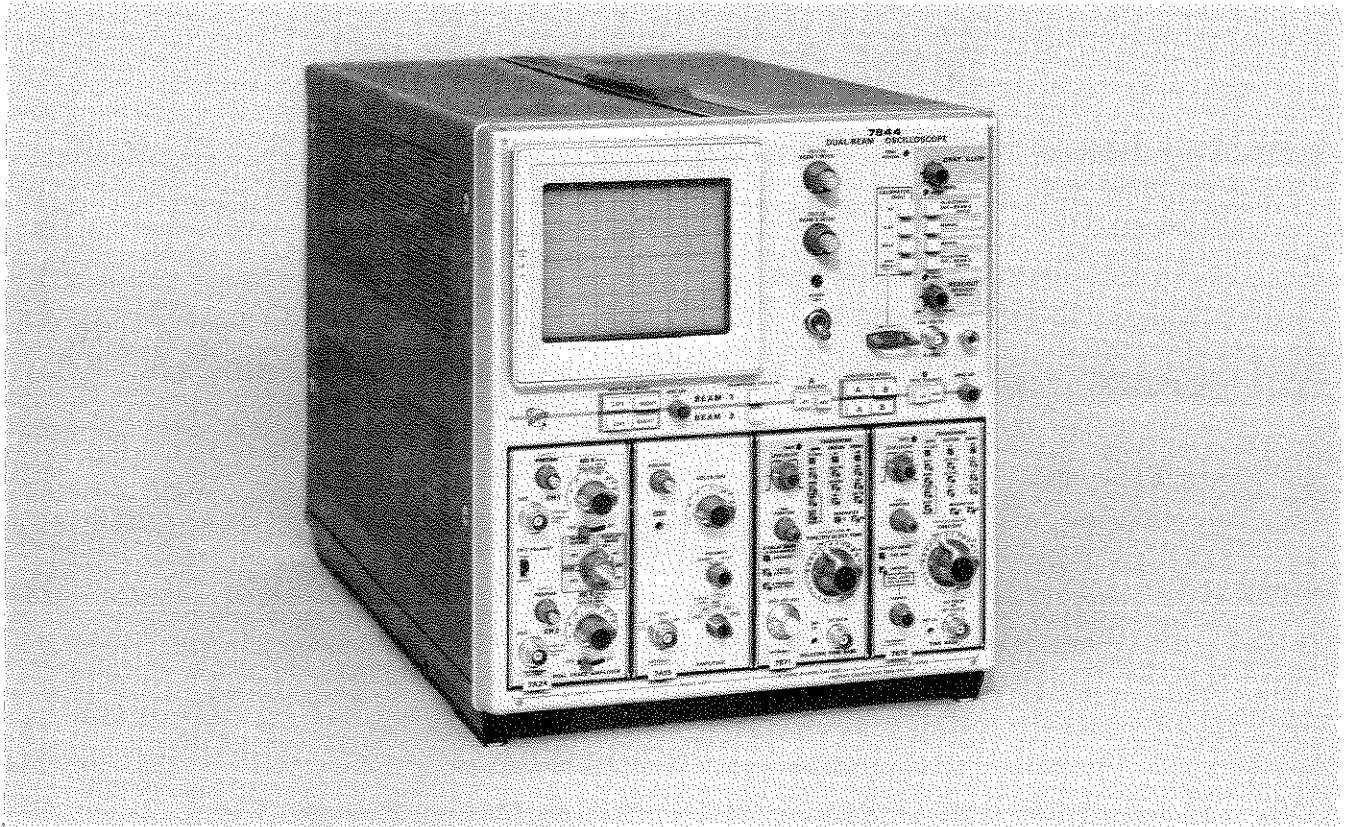
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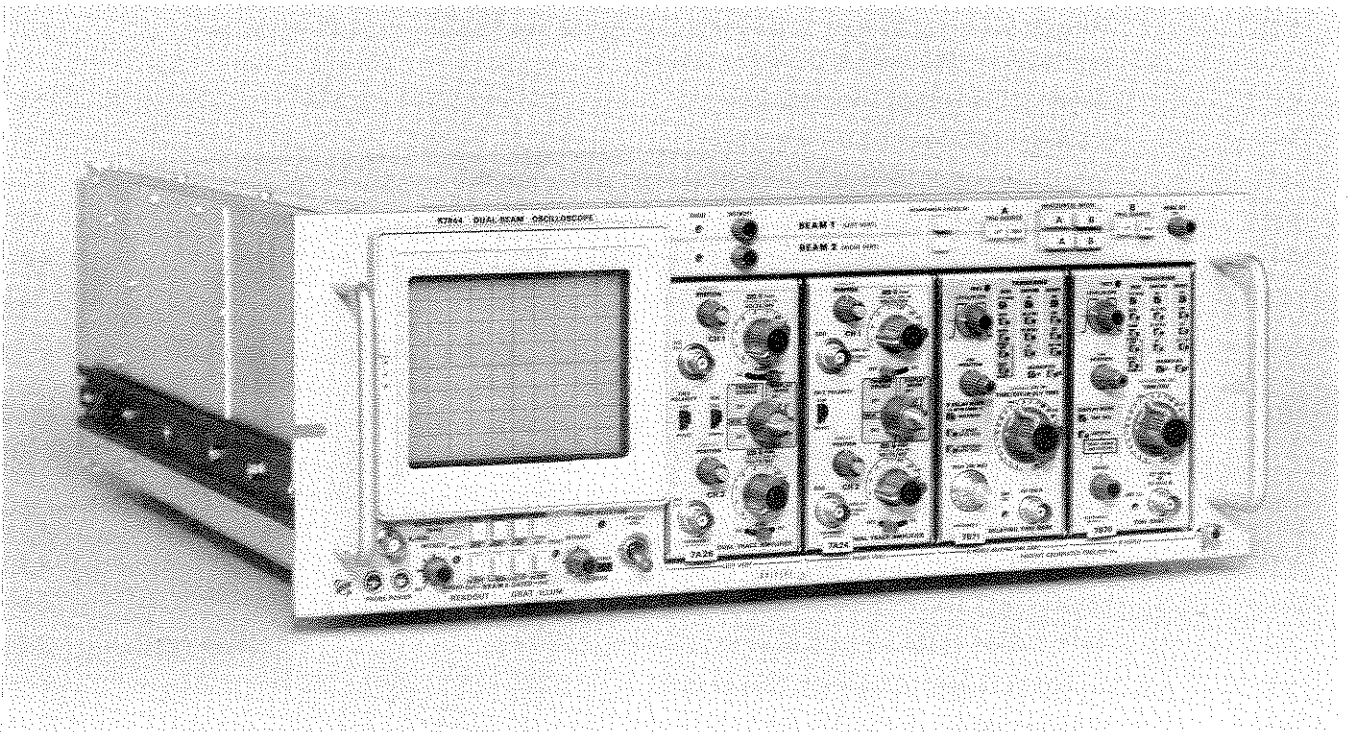
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7844 DUAL-BEAM OSCILLOSCOPE



R7844 OPTION 21 DUAL-BEAM OSCILLOSCOPE

1675-12

OPERATING INSTRUCTIONS

FEATURES

The Tektronix 7844/R7844 Dual-Beam Oscilloscope is a solid-state, wide bandwidth, dual-beam oscilloscope. The instrument accepts Tektronix 7000-Series plug-in units to form a complete measurement system. The flexibility of the plug-in feature and variety of plug-in units available allow the system to be used for many measurement applications.

The 7844/R7844 provides separate vertical and horizontal deflection systems, FOCUS, INTENSITY, and BEAMFINDER functions for each beam. The plug-in unit in either vertical compartment can be selected to provide vertical deflection for either beam. The plug-in units in either horizontal compartment may be selected to provide horizontal deflection for either beam.

The 7844/R7844 features regulated dc power supplies to ensure that the performance is not affected by variations in line voltage and frequency, or by changes in load due to varying power requirements of the plug-in units. The 7844/R7844 operates from a 115 volt or 230 volt (50 Hz to 400 Hz) nominal line source.

Other features include a dual-gun full-overlap crt with a graticule area of 8 x 10 centimeters. The instrument also provides a crt display of alphanumeric information encoded by the plug-in units. The READOUT display indicates plug-in unit status such as deflection factor, sweep rate, and other plug-in dependent parameters.

The Option 21 instrument is basically the same as the standard 7844/R7844 except that the vertical deflection system is dedicated. The amplifier unit in the LEFT VERT compartment controls the vertical deflection of beam 1 and the amplifier unit in the RIGHT VERT compartment controls the vertical deflection of beam 2. The VERTICAL MODE switch and VERT SEP control have been deleted. Refer to the Options section for details.

PRELIMINARY OPERATION

To effectively operate this instrument, the user must become familiar with the operation and capabilities of the instrument. This section describes how to use the front and rear-panel controls and connectors.

Safety Information

This instruction manual contains warning information which the user must follow to ensure safe operation of the instrument. Warning information is intended to protect the operator and Caution information is intended to protect the instrument.

WARNING

This instrument is intended to be operated from a single-phase earth-referenced power source having one current-carrying conductor (the Neutral Conductor) near earth potential. Operation from power sources where both current-carrying conductors are live with respect to earth (such as phase-to-phase on a three-wire system) is not recommended, since only the Line Conductor has over-current (fuse) protection within the instrument.

This instrument has a three-wire power cord with a three-terminal polarized plug for connection to the power source and safety-earth. The safety-earth terminal of the plug is directly connected to the instrument frame. For electric-shock protection, insert this plug only in a mating outlet with a safety-earth contact or otherwise connect the frame to a safety-earth system. The color-coding of the cord conductors is in accordance with recognized standards.

Power Cord Conductor Identification

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

Operating Voltage

The 7844/R7844 has a VOLTAGE SELECTOR switch which allows selection of either a 115 volt or 230 volt nominal line voltage source. When changing the Voltage Selector switch position, disconnect the power cord and use a small screwdriver to move the Voltage Selector switch to the desired range.

CAUTION

Damage to this instrument may occur if the Voltage Selector switch is set to an incorrect position for the line voltage applied.

Voltage Selector Switch Position	Regulating Range
115 V	90 to 132 volts
230 V	180 to 264 volts

Operating Temperature

The 7844/R7844 can be operated where the ambient air temperature is between 0°C and +50°C. After storage at temperatures beyond the operating limits, allow the chassis temperature to come within the operating limits before power is applied.

The 7844 is cooled by air drawn in through holes in the side and bottom panels and blown out through the fan exhaust. To ensure proper cooling of the 7844, maintain the clearance provided by the feet on the bottom and allow 2 inches clearance on the top, sides, and rear (more clearance, if possible). The R7844 is cooled by air drawn in through the air filter on the rear panel and blown out through holes located on the side panels. To ensure proper cooling of the R7844, refer to the dimensional drawing in Section 3 of this manual (Fig. 3-6).

A thermal cutout disconnects power from this instrument if the internal temperature exceeds a safe operating level. Power is automatically restored when the temperature returns to a safe level.

Operating Position

A bail-type stand is mounted on the bottom of the 7844. This stand permits the instrument to be tilted up about 10° for more convenient crt viewing.

PLUG-IN UNITS

The 7844/R7844 accepts up to 4 Tektronix 7000-Series plug-in units. This feature allows selection of bandwidth, sensitivity, display mode, etc., and provides for future expansion of the system.

The overall capabilities of the system are determined mainly by the characteristics of the plug-ins selected. Some typical

combinations are given under Applications, in this manual, along with simplified set-up instructions. For information on other plug-in units, refer to the current Tektronix catalog.

Installation of Plug-In Units

Plug-in units can be installed or removed without turning the instrument power off. To install a plug-in unit into a compartment, align the slots in the top and bottom of the plug-in unit with the associated guide rails in the plug-in compartment. Insert the plug-in unit into the compartment until it locks into place. To remove a plug-in unit, pull the release latch on the plug-in unit to disengage it. To meet emi specifications, all unused plug-in compartments should be covered with an emi-shielded, blank plug-in panel, Tektronix Part 016-0155-00.

The 7844/R7844 Calibration procedure given in the Service manual normalizes the vertical and horizontal gains. This allows plug-in units to be interchanged between plug-in compartments without recalibration. The basic calibration of the plug-in units should be checked when installed to verify their accuracy (refer to plug-in operating instructions).

CONTROLS AND CONNECTORS

Figure 1-1 and Figure 1-2 show the front and rear panels. A brief description of each control and connector is given. Refer to Detailed Operating Information in this manual for additional operating information.

Front-Panel Color Coding

Portions of the 7844/R7844 front-panel are color-coded. These color-coded areas are defined by their functions. Red identifies the nomenclature and controls that will uncalibrate the instrument. Blue identifies the controls affecting the crt display mode. Green identifies all trigger controls.

Other colors such as gray, orange and yellow, have no functional assignments, but are used as needed to indicate the relationship between controls and/or connectors.

FAMILIARIZATION PROCEDURE

The following procedure may be used for familiarization with the 7844/R7844 or as a check of basic instrument operation. If performing the Familiarization Procedure reveals improper calibration or instrument malfunction, first check the operation of the associated plug-in units; then refer to the Calibration and Maintenance sections of the 7844/R7844 Service manual.

Set-up information for both the standard 7844/R7844 and Option 21 precedes each major section of this Familiarization Procedure. The control settings for plug-in units and signal connections, when needed, are also given.

Set-Up Information

Set front-panel controls as follows:

POWER switch	Off
CALIBRATOR (1 kHz)	4 V push button in
READOUT INTENSITY	OFF
EXT/BEAM 2 GATED	BEAM 2 GATED (push button OUT)
GRAT ILLUM	Fully counterclockwise
EXT/BEAM 2 GATED	BEAM 2 GATED (push button OUT)
A TRIG SOURCE	LEFT
B TRIG SOURCE	RIGHT
BEAM 1	
INTENSITY	Midrange
FOCUS	Midrange
VERTICAL MODE	LEFT
BEAMFINDER	Push button out
HORIZONTAL MODE	A
HORIZ SEP (1)	Midrange
BEAM 2	
INTENSITY	Midrange
FOCUS	Midrange
VERTICAL MODE	RIGHT
BEAMFINDER	Push button out
HORIZONTAL MODE	B

1. Connect the 7844/R7844 to a power source that meets the voltage and frequency requirements of the instrument. If the available line voltage is outside the limits of the Voltage Selector, see Operating Voltage discussion in this section.

2. Install Tektronix 7A-Series amplifier units into both the LEFT VERT and RIGHT VERT compartments. Install Tektronix 7B-Series time-base units into the A and B HORIZ compartments.

3. Turn the POWER switch ON.

4. Connect the 4 V CALIBRATOR output to the left and right vertical plug-in units with a BNC cable and a dual input coupler.

5. Set the deflection factors of both vertical units for 2 divisions of displayed signal and center the position controls. Set both units for dc input coupling.

6. Set both time-base units for a sweep rate of 1 millisecond/division. Set the triggering for auto mode with ac coupling from the internal source and the level control for a stable display. Position the display as necessary.

Display Controls

7. Rotate the BEAM 1 and BEAM 2 INTENSITY controls throughout their ranges; then set the INTENSITY controls to a desired viewing level.

8. Set the BEAM 1 FOCUS control so that the top and bottom portions of the beam 1 display are as thin as possible but not elongated. Set the BEAM 2 FOCUS control so that the top and bottom portions of the beam 2 display are as thin as possible but not elongated.

NOTE

This instrument contains circuitry to automatically protect the crt against damage due to excessive crt beam current. If the INTENSITY control is set to a point where crt phosphor damage could occur, this circuit limits the beam current to a safe level. The circuit action will also cause the trace to defocus which indicates that the intensity should be reduced. Therefore, if the FOCUS adjustment cannot be satisfactorily made, reduce the INTENSITY and repeat step 8.

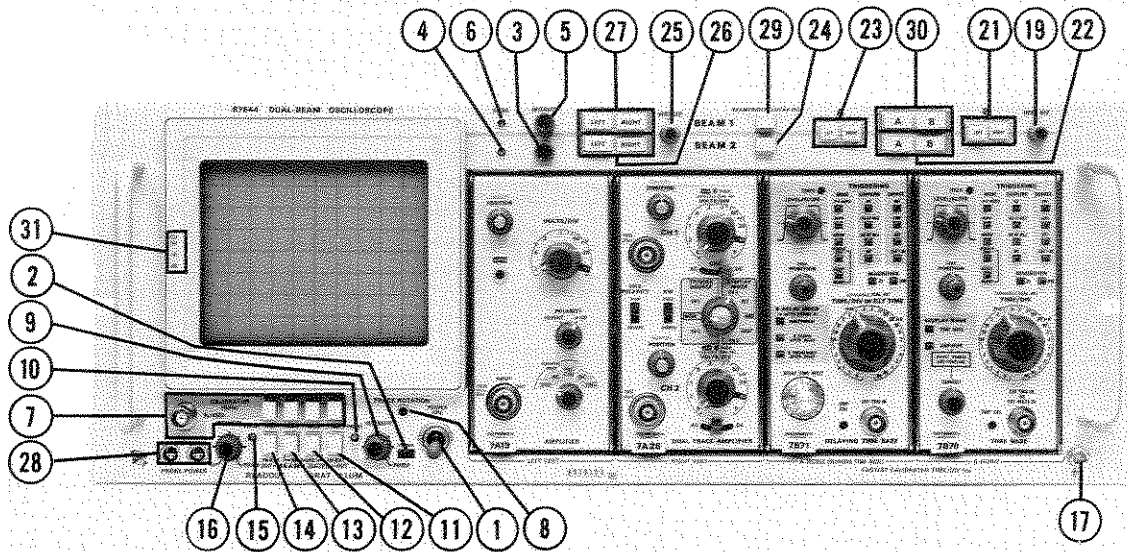
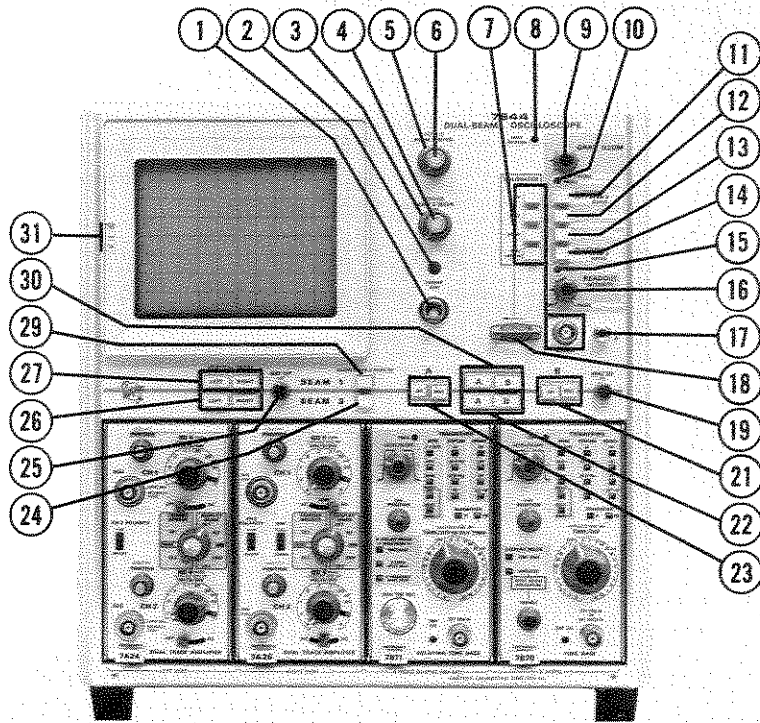


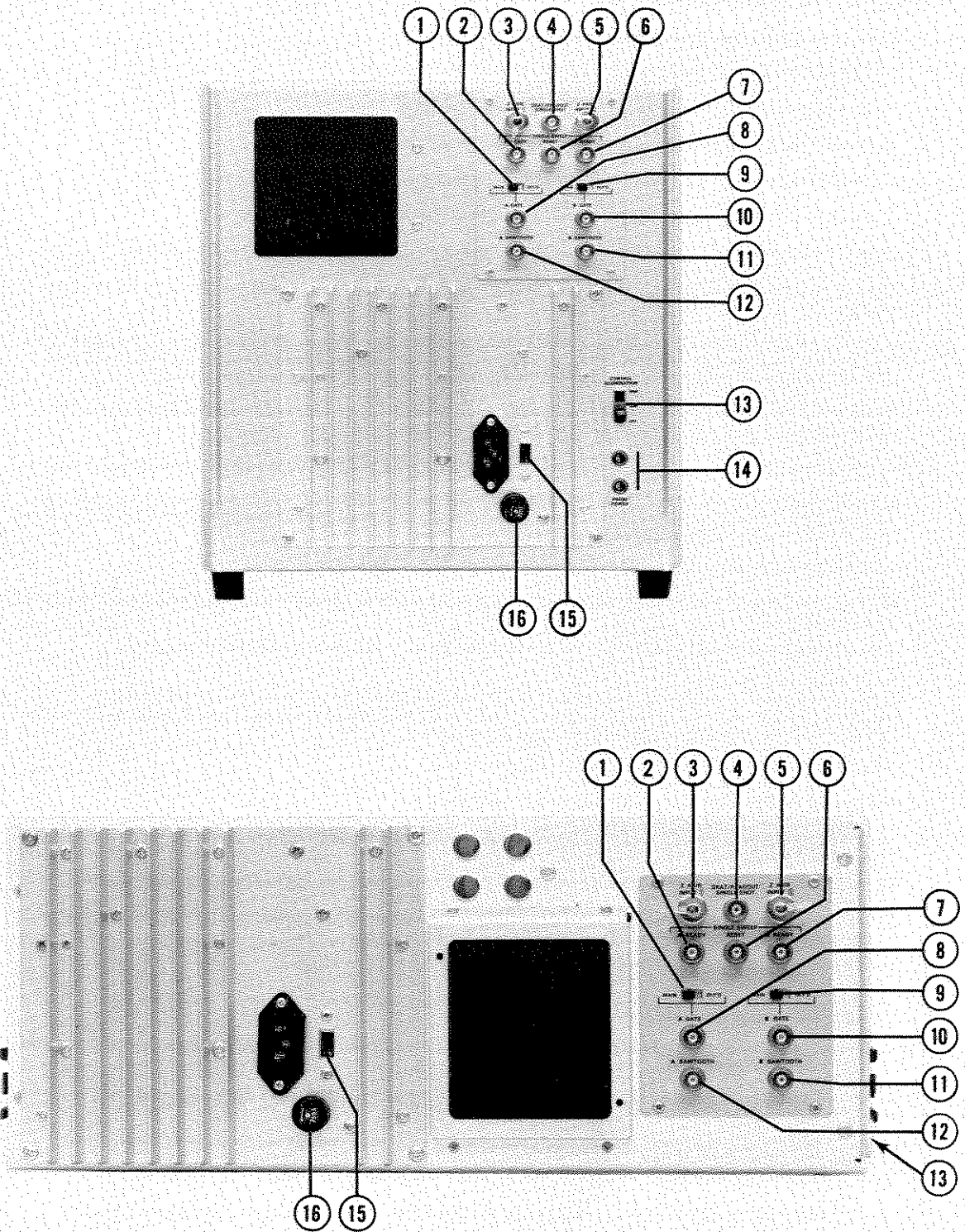
Fig. 1-1. Front-panel controls and connectors.

FRONT-PANEL CONTROLS, CONNECTORS, AND INDICATORS

- 1 POWER (ON) Switch—Applies power to instrument.
- 2 POWER Indicator—Lights when power is on.
- 3 BEAM 2 INTENSITY Control—Controls brightness of beam 2 display.
- 4 BEAM 2 FOCUS Control—Provides optimum definition of beam 2 display.
- 5 BEAM 1 INTENSITY Control—Controls brightness of beam 1 display.
- 6 BEAM 1 FOCUS Control—Provides optimum definition of beam 1 display.
- 7 CALIBRATOR Connector—Provides 1 kHz calibrated square-wave voltages.
- 8 TRACE ROTATION Adjustment—Aligns beam 1 and beam 2 traces with the graticule lines.
- 9 GRAT ILLUM Control—Varies level of graticule illumination or activates PULSED GRAT ILLUM functions.
- 10 GRAT ILLUM PRESET Adjustment (PULSED operation only)—Sets level of illumination for GRAT ILLUM PULSED operation.
- 11 GRAT ILLUM EXT/BEAM 2 GATED Control (PULSED operation only)—When in EXT (push button IN) a signal to the rear-panel GRAT/READOUT SINGLE SHOT connector provides momentary graticule illumination. When in BEAM 2 GATED (push button OUT) momentary graticule illumination is provided at the end of beam 2 sweep.
- 12 GRAT ILLUM MANUAL Control (PULSED operation only)—Provides momentary graticule illumination when push button is pressed.
- 13 READOUT MANUAL Control¹ (PULSED operation only)—One readout frame is displayed when push button is pressed.
- 14 READOUT EXT/BEAM 2 GATED¹ (PULSED operation only) Control—When in EXT (push button IN) a signal to the rear-panel GRAT/READOUT SINGLE SHOT connector provides one readout frame. When in BEAM 2 GATED (push button OUT) one readout frame is displayed at the end of beam 2 sweep.
- 15 READOUT PRESET Adjustment (PULSED operation only)—Sets PULSED readout intensity.
- 16 READOUT INTENSITY Control¹—Activates and controls brightness of the alphanumeric display or activates the PULSED readout functions.
- 17 Ground Connector (not marked)—Binding post to establish common ground between associated equipment.
- 18 Current Loop (not marked)
7844—Provides 40 mA square-wave current (1 kHz) when the CALIBRATOR switch is set to 40 mA position.
R7844—Provides 40 mA square-wave current (1 kHz) when optional current loop adapter is connected to the CALIBRATOR connector and the CALIBRATOR switch is set to 4 V position.
- 19 HORIZ SEP (1) Control—Horizontally positions beam 1 display.
- 20 ENHANCER PRESET Adjustment¹ (Option 22 only; not shown).
- 21 B TRIG SOURCE Control—Selects LEFT VERT or RIGHT VERT compartment as the source of internal trigger signal for B HORIZ compartment.
- 22 BEAM 2 HORIZONTAL MODE Control—A HORIZ or B HORIZ compartments can be selected to control beam 2.
- 23 A TRIG SOURCE Control—Selects LEFT VERT or RIGHT VERT compartment as the source of internal trigger signal for the A HORIZ compartment.
- 24 BEAM 2 BEAMFINDER (LOCKS IN) Control—Intensifies and locates beam 2 display.
- 25 VERT SEP (1) Control (deleted with Option 21)—Provides positioning of beam 1 when both beam 1 and beam 2 are being controlled by the same vertical compartment.
- 26 BEAM 2 VERTICAL MODE Control (deleted with Option 21)—Allows beam 2 to be controlled by either the LEFT VERT or RIGHT VERT compartments.
- 27 BEAM 1 VERTICAL MODE Control (deleted with Option 21)—Allows beam 1 to be controlled by either the LEFT VERT or RIGHT VERT compartments.
- 28 PROBE POWER Connectors (two)—Provide power for active probe systems (located on rear panel of 7844).
- 29 BEAM 1 BEAMFINDER (LOCKS IN) Control—Intensifies and locates beam 1 display.
- 30 BEAM 1 HORIZONTAL MODE Control—A HORIZ or B HORIZ compartments can be selected to control beam 1.
- 31 Camera Power Connector (not marked)—Three-pin connector provides power for camera operation and receives single-sweep reset signal.

¹ Refer to Instrument Options section for instruments equipped with the Writing Speed Enhancer (Option 22).

Fig. 1-1 (cont.). Front-panel controls and connectors.



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Fig. 1-2. Rear-panel controls and connectors.

REAR-PANEL CONTROLS AND CONNECTORS

- ① MAIN and DLY'D (A GATE) Switch—Selects between main and delay gates from time base unit in A HORIZ compartment.
- ② SINGLE SWEEP (A READY) Connector—Output for single-sweep ready signal from time-base unit in A HORIZ compartment.
- ③ Z AXIS INPUT 1 Connector—Input for intensity modulation of BEAM 1.
- ④ GRAT/READOUT SINGLE SHOT Connector—Input for single shot graticule illumination and single frame readout.
- ⑤ Z AXIS INPUT 2 Connector—Input for intensity modulation of BEAM 2.
- ⑥ SINGLE SWEEP RESET Connector—Input to externally reset single-sweep circuits in A HORIZ and B HORIZ compartments.
- ⑦ SINGLE SWEEP (B READY) Connector—Output for single-sweep ready signal from time-base unit in B HORIZ compartment.
- ⑧ A GATE Connector—Positive-going output for gate signal from the time-base unit in the A HORIZ compartment.
- ⑨ MAIN and DLY'D (B GATE) Switch—Selects between main and delay gates from time base unit in B HORIZ compartment.
- ⑩ B GATE Connector—Positive-going output for gate signal from the time-base unit in the B HORIZ compartment.
- ⑪ B SAWTOOTH Connector—Positive-going sawtooth from B time base.
- ⑫ A SAWTOOTH Connector—Positive-going sawtooth from A time base.
- ⑬ CONTROL ILLUMINATION Switch—Sets illumination level of push-button switches on plug-in units (located on left side panel of R7844).
- ⑭ PROBE POWER Connectors (two)—Provide power for active probe systems (located on front panel of R7844).
- ⑮ Voltage Selector Switch (not labeled)—Selects from either 115-volt or 230-volt nominal line source.
- ⑯ Line Fuse—4 A FAST BLOW.

Fig. 1-2 (cont.). Rear-panel controls and connectors.

Operating Instructions—7844/R7844 Operators

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

10. Set the deflection factor of the right vertical unit to 10 millivolts/division. Notice that the square-wave display is not completely visible since the deflection exceeds the scan area of the crt.

11. Press the BEAM 2 BEAMFINDER push button. Notice that the display is returned to the viewing area, in a compressed and defocused form. Release the BEAMFINDER switch and notice that the display again disappears from the viewing area.

12. With the BEAM 2 BEAMFINDER switch depressed, increase the deflection factor of the right vertical unit until the display is reduced to less than 2 divisions vertically. Adjust the right vertical unit position control to center the compressed display about the center of the graticule. Release the BEAMFINDER and notice that the display remains within the viewing area. Repeat steps 10, 11, and 12 for BEAM 1 and the left vertical unit.

13. Turn the READOUT INTENSITY control clockwise (out of detent) until the alphanumeric display is visible near the top and/or bottom of the graticule. Change the deflection factor of the amplifier plug-in units. Notice that the readout display corresponds to the deflection factor selected. Likewise, change the sweep rate of the time-base units, located in the A HORIZ and B HORIZ compartments. Notice that the readout display for the time-base units corresponds to the sweep rate selected. If an amplifier unit with 10X probe encoding is used, install a 10X probe on the input connector. Notice that the deflection factor indicated by the readout is increased by 10 times when the probe is added. If any of the plug-in units is a dual unit, notice that the readout can appear within the upper or lower graticule division. Also, note that the readout for each plug-in unit is allocated to a specific location on the graticule.

Set each time-base unit for magnified sweep operation (if time base unit is equipped with a sweep magnifier). Notice that the readout display changes to indicate the correct magnified sweep rate. Return the time-base unit to normal sweep operation and disconnect the 10X probe.

Vertical System and Calibrator

Set-up status:

POWER switch	On
CALIBRATOR (1 kHz)	4 V push button in
READOUT INTENSITY	As desired (out of PULSED switch detent)
EXT/BEAM 2 GATED	BEAM 2 GATED (push button out)
GRAT ILLUM	As desired (out of PULSED switch detent)
EXT/BEAM 2 GATED	BEAM 2 GATED (push button out)
A TRIG SOURCE	LEFT
B TRIG SOURCE	RIGHT
BEAM 1	
INTENSITY	As desired
FOCUS	As desired
VERTICAL MODE	LEFT
BEAMFINDER	Push button out
HORIZONTAL MODE	A
HORIZ SEP (1)	Midrange
BEAM 2	
INTENSITY	As desired
FOCUS	As desired
VERTICAL MODE	RIGHT
BEAMFINDER	Push button out
HORIZONTAL MODE	B

Set-up status for the associated equipment:

Left Vertical Unit	Deflection factor, 1 volt/division; position, centered in the top half of the graticule; input coupling, dc.
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Right Vertical Unit Deflection factor, 1 volt/division; position, centered in the bottom half of the graticule; input coupling, dc.

A and B Horizontal Units Sweep rate to 1 millisecond/division; triggering to auto mode, ac coupling, internal source, level adjusted for stable display.

14. Connect the CALIBRATOR output to both the left and right vertical units with a BNC cable and a dual input coupler. The display amplitude should be approximately 2 divisions (if not, adjust deflection factor accordingly).

15. Notice that the position control for the left vertical unit affects only the vertical position of the beam 1 displayed trace.

16. **(Delete with Option 21)** Set the BEAM 1 VERTICAL MODE switch to RIGHT. Notice that the position control for the right vertical unit affects the vertical position of the beam 1 and beam 2 displayed trace.

17. **(Delete with Option 21)** Rotate the VERT SEP (1) control. Notice that the beam 1 display is positioned with respect to the beam 2 display. Set the BEAM 2 VERTICAL MODE switch to LEFT and rotate the left vertical position control. Note that the left vertical positions only the BEAM 2 displayed trace.

18. **(Delete with Option 21)** Set BEAM 1 VERTICAL MODE switch to LEFT. Rotate the left vertical plug-in unit position control, in combination with the VERT SEP (1) control. Note that the VERT SEP (1) control positions beam 1 display above and below the beam 2 display and also that the VERT SEP (1) control is operational only when both beams are being controlled by the same vertical compartment.

19. Position the start of both traces to the left graticule line with the time-base unit position controls. Check the crt display for one complete cycle per graticule division. If necessary, adjust the sweep calibration adjustment on the front panel of the associated time-base unit for one complete cycle per graticule division.

20. Select different CALIBRATOR push buttons labeled 4 V, 0.4 V, 40 mV, and 4 mV and notice those outputs can be obtained (CALIBRATOR output must be terminated into more than a 100 kilohm load for stated output). When the CALIBRATOR output is terminated into 50 ohms, the output is 0.1 times the stated output.

Horizontal System

Set-up status:

POWER switch	On
CALIBRATOR (1 kHz)	4 V push button (pushed in)
READOUT INTENSITY	As desired (out of PULSED switch detent)
EXT/BEAM 2 GATED	BEAM 2 GATED (push button out)
GRAT ILLUM	As desired (out of PULSED switch detent)
EXT/BEAM 2 GATED	BEAM 2 GATED (push button out)
A TRIG SOURCE	LEFT
B TRIG SOURCE	LEFT
BEAM 1	
INTENSITY	As desired
FOCUS	As desired
VERTICAL MODE	LEFT
BEAMFINDER	Push button out
HORIZONTAL MODE	A
HORIZ SEP (1)	Midrange
BEAM 2	
INTENSITY	As desired
FOCUS	As desired
VERTICAL MODE	RIGHT
BEAMFINDER	Push button out
HORIZONTAL MODE	B

Operating Instructions—7844/R7844 Operators

Set-up status for the associated equipment:

CALIBRATOR	4 V output connected to the left and right vertical units with a BNC cable and a BNC dual input coupler.
Left Vertical Unit	Deflection factor, 1 volt/division; position, left vertical display centered in the top half of the graticule; input coupling, dc.
Right Vertical Unit	Deflection factor, 1 volt/division; position, right vertical unit display centered in the bottom half of the graticule; input coupling, dc.
A and B Horizontal Units	Sweep rate to 1 millisecond/division; triggering to auto mode, ac coupling, internal source, level adjusted for stable display.

21. Set the sweep rate switch on the B horizontal plug-in unit to 0.2 millisecond/division. Disconnect the 4 V CALIBRATOR signal from the left vertical unit and leave the CALIBRATOR signal connected to the right vertical plug-in. Set the vertical deflection factor for 2 divisions of displayed signal. Note that the beam 2 display is not triggered. Set B TRIG SOURCE to RIGHT. Now the beam 2 display should be triggered; if not, adjust the triggering controls.

22. Disconnect the 4 V CALIBRATOR signal from the right vertical unit and connect it to the left vertical. Then set the deflection factor for two divisions of displayed signal. Set the A TRIG SOURCE to RIGHT and note that the beam 1 display is not triggered. Set A TRIG SOURCE to LEFT and note that beam 1 display is now triggered.

23. Connect the 4 V CALIBRATOR signal to both vertical plug-in units and set the vertical deflection factors to display two divisions of signal. Note that the A HORIZ plug-in is displayed on beam 1. Use the position control of the A HORIZ plug-in to change the horizontal location of the displayed waveform. Align the start of this trace with left side of the graticule.

24. Note that the B HORIZ plug-in is displayed on beam 2. Use the position control of the B HORIZ plug-in to change the horizontal location of the displayed waveform. Align the start of this trace with the left side of the graticule.

25. With the HORIZ SEP (1) control, note that the beam 1 display can be horizontally positioned and that the HORIZ SEP (1) control positioning is in addition to that of the beam 1 plug-in horizontal positioning.

26. Set BEAM 2 HORIZONTAL MODE switch to A. Note that both beam 1 and beam 2 are being controlled by the A HORIZ plug-in unit. Use the HORIZ SEP (1) control to align the beam 1 trace with the beam 2 trace.

27. Set BEAM 1 HORIZONTAL MODE switch to B. Note that either A HORIZ or B HORIZ plug-in units can be selected to control beam 1 and beam 2.

Graticule and Readout Pulsed Operation

Set-up status:

POWER switch	On
CALIBRATOR (1 kHz)	4 V push button (pushed in)
READOUT INTENSITY	As desired (out of PULSED switch detent)
EXT/BEAM 2 GATED	BEAM 2 GATED (push button out)
GRAT ILLUM	As desired (out of PULSED switch detent)
EXT/BEAM 2 GATED	BEAM 2 GATED (push button out)
A TRIG SOURCE	LEFT
B TRIG SOURCE	RIGHT
BEAM 1	
INTENSITY	As desired
FOCUS	As desired

VERTICAL MODE	LEFT
BEAMFINDER	Push button out
HORIZONTAL MODE	A
HORIZ SEP (1)	Midrange

to EXT and a ground closure applied to the GRAT/READOUT SINGLE SHOT connector.

This completes the Familiarization Procedure.

BEAM 2

INTENSITY	As desired
FOCUS	As desired
VERTICAL MODE	RIGHT
BEAMFINDER	Push button out
HORIZONTAL MODE	A

DETAILED OPERATING INFORMATION

Crt Display Intensity Controls

The 7844/R7844 dual-beam oscilloscope has an INTENSITY control for each of the two beams. Each of these INTENSITY controls operate independently. The BEAM 1 INTENSITY control varies the brightness of only the beam 1 display. Likewise, the BEAM 2 INTENSITY control varies brightness of only the beam 2 display.



Crt phosphor damage can occur under adverse conditions. Avoid any condition where an extremely bright, sharply focused dot exists on the crt. Also remember that the light filter reduces the apparent light output from the crt.

28. Set the READOUT INTENSITY control clockwise to the PULSED (switch detent) position. Set the B HORIZ plug-in to 0.2 second/division. Observe that 1 READOUT frame occurs for each sweep of the beam 2 horizontal system. Adjust READOUT INTENSITY PRESET control to a desired viewing level.

29. Set READOUT EXT/BEAM 2 GATED push button switch to EXT. Depress the READOUT MANUAL push button. Observe that 1 READOUT frame occurs each time the MANUAL push button is depressed. Set READOUT EXT/BEAM 2 GATED push button to BEAM 2 GATED.

30. Set GRAT ILLUM control clockwise to the PULSED detent position. Note that one graticule illumination occurs for each sweep of the beam 2 horizontal system. Set the GRAT ILLUM PRESET control to a desired viewing level.

31. Set GRAT ILLUM EXT/BEAM 2 GATED push button to EXT. Depress the GRAT ILLUM MANUAL push button. Observe 1 graticule illumination each time the MANUAL push button is depressed.

NOTE

The GRAT ILLUM and READOUT PULSED functions can be actuated by a remote signal applied through the rear-panel GRAT/READOUT SINGLE SHOT connector. The EXT/BEAM 2 GATED push buttons should be set

When the INTENSITY controls are advanced to the point where crt beam current exceeds a safe level, protection circuitry automatically limits the beam current. The beam current is limited to an even lower level during x-y mode of operation or when either time-base unit is set for a slow sweep rate (even if that time-base unit is not selected for display by the HORIZONTAL MODE switch). This reduces the danger of damaging the crt phosphor with a stationary or slowly moving spot. Since beam-current limiting does not take effect until after 10 milliseconds, the full display intensity is available for most single-shot uses.

Display Focus

The FOCUS controls are used to increase the crt display definition, for a variety of waveforms and intensity settings. Once the FOCUS controls have been properly set, the automatic-focusing circuits will maintain optimum focus for most intensity settings and display conditions. The optimum FOCUS setting is most readily obtained with a square-wave signal displayed on the crt and with a low level of trace brightness. Use the following procedure to adjust the FOCUS controls:

1. Set the vertical deflection factor to display 2 divisions of the CALIBRATOR signal.

Operating Instructions—7844/R7844 Operators

2. Set the horizontal deflection factor to display 5 cycles of the CALIBRATOR signal.
3. Adjust the FOCUS control so that the top and bottom portions of the waveform are as thin as possible but not elongated.

Trace Alignment

The TRACE ROTATION control allows the trace to be aligned with the horizontal graticule lines.

Position both beams to the center horizontal line and adjust the TRACE ROTATION adjustment so that the 2 traces are parallel with the horizontal graticule lines.

Graticule

The crt graticule lines are internally marked on the face of the crt. This feature eliminates measurement error due to faceplate parallax. The crt faceplate is divided into 8 vertical and 10 horizontal divisions. Each division is 1 centimeter square, each major division is divided into 5 minor divisions. The gains of the vertical and horizontal compartments are calibrated to the crt graticule. Figure 1-3 illustrates the graticule and defines the various measurement lines. The terminology defined here will be used in all discussions involving graticule measurements.

NOTE

Two types of crt graticules have been used in some Tektronix oscilloscopes. One graticule has 0% and 100% risetime reference points that are separated by 6 vertical graticule divisions. The other graticule has the 0% and 100% risetime reference points separated by 5 vertical divisions. In your manual, illustrations of the crt face or risetime measurement instructions may not correspond with the graticule markings on your oscilloscope.

Light Filters

The tinted filter provided with the standard instrument, minimizes light reflections from the face of the crt to improve contrast when viewing the display under high ambient light conditions. This filter should be removed for waveform photographs or when viewing high writing rate displays. To remove the filter, pull outward on the bottom of the plastic crt mask and remove it from the crt. Remove the tinted filter (leave the metal light shield in place) and snap the plastic crt mask back into place.

WARNING

Do not remove the clear plastic implosion shield.

An optional mesh filter is available at extra cost (included with Option 3). This filter provides shielding against radiated emi (electro-magnetic interference) from the face of the crt.

It also serves as a light filter to make the trace more visible under high ambient light conditions. The mesh filter fits in place of the plastic crt mask and the tinted filter. The filter can be ordered by Tektronix Part 378-0603-00.

The apparent light output from the crt is reduced when tinted and emi filters are used. Therefore, these filters should be removed to obtain the best visible photographic writing rate.

Graticule Illumination

The GRAT ILLUM control varies the illumination of the graticule lines. The GRAT ILLUM can also be operated in the PULSED mode. With the GRAT ILLUM control set to the PULSED detent and the EXT/BEAM 2 GATED switch set to the BEAM 2 GATED position, the graticule will be illuminated momentarily after beam 2 completes a sweep. With the EXT/BEAM 2 GATED switch set to the EXT position, the graticule can be momentarily illuminated either by depressing the GRAT ILLUM MANUAL push button or by

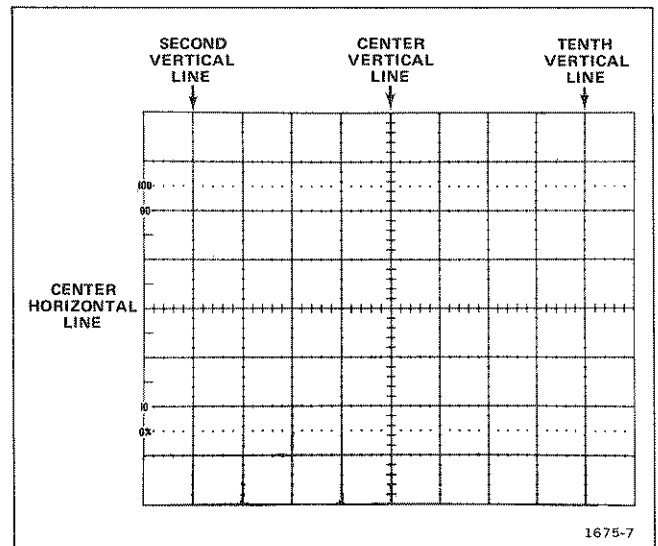


Fig. 1-3. Definition of measurement lines on the 7844/R7844 graticule.

applying a remote signal to the GRAT/READOUT SINGLE SHOT BNC connector, located on the rear panel (see Table 2-1 for signal requirements). When operating in the PULSED mode, the level of illumination is controlled by the GRAT ILLUM, PRESET screwdriver adjustment.

Readout Display

The Readout System displays alphanumeric plug-in unit scale factors on the crt in conjunction with the displayed analog waveform. Each installed plug-in unit encodes the readout information into a word. Up to 8 words of readout information can be displayed on the crt (2 channels from each of the 4 plug-in compartments). Figure 1-4 illustrates readout word placement on the crt. Notice that the readout

from channel 1 of each plug-in unit is displayed in the top division of the graticule and the readout from channel 2 is displayed directly below in the bottom division of the graticule. Only readout information from plug-in units, which are selected for display by the MODE switches, will appear in the readout display. Some special purpose plug-in units can over-ride the MODE switches and display readout even through the compartment is not selected for readout display.

A channel identification feature is provided by the Readout System to link the readout word with the originating plug-in unit and channel (amplifier units only). When the Identify button on the amplifier unit is pressed, the word IDENTIFY appears in the readout display. The word IDENTIFY appears in the place of the normal scale factor readout. Other readout words in the display remain unchanged. When the Identify button is released, the readout display from this plug-in channel is again displayed. Circuitry may also be provided in the plug-in unit which produces a noticeable change in the analog waveform display when the Identify button is pressed (see the plug-in unit instruction manuals for details).

NOTE

The READOUT MODE switch, located internally on the readout board, should be set to F.R. (free running). This is the recommended setting to insure proper operation of front panel controls and external connectors.

The READOUT INTENSITY control determines the brightness 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 the top and bottom divisions of the graticule area are to be used for waveform display, or when the trace interruptions necessary to display characters interfere with the waveform display. In the normal free-run mode, the trace is interrupted for about 20 microseconds for each character displayed.

NOTE

For instruments equipped with Option 22 (photographic writing speed enhancer) refer to Section 4.

One complete frame of readout information can be displayed at the end of the beam 2 sweep, by rotating the READOUT INTENSITY control fully clockwise to the PULSED detent

and by setting the EXT/BEAM 2 GATED switch to BEAM 2 GATED. The PULSED mode is very useful for single-shot photography. When the EXT/BEAM 2 GATED switch is set to EXT, one complete frame of readout information can be displayed by applying an external signal to the GRAT/READOUT SINGLE SHOT connector on the rear panel (see Table 2-1 in the Specification section for signal requirements). One frame of readout information is also displayed each

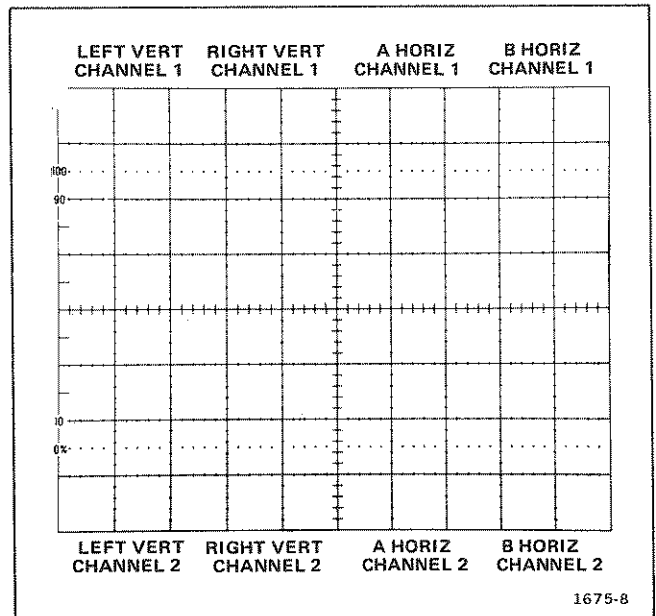


Fig. 1-4. Location of readout display on the crt identifying the originating plug-in and channel.

time the READOUT MANUAL push button is pressed (READOUT PULSED mode only). The brightness of the readout display, when operating in the PULSED mode, is set by the READOUT PRESET control.

Beamfinder

The BEAMFINDER push button switch aides in locating displays that overscan the viewing area vertically or horizontally. When the BEAMFINDER switch is pressed, the display is compressed and defocused within the graticule area (the crt is unblanked by the BEAMFINDER). To locate and reposition an overscanned display, use the following procedure:

1. Depress the BEAMFINDER switch. While the display is compressed, change the vertical and horizontal deflection factors until the vertical deflection is about two divisions and the horizontal deflection is about 4 divisions (the horizontal deflection needs to be reduced only when in the X-Y mode of operation).

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2. Adjust the vertical and horizontal Position controls to center the display on the graticule.
3. Release the BEAMFINDER switch; the display should remain within the graticule.

Control Illumination

The CONTROL ILLUMINATION switch sets the illumination level of the lighted push button switches on the plug-in units. The positions available are OFF, LOW and HIGH. This switch is located on the rear panel of the 7844 and the left side panel of the R7844. The CONTROL ILLUMINATION switch does not affect the function indicator lights (such as TRIG'D lights or SINGLE-SWEEP READY lights).

Calibrator Output

The internal calibrator provides a convenient signal 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. In addition, the calibrator can be used as a convenient signal source for application to external equipment. See Table 2-1 in the Specification section for calibrator accuracy.

VOLTAGE. The calibrator provides accurate output voltages at the CALIBRATOR Output connector from 4 millivolts to 4 volts in decade steps into loads of more than 100 kilohms. In addition, it provides from 0.4 millivolts to 0.4 volt into a 50 ohm load.

CURRENT. The current loop provides a 40 milliamper output which can be used to check and calibrate current-measuring probe systems. The current output is selected by the CALIBRATOR switch when set to the 40 mA position. The current signal is obtained by clipping the probe around the current loop. The arrow above the current loop indicates conventional current flow; i.e., from plus to minus. Forty milliamperes is available from the R7844 when the optional current loop adapter is used (Tektronix part 012-0031-00) and the CALIBRATOR is set for a 4 volt output.

REPETITION RATE. The repetition rate of the calibrator is 1 kilohertz. The calibrator circuit uses frequency-stable components to maintain accurate frequency and constant duty cycle. Thus, the calibrator can be used for checking the basic sweep timing of time-base units.

WAVE SHAPE. The square wave output signal of the calibrator can be used as a reference wave shape when checking

or adjusting the compensation of passive, high-resistance probes. The square wave has a flat top so any distortion in the displayed waveform is due to improper probe compensation.

Probe Power

Two PROBE POWER connectors on the rear panel of the 7844 and the front panel of the R7844 provide power for accessories. Current from these connectors is limited, therefore it is not recommended that they be used as a power source for applications other than the compatible probes or other accessories which are specifically designed for use with this system.

Horizontal Display Mode Combinations

The HORIZONTAL MODE switch allows both beam 1 and beam 2 to be controlled by either A HORIZ or B HORIZ compartments. When both beams use the same time-base unit as a sweep source, the other unused horizontal compartment can be used for special purpose plug-in units such as a counter, digital voltmeter, etc.

The HORIZ SEP (1) control provides horizontal positioning of beam 1 in addition to the Position control of the horizontal plug-in unit selected by the BEAM 1 HORIZONTAL MODE switch. When the same time base is selected for horizontal deflection of both beams, the HORIZ SEP (1) control can be used to align an event on the beam 1 trace so that the timing of both beams coincide.

Vertical Display Mode Combinations

The 7844/R7844 Option 21 model has dedicated vertical plug-in compartments. The left vertical compartment is directly connected to the beam 1 trace and the right vertical compartment is directly connected to the beam 2 trace.

The 7844/R7844 standard model has vertical crossover switching. The VERTICAL MODE switch allows both the beam 1 and beam 2 traces to be controlled by either vertical plug-in compartment. When both beams are being controlled by the same vertical compartment, the VERT SEP (1) control becomes operational. The VERT SEP (1) control will position the beam 1 display above or below the beam 2 display.

Beam 2 Display Characteristics

The readout display is produced on a time-shared basis with the beam 2 crt display in both the PULSED and free-run (non-pulsed) READOUT modes.

When the READOUT controls are set for non-pulsed operation, the beam 2 display is interrupted by the character generator during the time each character is written. The time interval, between characters being written, is automatically varied, thereby reducing the possibility that blank spots in the beam 2 display will be noticeable.

In the READOUT PULSED mode, the readout display is written by beam 2 at the end of each sweep. For single sweep applications, the pulsed mode eliminates the beam 2 display interruptions. However, when high speed repetitive signals are displayed, blank spots on the beam 2 display may appear.

If the beam 2 display interruptions become objectionable, the character generator can be disabled by rotating the READOUT INTENSITY control to the OFF position. For further information on readout operation, refer to the Readout Display discussion in this section.

Amplifier Unit Alternate Operation

Dual-trace 7000-series amplifier plug-in units with alternate display modes can be used with the 7844/R7844. Alternation occurs after the completion of each sweep when each amplifier plug-in unit controls only one beam or when both beams are controlled by the same time-base unit.

However, when the same amplifier unit (set for alternate operation) is selected for vertical deflection of both beams and different time-base units are selected for the horizontal deflection of each beam, a special condition exists in the oscilloscope logic circuits (this condition exists only in instruments which have VERTICAL MODE switches). The B HORIZ time base completes one sweep and locks out further B sweeps until after the next A HORIZ sweep is completed. At the end of A HORIZ sweep, alternation occurs within the amplifier unit and the A HORIZ and B HORIZ sweeps are unlocked for another alternate cycle. A HORIZ sweeps that end before the end of B HORIZ sweep have no effect on alternate operation within the amplifier unit.

Therefore, when an amplifier unit controls the vertical deflection of both beams, both the A HORIZ and B HORIZ compartments must have time-base units installed and each sweep must be running for proper alternate operation within the amplifier unit. If the A HORIZ compartment does not have a time-base unit installed or the time-base sweep is not running, the B HORIZ time-base unit will generate one sweep, then there will be no display. If the B HORIZ compartment does not have a time-base unit installed or the time base sweep is not running, the A HORIZ time-base unit will be displayed.

Trigger Source

The Trigger Source switches allow the horizontal plug-in units to acquire an isolated replica of either the left vertical or right vertical displayed signals. The Trigger Source switches are generally used for internal triggering of time-base units but can be used to route input signals to special purpose plug-in units such as counters.

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 signal. This is accomplished by changing the intensity of the displayed waveform to provide a "gray scale" display.

The voltage amplitude required for visible trace modulation depends on the setting of the INTENSITY controls. A 2 volt peak-to-peak signal will completely blank the display even at maximum intensity levels; lower amplitude signals can be used to increase or decrease the trace brightness. A positive-going signal will decrease the trace brightness and a negative-going signal will increase the trace brightness. Refer to Table 2-1 for signal requirements.

Time markers applied to the Z-AXIS INPUT provide a direct time reference on the display. With uncalibrated horizontal sweep or X-Y mode operation, the time markers provide a means of reading time directly from the display. If the markers are not time-related to the displayed waveform, use a single-sweep display.

Remote Grat/Readout Single Shot

The GRAT/READOUT SINGLE SHOT BNC connector (located on the rear panel) allows an external signal to actuate one frame of readout information and one momentary illumination of the graticule when the READOUT INTENSITY and GRAT ILLUM controls are set to PULSED, and the EXT/BEAM 2 GATED push buttons for READOUT and GRAT ILLUM are set to EXT. The signal source can be either active (pulse generator, logic circuit, etc.) or passive (switch or relay). Refer to Table 2-1, in the Specification section, for input requirements.

Single Sweep Input/Output

The single sweep feature of the 7B-series time-base units can be reset with an external signal applied to the SINGLE SWEEP RESET connector. The signal source can be either active (pulse generator, logic circuit, etc.) or passive (switch or relay). A and B READY outputs are provided for external indicators. The indicators signify that the time-base unit has been reset, and is ready to present a single sweep when the next trigger pulse arrives. Refer to Table 2-1, in the Specification section, for signal parameters.

Output Signals

SAWTOOTH SIGNALS. The A SAWTOOTH connector provides a positive-going sawtooth signal derived from the time-base unit installed in the A HORIZ compartment and the B SAWTOOTH connector provides a positive-going sawtooth signal derived from the time-base unit installed in the B HORIZ compartment. The unit of time for the sawtooth outputs is determined by the setting of the time-base unit Time/Division switch. Refer to Table 2-1, in the Specification section, for signal parameters.

GATE SIGNALS. The A GATE connector provides an output from the time-base unit in the A HORIZ compartment and the B GATE connector provides an output from the time-base unit in the B HORIZ compartment.

When the A or B GATE selector is set to MAIN, the output is a positive-going gate signal derived from the displayed gate.

When the A or B GATE selector is set to DLY'D, the output is a positive-going gate signal derived from the delay gate of those time-base units which furnish a delay gate. The output is always positive when no plug-in unit is installed or the plug-in unit does not provide a delay gate. Refer to Table 2-1 in the Specification section and to the specifications in the time-base unit instruction manual for signal parameters.

Display Photography

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

The crt bezel provides integral mounting for a Tektronix oscilloscope camera. The 3 pins, located on the left side of the crt bezel, connect power to compatible camera systems. Control signals are also received from Tektronix automatic cameras to allow camera-controlled single-shot photography (see camera instruction manual for further information).

The 7844/R7844 provides readout and pulsed graticule illumination to aid in single-sweep photography. To activate the pulsed functions, set the READOUT INTENSITY and GRAT ILLUM controls to the PULSED detent.

When both the READOUT and GRAT ILLUM EXT/BEAM 2 GATED switches are set to BEAM 2 GATED, one readout frame is displayed and the graticule illumination is turned on at the end of beam 2 sweep (be sure the camera

shutter remains open at least 0.5 second after the sweep is completed to photograph the readout display and the graticule). The pulsed readout and graticule illumination functions can also be actuated by an external signal applied to the rear-panel GRAT/READOUT SINGLE SHOT connector or by the front-panel MANUAL push buttons.

For more information on single-sweep and photographic related functions, refer to the Graticule Illumination, Readout Display, Remote Grat/Readout Single Shot, Light Filters, and Single Sweep Input/Output discussions in this section

NOTE

For instruments equipped with Option 22 (Photographic writing speed enhancer) refer to Section 4.

APPLICATIONS

The 7844 Oscilloscope and its associated plug-in units provide a very flexible measurement system. The capabilities of the overall system depend mainly upon the plug-in units selected for use with this instrument. Specific applications for the individual plug-in units are described in the plug-in unit instruction manuals. The overall system can also be used for many applications which are not described in detail, either in this manual or in the manuals for the individual plug-in units. Contact your Tektronix Field Office or representative for assistance in making specific measurements with this instrument.

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

John D. Lenk, "Handbook of Oscilloscopes, Theory, and Application", Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1968.

J. Czech, "Oscilloscope Measuring Techniques", Springer-Verlag, New York, 1965.

J. F. Golding, "Measuring Oscilloscopes", Transatlantic Arts, Inc., 1971.

Charles H. Roth Jr., "Use of the Oscilloscope", A Programmed text, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1970.

Vertical Amplifier Plug-In Units

All 7A-series plug-in units can be used with the 7844/R7844. Bandwidth and sensitivity ranges should be taken into consideration when selecting amplifier plug-in units.

SINGLE-TRACE. Any single-channel amplifier will display a signal, with the sweep provided by any 7B-series time base plug-in. This combination leaves 2 unused compartments available for other special purpose units. Blank plug-in panels are available to cover any unfilled plug-in compartments.

DUAL-TRACE. A dual-channel amplifier in either vertical compartment can display 2 separate signals with the other vertical compartment free for other uses.

THREE-TRACE. A dual-channel amplifier can be used with any single-channel amplifier to display 3 separate signals. If 2 sweep plug-in units are used in the horizontal compartments 2 signals can be displayed at 1 sweep rate while the other signal is displayed at the other sweep rate.

FOUR-TRACE. Two dual-channel amplifiers can display 4 separate signals. If 1 time-base unit is used, all 4 signals will be displayed at the same sweep rate.

Time-Base Plug-In Units

The 7844/R7844 is compatible with time-base units of the 7B70 and 7B90 series. Sweep rates and triggering ranges should be taken into consideration when selecting time-base plug-in units.

To obtain a delayed-sweep display, a delaying time-base unit must be inserted in the A HORIZ compartment and a delayed time-base unit installed in the B HORIZ compartment. A delayed-sweep display can also be obtained with 1 horizontal plug-in unit in either horizontal compartment if a dual time-base unit is used. This leaves the other horizontal compartment available for other plug-in units as suggested later in this section.

The 7B50-series time base units are not recommended for use with this instrument because they require a longer delay line than is used in the 7844/R7844. Therefore, the triggering event may not appear on the display.

CAUTION

The 7B53AN Option 11 must not be used in the 7844/R7844 because the interface connectors are not totally compatible.

Sampling Displays

Sampling-system plug-in units for the 7000-series oscilloscopes provide displays of fast-changing signals that cannot be examined using any other method. For example, sampling systems available for the 7844/R7844 can resolve repetitive signals having less than 10 millivolts of peak amplitude and occurring in less than 1 nanosecond.

The technique used for sampling is very similar in principle to the use of stroboscopic light to study fast motion. Samples of successive waveforms are taken, amplified by a relatively low-bandwidth amplifier, and then displayed on the crt as a replica of the sampled waveforms.

Three sampling systems are available at this time for the 7844: (1) the 7S12, which provides time-domain reflectometer displays or general-purpose measurements, (2) the 7S11/7T11 system and (3) 7S14, a dual-channel vertical sampling system, including main and delayed sweep functions. See the Tektronix catalog to determine the characteristics of the individual units mentioned and of additional units made available after this manual was written.

SINGLE-TRACE SAMPLING. A single-trace sampling display requires either a double-width 7S12 (which includes a time-base), or the 7S11 sampling unit and the 7T11 sampling sweep unit. Direct interconnections between the 7S11 and the 7T11 require these units to be adjacent, with the 7S11 in the RIGHT VERT compartment and the 7T11 in the A HORIZ compartment. If either the 7S12 or the 7S14 is used, it must be located in the 2 middle compartments to make the proper connections with the 7844/R7844.

DUAL-TRACE SAMPLING. Two 7S11's can be used with a single sampling-time-base unit for time-related displays of two signals. Direct interconnections from the LEFT VERT 7S11 pass through the RIGHT VERT 7S11 to reach the A HORIZ time-base unit.

The 7S14 is a dual-channel sampling unit with delaying sweep capability. It must be used in the 2 center plug-in compartments.

Dual-trace sampling displays can also be made by a 7S12 in the 2 middle compartments and a 7S11 in the LEFT VERT compartment. In this application the 7S12 supplies the time-base for both traces.

X-Y SAMPLING. One 7S11 inserted in the RIGHT VERT compartment and one in the adjacent A HORIZ compartment automatically share a 50 kilohertz free-running strobe

condition specified for X-Y displays. The 7S14 has X-Y operation incorporated as one of its normal mode functions.

Special Purpose Plug-In Units

The variety of special-purpose plug-in units available allows the 7844/R7844 Oscilloscope to be used for many specialized applications. The following is a brief discussion of some of the available special-purpose plug-in units.

DIGITAL COUNTERS AND MULTIMETER PLUG-IN

UNITS. The digital multimeter plug-in units measure current, voltage, temperature, and resistance; digital frequency counter plug-in units measure frequency, from dc to above 500 MHz. These units make use of the readout system to display the measured information on the crt and can function in any compartment, in combination with each other or with any other plug-in units available for use with the 7844/R7844 oscilloscope system.

The ability of digital readout plug-in units to operate with other plug-in units makes it possible to process and monitor signals at the same time the digital measurement is being made. For example, by locating a frequency counter in one of the vertical compartments and an amplifier unit in the other vertical compartment, the crt can display the trigger waveform, superimposed on the displayed signal, to indicate the actual triggering point. Or, if the counter is placed in a horizontal compartment, a low-amplitude signal can be applied to a vertical amplifier and amplified before it is internally routed, by the trigger source switches to the counter trigger circuit. This allows the unit to be used on signals too small to trigger other counters.

READOUT ACCESS PLUG-IN UNIT. The 7M13 READ-OUT plug-in unit provides front-panel keyboard operation for convenient access to the crt readout characters. This allows information, such as dates and identifying nomenclature, to be displayed on the crt with the normal crt display. This capability is particularly useful when making photographs.

TRANSISTOR CURVE-TRACER PLUG-IN UNITS. The 7000-series transistor curve-tracer plug-in units check small-signal transistors and diodes by producing a display showing the basic characteristic curves for the device being tested. Stepped sweep signals from an internal power supply are applied to the device under test. The resulting output signals are, in turn, applied to the horizontal and vertical deflection systems of the oscilloscope to plot a family of characteristic curves. This plot can be used to check for damaged transistors and diodes, or to select for special or matched characteristics, and to calculate gain, leakage, breakdown voltage, etc.

SPECTRUM ANALYZER PLUG-IN UNITS. The 7000-series spectrum analyzer plug-in units display applied signal amplitude dispersed over portions of the rf spectrum. Absolute signal energy is plotted on the vertical axis against frequency on the horizontal axis. Applications include waveform and distortion analysis, emi and random noise measurement, filter design, spectrum surveillance, etc.

DIRECT ACCESS UNIT. This plug-in unit provides ac coupling of high-frequency or fast-risetime signals directly to the crt vertical deflection plates. Two front-panel input connectors permit either single ended or differential operation (internally selected). Trace positioning is accomplished with a front-panel control. Direct access units can be installed in either or both vertical compartments. However, the readout capability for the 7844/R7844 is lost when installed in the right vertical compartment. Also, the VERTICAL MODE switch is inoperative on the standard 7844/R7844 when the direct access unit is installed in either vertical compartment. When one direct access unit is installed in either compartment the other compartment can be used for normal plug-in functions. Refer to the direct access unit instruction manual for installation information.

X-Y Operation

In some applications, it is desirable to display one signal versus another (x-y) rather than against time (internal sweep). The flexibility of the amplifier plug-in units available for use with the 7844/R7844 provide the means of applying external signals to the horizontal deflection system.

Installation of a 7A-series amplifier plug-in unit in one of the horizontal and one of the vertical compartments provides x-y operation. For further information, refer to the horizontal specifications in this manual and to the instruction manual for the amplifier units.

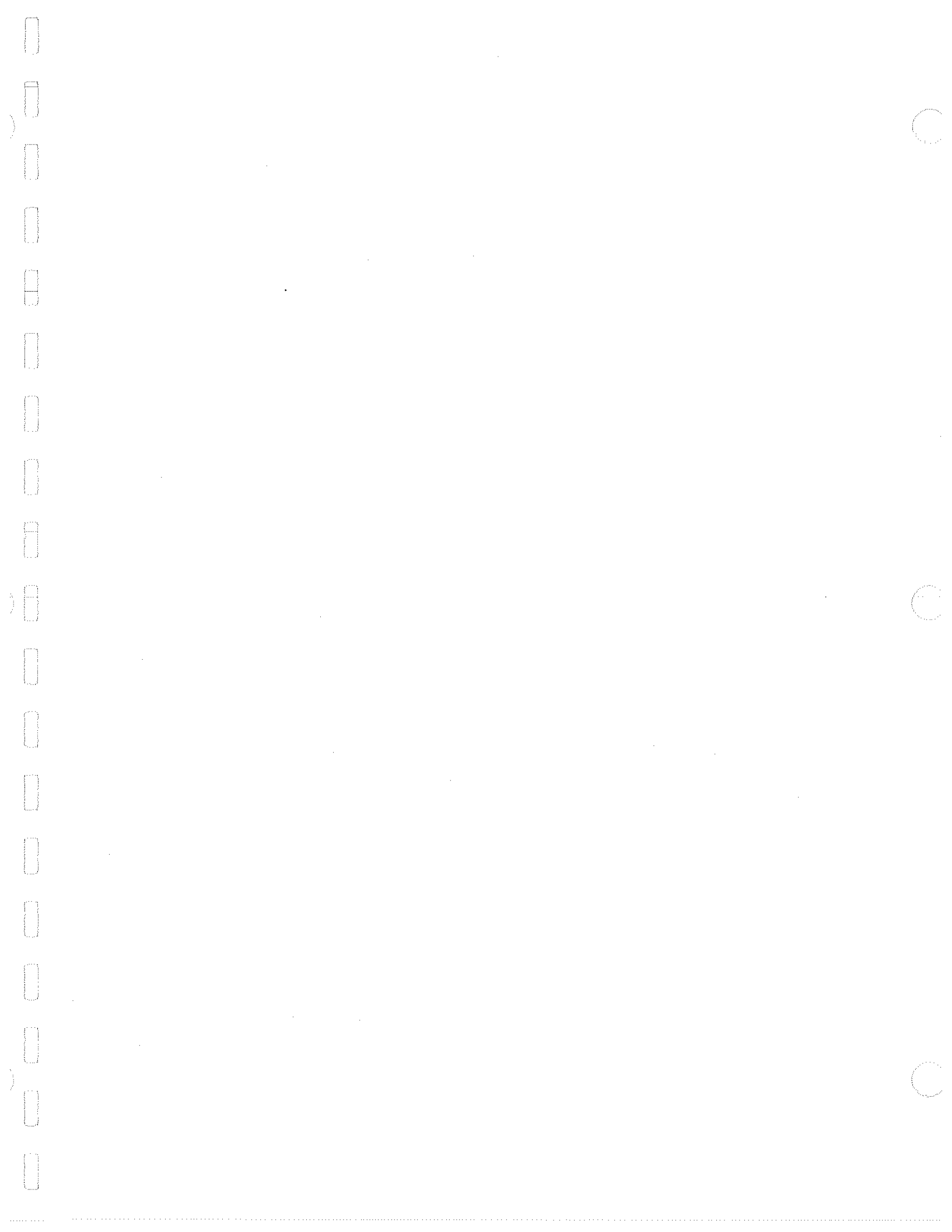
Some of the 7B series time-base units can be operated as amplifiers in addition to their normal uses as time-base generators. This feature allows an external signal to provide the horizontal deflection to the crt. For most of the time-base units with the amplifier function, the X (horizontal) deflection signal can be connected either to an external input connector on the time-base unit, or it can be routed to the time-base unit through the internal triggering system (see time-base instruction manual for details). If the latter method is used, the A and B TRIG SOURCE switches must be set so that the X (horizontal) deflection signal is obtained from one of the vertical amplifier units and the Y (vertical) deflection signal is obtained from the other vertical unit. The attenuator switch on the amplifier unit can provide the horizontal with a preconditioned signal, compatible to the horizontal deflection factor. Also, plug-in units need not be moved between compartments when changing from X-Y operation to other modes of operation.

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. One way of accomplishing this is by installing a 7B-series time-base unit in one of the horizontal compartments, and a dual-trace 7A-series amplifier unit in one of the vertical compartments. A sawtooth signal must be externally connected to one of the dual-trace amplifier inputs. Normally, the vertical unit should be swept slower than the horizontal unit; the number of horizontal traces in the raster depends upon the ratio of the two sweep rates. Information can be displayed on the raster using different methods. To display information, a signal connected to the unused input of the dual-trace amplifier unit can be added to the vertical deflection. Using this method, the vertical signal amplitude on the crt should not exceed the distance between the horizontal lines of the raster. Another method of displaying information on the raster is to use the Z-AXIS

input to provide intensity modulation of the raster display. With this system, a 7B-series time-base unit can be substituted for the external sawtooth generator and the dual-trace amplifier unit. This type of raster display could be used to provide a television-type display. Additional information for using the Z-AXIS feature is given under Intensity Modulation.

To provide a stable raster display, both time-base units must be correctly triggered. Internal triggering is not provided for the time-base units when they are used in the vertical compartments (external triggering must be used). Also, blanking is not provided for the time-base units when they are installed in the vertical compartment. To blank out the retrace portion from the time-base unit in the vertical compartment, special connection must be made from the time-base unit to the blanking network (for further information, see the time-base unit instruction manual).



SPECIFICATION

INTRODUCTION

Information given in this section of the manual applies to both the 7844 and R7844 Dual-Beam Oscilloscopes, except as otherwise indicated. The R7844 is electrically identical to the 7844, but is adapted for mounting in a standard 19-inch rack. Rackmounting Instructions and a dimensional drawing for the R7844 are given in Section 3.

This instrument will meet the electrical characteristics listed in the Performance Requirement column of Table 2-1 following complete calibration as given in the Service Instruction

Manual. The following electrical characteristics apply over an ambient temperature range of 0°C to +50°C, except as otherwise indicated. Warmup time for given accuracy is 20 minutes.

NOTE

Many of the measurement capabilities of this instrument are determined by the choice of plug-in units. The following characteristics apply to the 7844/R7844 Oscilloscope only. See the System Specification in this section (Tables 2-2 and 2-3) for specifications of the complete system.

TABLE 2-1
Electrical

Characteristic	Performance Requirement	Supplemental Information
VERTICAL		
Deflection Factor	Compatible with all 7-series plug-in units	
Accuracy	1% or less difference between vertical compartments	
Low-Frequency Linearity	0.1 div or less compression or expansion of a center-screen, 2-div signal positioned anywhere vertically within the graticule area	
System Bandwidth	Varies with plug-in selected. See 7800-Series Oscilloscope Systems Specification	Refer to Table 2-2
Isolation Between Beam 1 and Beam 2 All Vertical Modes	At least 100:1 from dc to 150 MHz and at least 30:1 from 150 MHz to 400 MHz	
Delay Line		Permits viewing the leading edge of an internally triggered signal. Delay Line not compatible with 7B50-series time-base units.

TABLE 2-1 (cont.)
Electrical

Characteristic	Performance Requirement		Supplemental Information
Vertical Display Modes	Plug-in compartment controlling vertical deflection of electron beam		
7844/R7844	BEAM 1	BEAM 2	Selected by front-panel VERTICAL MODE switch
	LEFT	LEFT	
	LEFT	RIGHT	
	RIGHT	LEFT	
	RIGHT	RIGHT	
7844/R7844 Option 21 only	LEFT	RIGHT	
Vertical Centering			Within 0.5 div of graticule center
Vertical Separation Control Range (deleted by Option 21)			Beam 1 trace can be positioned at least +4 and -4 div with respect to beam 2 trace

TRIGGERING

Trigger Source		Supplemental Information
A HORIZ	LEFT VERT or RIGHT VERT compartment	Selected by front-panel A TRIG SOURCE and B TRIG SOURCE switches
B HORIZ	LEFT VERT or RIGHT VERT compartment	

HORIZONTAL

Deflection Factor	Compatible with all 7-series plug-in units		
Accuracy	1% or less difference between horizontal compartments		
Low-Frequency Linearity	0.1 div or less compression or expansion with a center-screen 2 div signal positioned anywhere horizontally within the graticule area		
Fastest Calibrated Sweep Rate	1 ns/div		
Horizontal Display Modes	Plug-in compartment controlling horizontal deflection of electron beam		Selected by front-panel HORIZONTAL MODE switches
	BEAM 1	BEAM 2	
	A	A	
	A	B	
	B	A	
B	B		

TABLE 2-1 (cont.)
Electrical

Characteristic	Performance Requirement	Supplemental Information
Phase Shift Between Vertical and Horizontal Deflection Systems		2° or less from dc to at least 50 kHz
Bandwidth (10 div reference)		Dc to at least 1 MHz
Horizontal Centering		Within 0.5 div of graticule center
Horizontal Separation Control Range		Beam 1 event can be positioned at least 0.25 div to the left, 0.25 div to the right, and 2 div total range with respect to Beam 2 event
DISPLAY		
CRT Graticule Type	Internal	
Area	8 div vertical by 10 div horizontal. Each div equals 1 cm.	
Illumination	Variable, with edge lighting	
PULSED modes		Selected by front-panel GRAT ILLUM controls
BEAM 2 GATED	The graticule illumination is triggered at the end of each sweep of beam 2.	
EXTERNAL	The graticule is illuminated momentarily when an appropriate remote signal is applied to the rear-panel GRAT/READOUT SINGLE SHOT connector.	
MANUAL	The graticule is illuminated momentarily when the MANUAL push button is pressed independently of other PULSED modes.	
BEAMFINDER (BEAM 1)		Limits beam 1 display within the graticule area when actuated. The beam 1 intensity turns on independently of horizontal plug-in status.
BEAMFINDER (BEAM 2)		Limits beam 2 display within the graticule area when actuated. The beam 2 intensity turns on independently of horizontal plug-in status.
CRT Phosphor	P31	P11 available with Option 78

TABLE 2-1 (cont.)
Electrical

Characteristic	Performance Requirement	Supplemental Information
Minimum Photographic Writing Speed with Type 47 Polaroid Film (without film fogging)		After 5 minutes phosphor decay time
P-11 phosphor Tektronix C-27R Camera with f1.3 Lens and 1:0.5 Object-to-Image Ratio		1.5 cm/ns
Tektronix C-51R Camera with f1.2 Lens and 1:0.5 Object-to-Image Ratio		1.7 cm/ns
P-31 Phosphor		Writing speed for P31 phosphor is approximately ½ the writing speed for P11 phosphor in typical applications.
With Option 22 Writing Speed Enhancer		Writing speed is approximately 2 times the specified writing speed

CALIBRATOR

Waveshape	Square wave	
Polarity	Positive going with baseline near ground	
Source Impedance		450 Ω
Output Voltage Into 100 kΩ or Greater	4 mV, 40 mV, 0.4 V, 4 V	Selected by front-panel CALIBRATOR switch
Into 50 Ω	0.4 mV, 4 mV, 40 mV, 0.4 V	
Output Current 7844	40 mA	Available through front-panel current loop when CALIBRATOR switch is set to 40 mA
R7844	40 mA	Available through CALIBRATOR output with optional BNC-to-Current Loop Adapter, Tektronix part 012-0341-00. CALIBRATOR Switch must be set to the 4 V position for 40 mA output.
Amplitude Accuracy (p-p voltage and current)	Within 1%	
Repetition Rate	1 kHz within 0.25%.	
Duty Cycle	49.8% to 50.2%	
Risetime and Faltime	250 ns or less into 100 pF or less	

TABLE 2-1 (cont.)
Electrical

Characteristic	Performance Requirement	Supplemental Information
SIGNAL OUTPUTS		
A SAWTOOTH Source	Time-base unit in A HORIZ Compartment	
Polarity		Positive-going with base-line at 0 V within 1 V (into 1 M Ω)
Output Voltage Rate of Rise Into 50 Ω	50 mV/unit of time (selected by time-base time/div switch) within 15%. 100 ns/div maximum	
Into 1 M Ω Paralleled by 150 pF	1 V/unit of time (selected by time-base time/div switch) within 10%. 1 μ s/div maximum	
Output Resistance		Approximately 950 Ω
B SAWTOOTH Source	Time-base unit in B HORIZ Compartment	
Polarity		Positive-going with baseline at 0 V within 1 V (into 1 M Ω)
Output Voltage Rate of Rise Into 50 Ω	50 mV/unit of time (selected by time-base time/div switch) within 15%. 100 ns/div maximum	
Into 1 M Ω Paralleled by 150 pF	1 V/unit of time (selected by time-base time/div switch) within 10%. 1 μ s/div maximum	
Output Resistance		Approximately 950 Ω
A GATE Source	MAIN or DLY'D gates from time-base unit installed in the A HORIZ compartment	Selected by rear-panel switch
MAIN		Derived from the displayed sweep, gate is positive-going with baseline at 0 V within 0.1 V (into 1 M Ω)
DLY'D		Derived from the delay gate of those time-base units that furnish a delay gate (see plug-in unit specification) and is a positive level with base line at 0 V within 0.1 V (into 1 M Ω). Output is always positive when no plug-in is used or plug-in does not provide a delay gate.

TABLE 2-1 (cont.)
Electrical

Characteristic	Performance Requirement	Supplemental Information
Output Voltage Input 50 Ω	0.5 V within 10%	
Into 1 MΩ	10 V within 10% (up to 1 μs/div)	
Risetime Into 50 Ω		5 ns or less
Output Resistance		Approximately 950 Ω
B GATE Source	MAIN or DLY'D gates from time-base unit installed in the B HORIZ compartment	Selected by rear-panel switch
MAIN		Derived from the displayed sweep, gate is positive-going with baseline at 0 V within 0.1 V (into 1 MΩ)
DLY'D		Derived from the delay gate of those time-base units that furnish a delay gate (see plug-in unit specification) and is a positive level with baseline at 0 V within 0.1 V (into 1 MΩ). Output is always positive when no plug-in is used or plug-in does not provide a delay gate.
Output Voltage Input 50 Ω	0.5 V within 10%	
Into 1 MΩ	10 V within 10% (up to 1 μs/div)	
Risetime Into 50 Ω		5 ns or less
Output Resistance		Approximately 950 Ω

BEAM 1 and 2 EXTERNAL Z-AXIS INPUT

Sensitivity	2 V p-p provides trace modulation over full intensity range	Approximately 0 V input produces no intensity change
Polarity of Operation	Positive-going signal decreases trace intensity; negative-going signal increases trace intensity	
Intensity Circuit Pulse Performance (between rear-panel connector and crt)		
Low-Frequency Limit		dc
Risetime With Negative-Going Input and Falltime with Positive-Going Input		Approximately 15 ns

TABLE 2-1 (cont.)
Electrical

Characteristic	Performance Requirement	Supplemental Information
Propagation Delay		Approximately 30 ns
Input Resistance at DC		Approximately 500 Ω
Maximum Safe Input Voltage		15 V (dc + peak ac)
Maximum Repetition Rate		1 MHz
REMOTE CONNECTORS AND SWITCHES		
CONTROL ILLUMINATION (for plug-in units only)	HIGH, LOW, OFF	The three-position switch is located on the left side-panel of the R7844 and on the rear panel of the 7844
SINGLE SWEEP RESET (rear panel)		BNC connector. Remote single-sweep reset (A and B HORIZ) with compatible time-base units
Signal Required		Switching from the high level (+50 V to +10 V; sink less than 40 μ A) to the low level (+0.5 V to -5 V; sink less than 10 mA), in less than 1 ms, resets the sweep
Minimum Pulse Width		10 μ s at 50% amplitude points
Maximum Safe Input		+50 V to -5 V
A SINGLE SWEEP READY (rear panel)		BNC connector. Remote ready indicator for A HORIZ time-base unit
Output Signal		Open when not ready; +5 V at 47 Ω source impedance when ready. Output will light a No. 49 bulb.
B SINGLE SWEEP READY (rear panel)		BNC connector. Remote ready indicator from B HORIZ time-base unit
Output Signal		Open when not ready; +5 V at 47 Ω source impedance when ready. Output will light a No. 49 bulb
GRAT/READOUT SINGLE SHOT (rear panel) Signal Required		BNC connector. Switching to the low level (+1 to -5 V; sink less than 2 mA) from the high level (+10 V to +15 V; sink less than 300 μ A), in less than 1 μ s, initiates the Readout System to display one complete readout frame and the graticule illumination to be displayed for approximately 0.5 s

TABLE 2-1 (cont.)
Electrical

Characteristic	Performance Requirement	Supplemental Information
Maximum Open Circuit Voltage		+15 V
Maximum Safe Input Voltage		+15 V, -5 V (dc + peak ac)
READOUT DISPLAY		
Mode (front panel) Free-run (not marked)	The alphanumeric readout is continuously displayed	Selected by front-panel READOUT INTENSITY control
PULSED BEAM 2 GATED	The readout display is triggered at the end of each sweep of beam 2	
EXTERNAL	One readout frame is displayed when an appropriate remote signal is applied to the rear-panel GRAT/READOUT SINGLE SHOT connector	
MANUAL	One readout frame is displayed when the MANUAL push button is pressed	
Mode (internal switch) Free-Run (FR)	The internal readout mode is dependent on the front-panel Readout Mode	
Beam 2 Gated	The readout display is triggered at the end of each sweep of beam 2. The internal Readout Mode Switch operates independently of the front-panel READOUT controls	
Character Height		0.25 div to 0.5 div (adjustable)
POWER SOURCE		
Line Voltage Range (ac, rms)		Selected by rear-panel Line Selector switch
115 V Nominal	90 to 132 V	
230 V Nominal	180 to 264 V	
Line Frequency		48 to 440 Hz
Maximum Power Consumption		235 W, 2.9 A at 60 Hz, 115 V line

SYSTEM ELECTRICAL SPECIFICATION

Your Tektronix 7844/R7844 oscilloscope system provides exceptional flexibility in operation with a wide choice of general and special purpose plug-in units. The type number of a particular plug-in unit identifies its usage as follows:

The first digit (7) denotes the oscilloscope system for which the plug-in unit is designed (7000-series).

The second letter describes the purpose of the plug-in unit:

- A—Amplifier unit
- B—"Real time" time-base unit
- C—Curve Tracer
- D—Digital unit
- L—Spectrum Analyzer
- M—Miscellaneous

- S—Sampling unit.
- T—Sampling time-base unit

The third and fourth digits of the plug-in type number are sequence numbers and do not carry any special connotation.

An "N" suffix letter added to the normal four-digit type number identifies a unit not equipped with the circuitry necessary to encode data for the 7000-series readout system.

Table 2-2 lists the vertical specifications which are system dependent. For more complete specifications on plug-in units for the 7000-Series Oscilloscope System, refer to the Tektronix Products catalog.

TABLE 2-2
7844/R7844 Oscilloscope
System Vertical Specification

Amplifier Plug-In Unit	Probe	Bandwidth (MHz)	Risetime (ns)	Accuracy ¹	
				EXT CAL 0°C to 50°C (%)	INT CAL 0°C to 50°C (%)
7A11	Integral	200	1.8	2	3
7A12	None	105	3.4	2	3
	P6053B			3	4
7A13	None	100	3.5	1.5	2.5
	P6053B P6055	65	5.4		
7A14	P6021	55	6.4	2	3
	P6022	110	3.2		
7A15A/N	None	80	4.4	2	3
	P6053B			3	4
7A16A	None	175	2.0	2	3
	P6053B			3	4
7A17	None	150	2.4		
7A18	None	75	4.7	2	3
	P6053B			3	4
7A19	None	400 ²	0.9 ²	3	4
	P6056, P6057			4	5
	P6201	375 ²	1.0 ²	4	5

¹ Deflection Factor accuracy is checked as follows:
EXT CAL 0°C to 50°C—Plug-in gain set at a temperature within 10°C of operating temperature, using an external calibrator with accuracy within 0.25%.

INT CAL 0°C to 50°C—Plug-in gain set using the oscilloscope calibrator (within 10°C of the operating temperature) in a temperature range between 0°C and +50°C.

² System temperature range from 0°C to +35°C; derate for 0°C to +50°C temperature range.

TABLE 2-2 (cont.)
7844/R7844 Oscilloscope
System Vertical Specification

Amplifier Plug-In Unit	Probe	Bandwidth (MHz)	Risetime (ns)	Accuracy ¹	
				EXT CAL 0°C to 50°C (%)	INT CAL 0°C to 50°C (%)
7A19 (10 mV/Div only)	None	325	1.1	3	4
	P6056, P6057			4	5
	P6201	300	1.2	4	5
7A21N	None	1000	0.35		
7A22	None or Any	1 MHz (within 10%)	350 (within 9%)	2	3
7A24	None	300 ²	1.2 ²	3	4
	P6056, P6057			4	5
	P6201	275 ²	1.3 ²	4	5
7A26	None	160	2.2	2	3
	P6053B			3	4

Table 2-3 lists the horizontal specifications which are system dependent. For more complete specifications on plug-in units for the 7000-Series Oscilloscope System, refer to the Tektronix Products Catalog.

TABLE 2-3
7844/R7844 Oscilloscope
System Horizontal Specification

Time Base Unit	Performance Feature	Maximum Calibrated Sweep Rate	Triggering Frequency Range
7B70	Delayed Sweep & Ext Amplifier	2 ns/div	Dc to 200 MHz
7B71	Delaying Sweep	2 ns/div	Dc to 200 MHz
7B92	Display Switching	1 ns/div	Dc to 500 MHz

TABLE 2-4
Special Purpose and Sampling Plug-In Units

Plug-In	Performance Feature
7CT1N	Low-Power Semiconductor Curve Tracer
7D11	Digital Delay Unit
7D12	A/D Converter; plug-in Modules provide flexible measurement capability.
7D13	Measures Temperature, Voltage, Current and Resistance
7D14	Directly Gated Counter to 525 MHz
7K11	CATV Preamplifier
7L12	100 kHz to 1.8 MHz Spectrum Analyzer
7L13	10 kHz to 1.8 GHz Spectrum Analyzer
7M11	Dual Delay Line
7M13	Readout Access Unit
7S11	Accepts Plug-In Sampling Heads
7S12	Time Domain Reflectometer and Sampling Applications
7S14	Dual-Trace Delayed Sweep Sampler
7T11	Random or Sequential; Equivalent or Real-Time Sampling

¹ Deflection Factor accuracy is checked as follows:
EXT CAL 0°C to 50°C—Plug-in gain set at a temperature within 10°C of operating temperature, using an external calibrator with accuracy within 0.25%.

INT CAL 0°C to 50°C—Plug-in gain set using the oscilloscope calibrator (within 10°C of the operating temperature) in a temperature range between 0°C and +50°C.

² System temperature range from 0°C to +35°C; derate for 0°C to +50°C temperature range.

TABLE 2-5
Environmental

Characteristic	Information
NOTE	
<i>This instrument will meet the electrical characteristics given in the Performance Requirement column of Table 2-1 over the following environmental limits.</i>	
Temperature Range Operating	0°C to +50°C
Non-Operating	-55°C to +75°C
Altitude Operating	15,000 feet
Non-Operating	Test limit 50,000 feet
Electro-Magnetic Interference (emi) in accordance with MIL-STD-461A as tested in MIL-STD-462 (when equipped with Option 3)	NOTE
Radiated Interference	<i>Any unused plug-in compartments must be covered with a blank plug-in panel (emi shielded) in order to meet emi specifications. See Options section for additional information.</i> Interference radiated from the instrument under test within the given limits from 150 kHz to 1000 MHz
Conducted Interference	Interference conducted out of the instrument under test through the power cord within the given limits from 150 kHz to 25 MHz
Transportation (packaged instrument, without plug-ins)	Qualifies under National Safe Transit Committee test procedure 1A, Category 11

TABLE 2-6
Physical

Characteristic	Information	
Ventilation	Safe operating temperature maintained by dc fan. Automatic resetting thermal cutout protects instrument from overheating	
Warm-up Time	20 minutes for rated accuracy	
Finish	Anodized front panel. 7844—blue vinyl painted aluminum cabinet, R7844—lacquered aluminum cabinet	
Overall Dimensions (measured at maximum points)	7844	R7844
Height	13.6 inch 34.5 cm	7.0 inch 17.8 cm
Width	12.0 inch 30.5 cm	19.0 inch 48.3 cm

TABLE 2-6 (cont.)
Physical

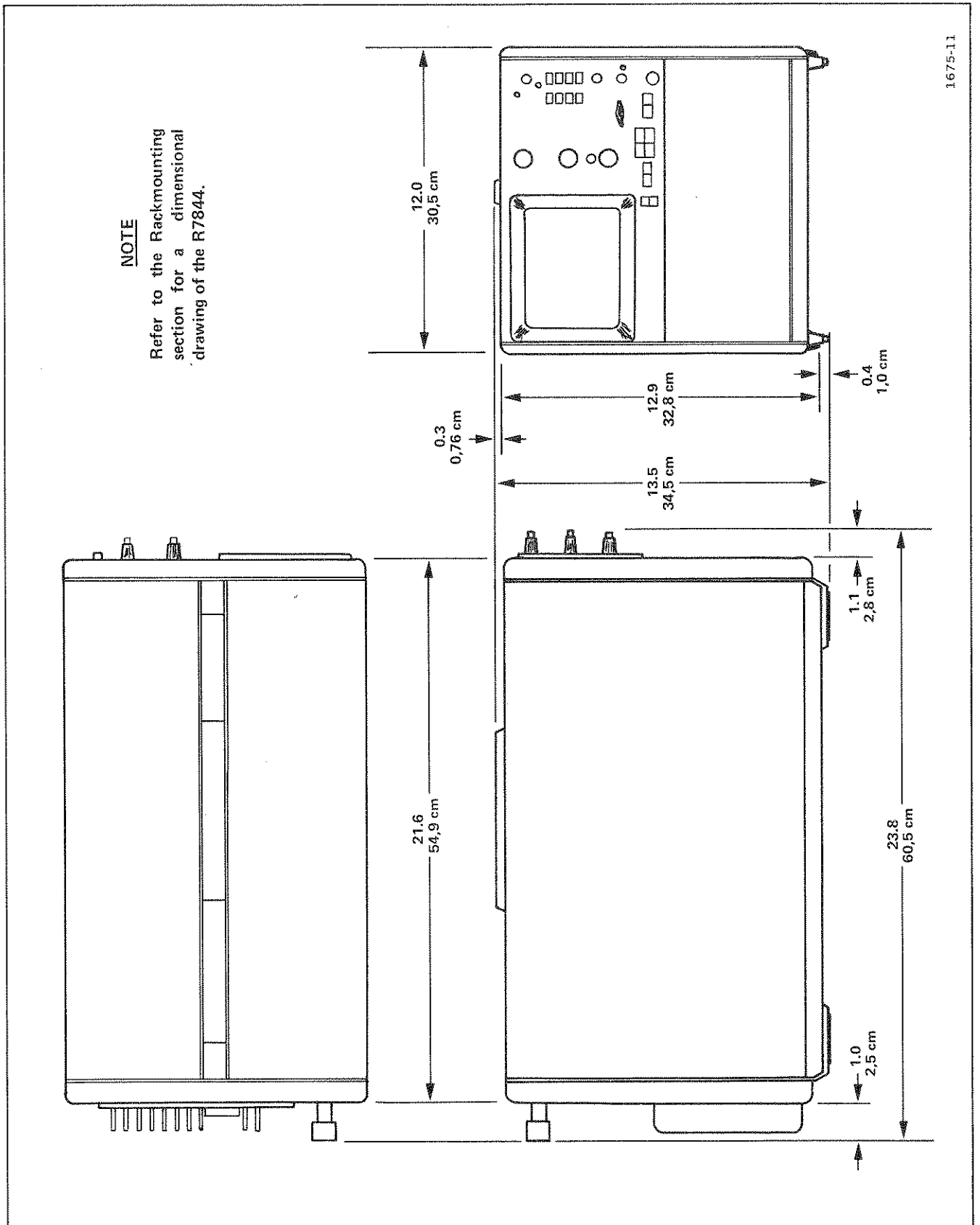
Characteristic	Information	
	7844	R7844
Length	23.8 inch 60.5 cm	22.8 inch 57.9 cm
Net Weight (Instrument Only)	36 lbs 16.3 kg	33 lbs 15.0 kg

NOTE

See Fig. 2-1 for 7844 dimensional drawing. Refer to Fig. 3-6, in Section 3 for the R7844 dimensional drawing.

STANDARD ACCESSORIES

Standard accessories supplied with the 7844 and R7844 are given in the Mechanical Parts List illustrations in the Service manual. For optional accessories available for use with this instrument, see the Tektronix Products Catalog.



1675-11

Fig. 2-1. 7844 dimensional drawing.

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RACKMOUNTING INSTRUCTIONS

INTRODUCTION

The R7844 is designed to be installed in a standard 19-inch rack with Universal hole spacing. (If a rack with other than Universal hole spacing is used, additional mounting holes may need to be drilled.)

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 supplies 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.

INSTRUMENT DIMENSIONS

A drawing showing the major dimensions of the R7844 is shown in Fig. 3-6.

RACK DIMENSIONS

Height

At least 7 inches of vertical space are required to mount this instrument in a rack. This gives enough clearance for adjacent instruments and panels. (Additional height may be required if an oscilloscope camera is to be used with this instrument.)

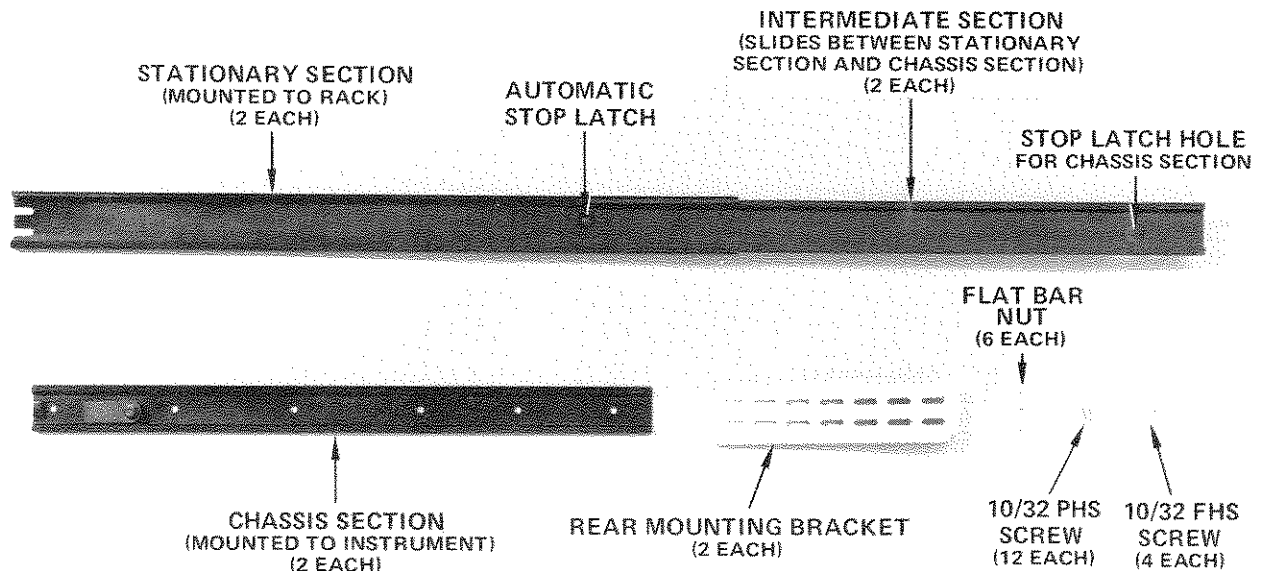
Width

Minimum space between the front rails of the rack is 17.625 inches. This space allows the slide-out tracks to operate freely, permitting the R7844 to move in and out of the rack.

Depth

Total depth required to mount this instrument in an enclosed cabinet rack is approximately 24 inches. This allows enough space for air circulation, signal connections, and the power cord.

The rear mounting brackets allow this instrument to be mounted in racks with 14.625 to 28.5 inches between the front and rear rails. The R7844 must be properly supported at the rear. Improper support may result in instrument



1675-1

Fig. 3-1. Slide-out track assembly.

SLIDE-OUT TRACKS

The slide-out tracks provided with this instrument permit it to be extended out of the rack for maintenance and calibration without removing it from the rack. Be sure the power cord and signal cables are long enough to allow operation in the extended position.

The slide-out tracks consist of two assemblies, one for the left side of the instrument and one for the right side. Fig. 3-1 shows the slide-out track assembly. The stationary section of each assembly attaches to the front and rear rails of the rack. The chassis sections allow the instrument to be extended out of the rack.

The hardware needed to mount the tracks to the rack is shown in Fig. 3-1. Since enough hardware is supplied to make the tracks compatible with a variety of racks and installation methods, some of it may not be needed.

MOUNTING PROCEDURE

1. Select the proper front-rail mounting holes for the stationary sections using the measurements shown in Fig. 3-2.
2. Mount the front flanges of the stationary sections to the front rails of the rack with a bar nut and two pan-head screws (see Fig. 3-3A).

3. Mount the rear of the stationary sections to the rear rails using the method shown in Fig. 3-3B or 3-3C. Be sure that the tracks are level.

4. Refer to Fig. 3-4 to install the instrument into the rack.

5. See Fig. 3-5 to adjust the alignment of the stationary sections.

6. After the tracks operate smoothly, connect the power cord and all necessary cables to the rear panel connectors. Push the instrument all the way into the rack and secure it to the front rail of the rack with the securing screws and washers shown in Fig. 3-2. If the securing holes are not tapped, use a "speed-nut" or similar item to install the securing screws.

NOTE

If the rails of the rack are tapped, either drill out the holes with a 0.196-inch drill, or mount the front flanges in front of the rails.

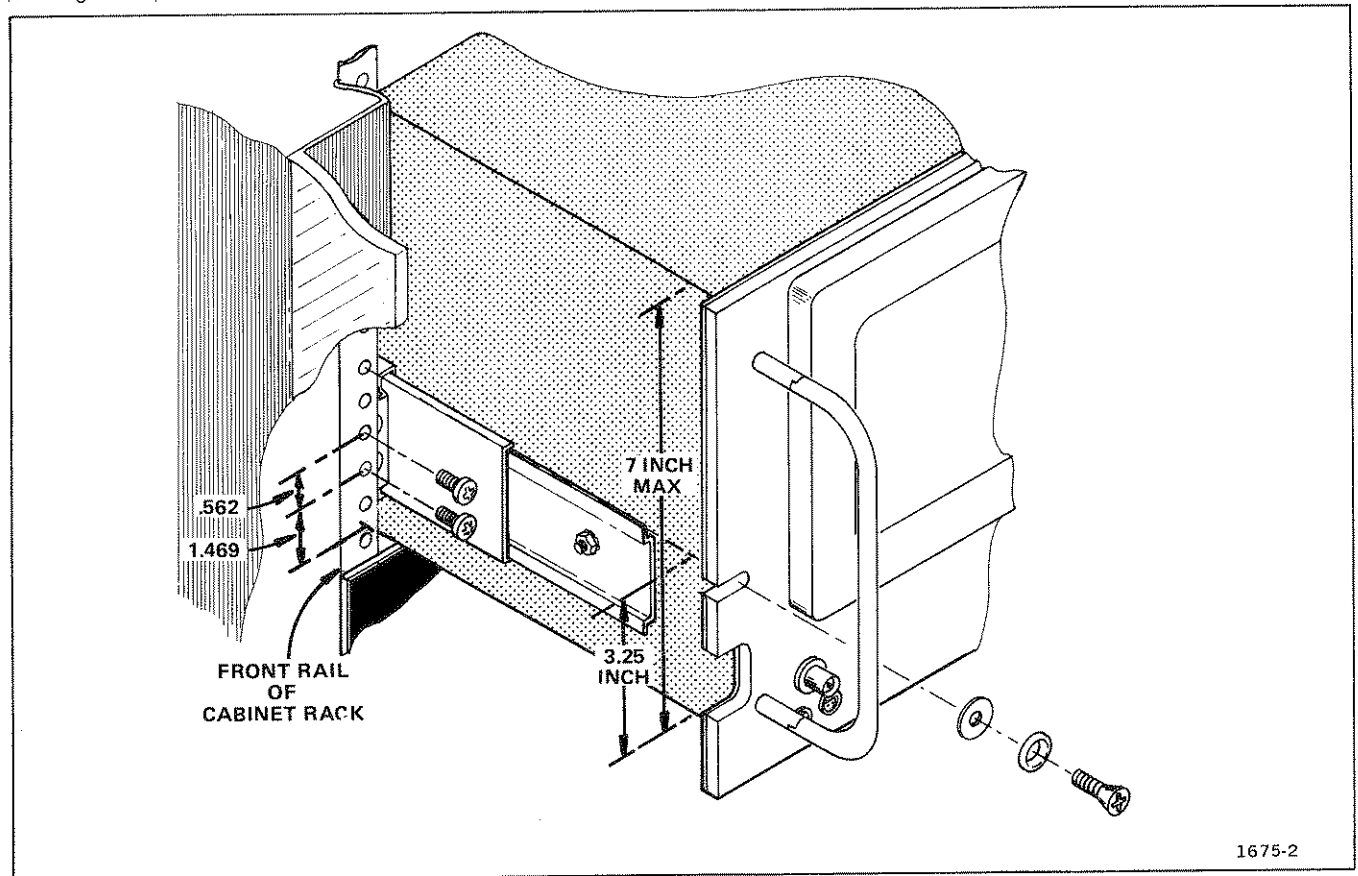


Fig. 3-2. Vertical mounting position of the stationary section and location of the thumb screw securing hole (left stationary section shown).

REMOVING OR INSTALLING THE INSTRUMENT

After initial installation and adjustment of the slid-out tracks, the instrument can be removed or installed by following the instructions given in Fig. 3-4. No further adjustments are required under normal conditions.

SLIDE-OUT TRACK LUBRICATION

The special finish on the sliding surfaces of the tracks provides permanent lubrication. However, if the tracks require additional lubrication, a thin coat of paraffin can be rubbed onto the sliding surfaces.

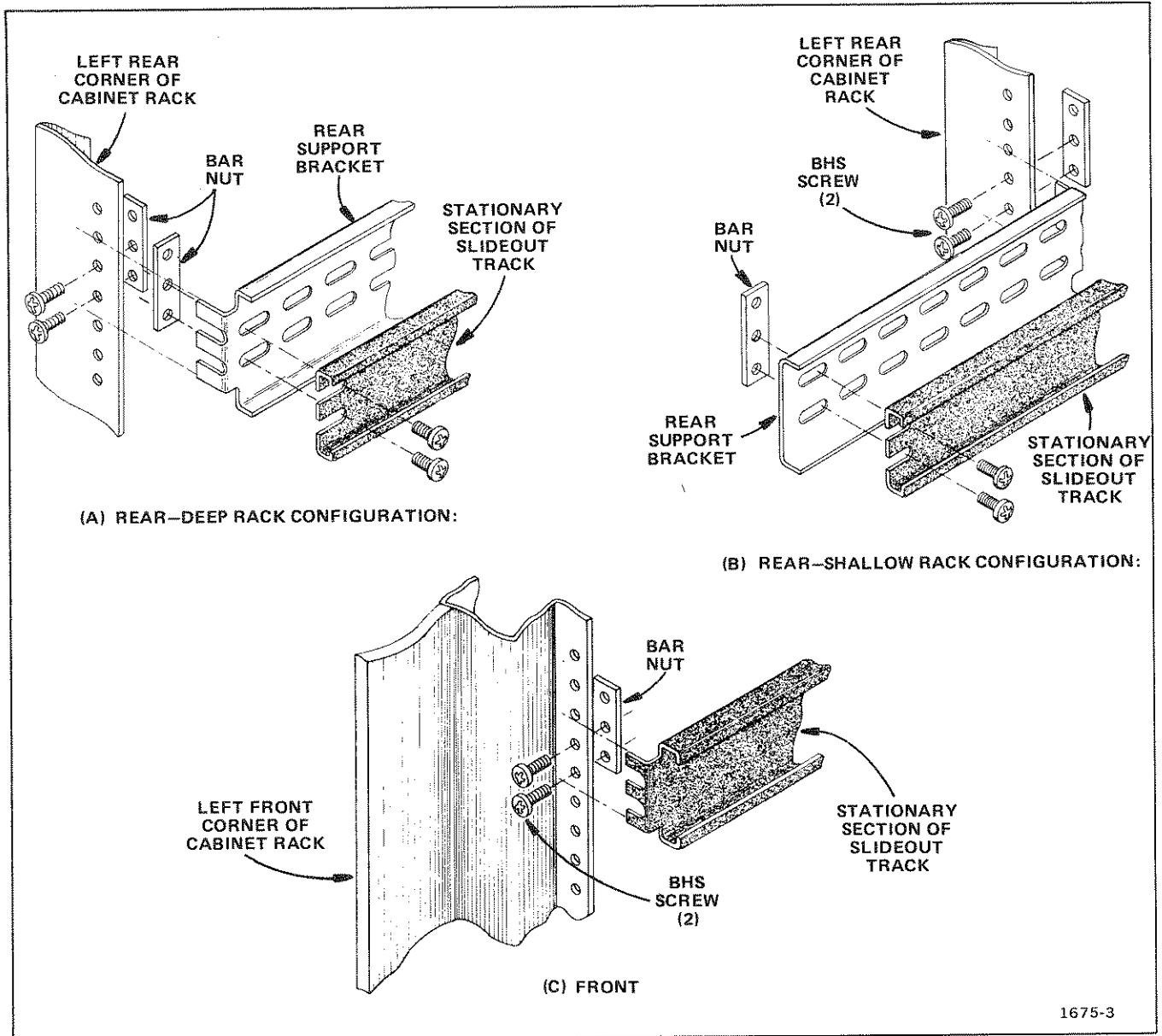


Fig. 3-3. Details for mounting stationary sections.

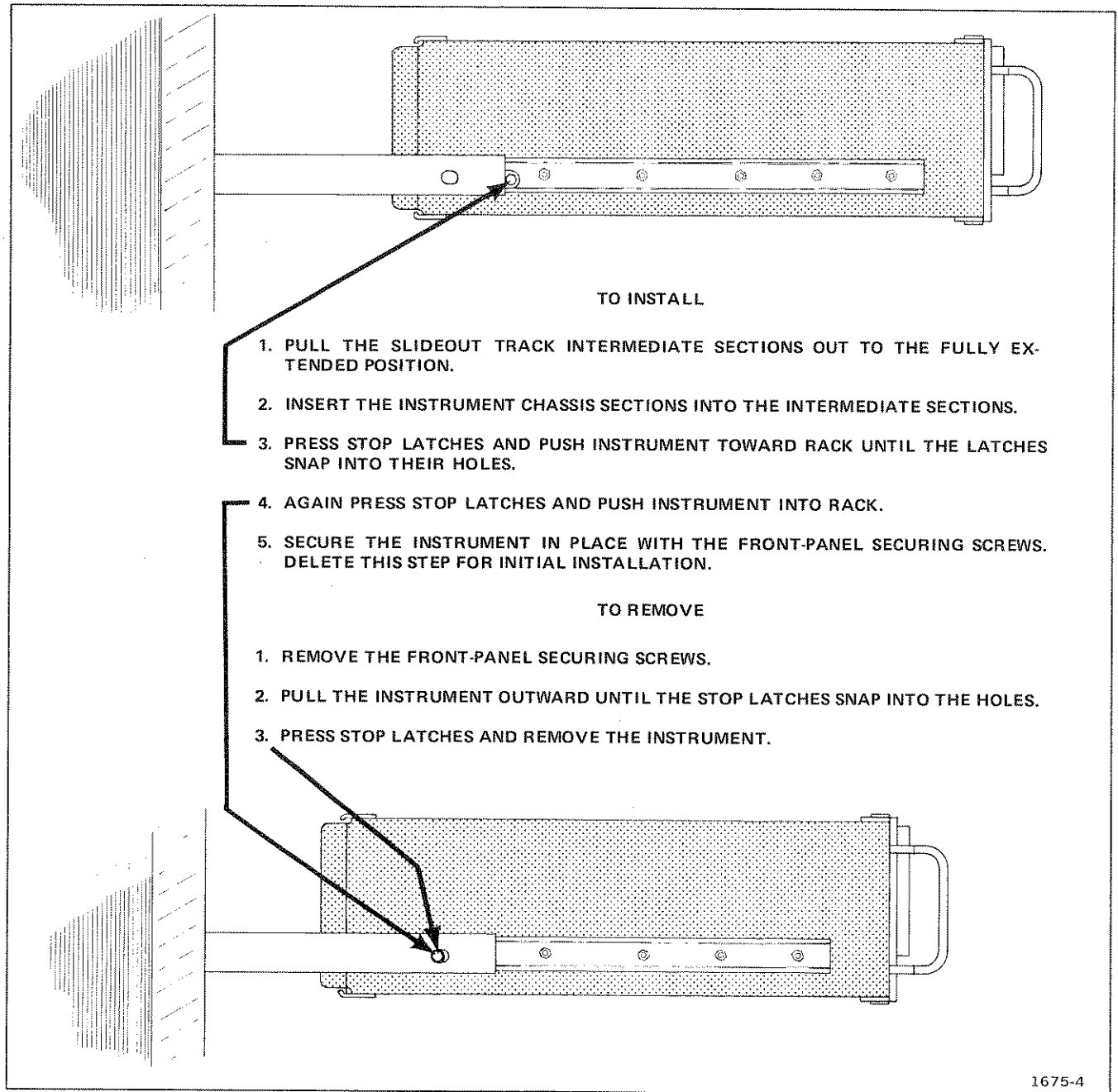


Fig. 3-4. Installing and removing the instrument.

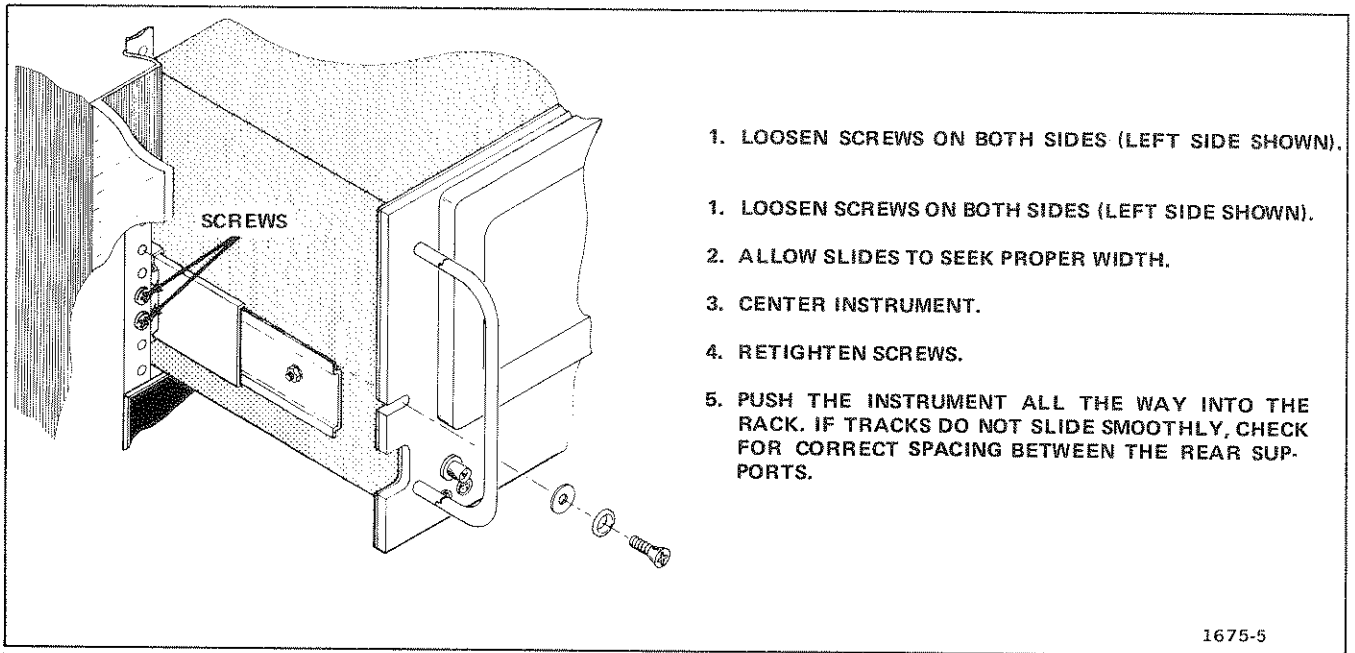
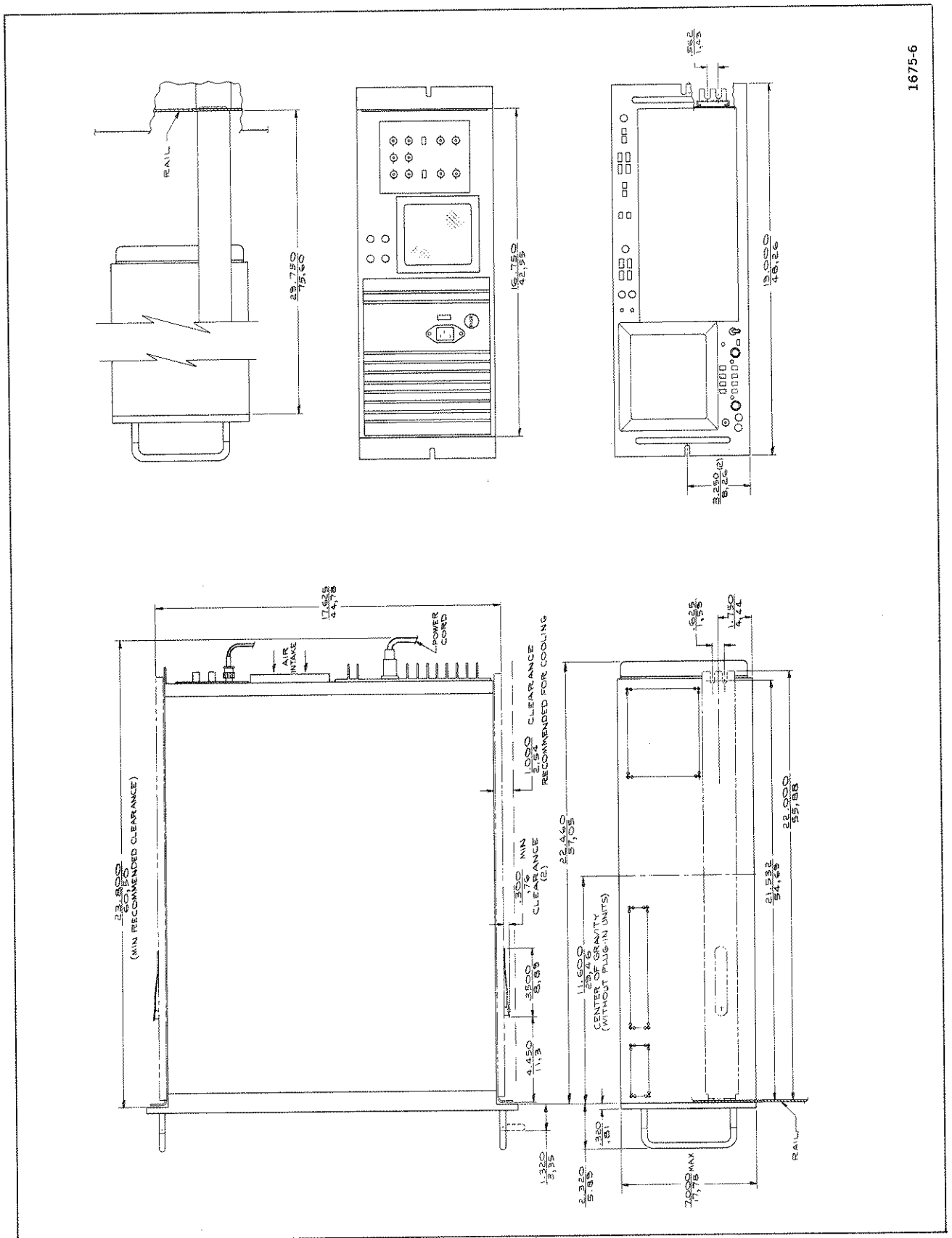


Fig. 3-5. Adjustment of the slide-out tracks for smooth sliding action.



1675-6

Fig. 3-6. R7844 dimensional drawing.

INSTRUMENT OPTIONS

Your instrument may be equipped with one or more instrument options. A brief description of each option is given in the following discussion. Option information is incorporated into the appropriate sections of the manual. Refer to Table 4-1 and the Table of Contents for location of option information.

Conversion kits, for most options, are available and can be installed at a later time. For further information on instrument options, see your Tektronix Catalog or contact your Tektronix Field Office.

OPTION 3

This option provides electromagnetic shielding so that the instrument will meet the emi (electromagnetic interference) parameters given in the Specification section of this manual. To meet emi specifications of instruments equipped with Option 3, all unused plug-in compartments must be covered with an emi-shielded blank plug-in panel (Tektronix part 016-0155-00). One blank panel is required for each unused plug-in compartment.

OPTION 21

This option eliminates the VERTICAL MODE switch, thereby dedicating the LEFT VERT plug-in compartment to beam 1 and the RIGHT VERT plug-in compartment to beam 2. The VERT SET (1) control is also eliminated.

OPTION 78

Option 78 allows selection of P11 cathode-ray tube phosphor. Cathode-ray tubes with P11 phosphor provide maximum photographic writing speed for the 7844/R7844.

OPTION 22

This option provides an oscilloscope enhancer to effectively increase the writing rate for single-shot photographs. Photographic writing speed is increased by providing raster scanning of the crt at the end of beam 2 sweep. Option 22 is recommended when a camera equipped with a writing speed enhancer is not available.

OPERATING INFORMATION

CONTROLS AND CONNECTORS

The major controls required for the operation of the 7844/R7844 Option 22 (Writing Speed Enhancer) are located on the front panel of the instrument. However, the Readout Mode Switch is located on the Readout circuit board inside the instrument. A brief description of the controls unique to Option 22 will follow.

READOUT INTENSITY/PULSED ENHANCER (PULSED Mode)

Varies the brightness of the readout display. In the counter-clockwise detent (OFF), the pulsed readout and enhancer functions are inoperative. In the clockwise detent, the readout system and the enhancer system are in the PULSED mode. The READOUT PRESET, ENHANCER PRESET, EXTERNAL or BEAM 2 GATED, and MANUAL functions are activated in the PULSED mode.

READOUT INTENSITY/PULSED ENHANCER EXTERNAL or BEAM 2 GATED Switch (PULSED Mode)

In the BEAM 2 GATED mode (push button out), one raster scan display is provided for single sweep enhancement and one readout frame is displayed at the end of beam 2 sweep. When in the EXTERNAL mode (push button in), an input (ground closure) to the rear-panel GRAT/READOUT SINGLE SHOT connector provides one raster scan and one display of readout signal.

READOUT AND ENHANCER MANUAL Switch (PULSED Mode)

Displays one raster scan and one readout frame when the MANUAL push button is pressed.

READOUT PRESET Adjustment (PULSED Mode)

Controls brightness of readout portion of the crt display, when operating in the PULSED mode.

ENHANCER PRESET Adjustment (PULSED Mode)

Varies the brightness of the raster scan display for single sweep enhancement.

Readout Mode Switch (Internal)

The two-position Readout Mode switch determines whether the readout display mode is dependent on the front-panel controls (Free-Run mode) or is in the Gated mode (see Figure 4-1). In the Free-Run mode (marked F.R. on circuit board) the readout display is dependent on the setting of the front-panel READOUT controls. When the internal

switch is set for Gated operation (not marked on circuit board) readout is displayed at the end of beam 2 sweep, independent of front-panel READOUT control settings. The internal switch is only recommended for use with single-sweep photography when raster scanning is not desired. For further information, see the Display Photography discussion in this section.

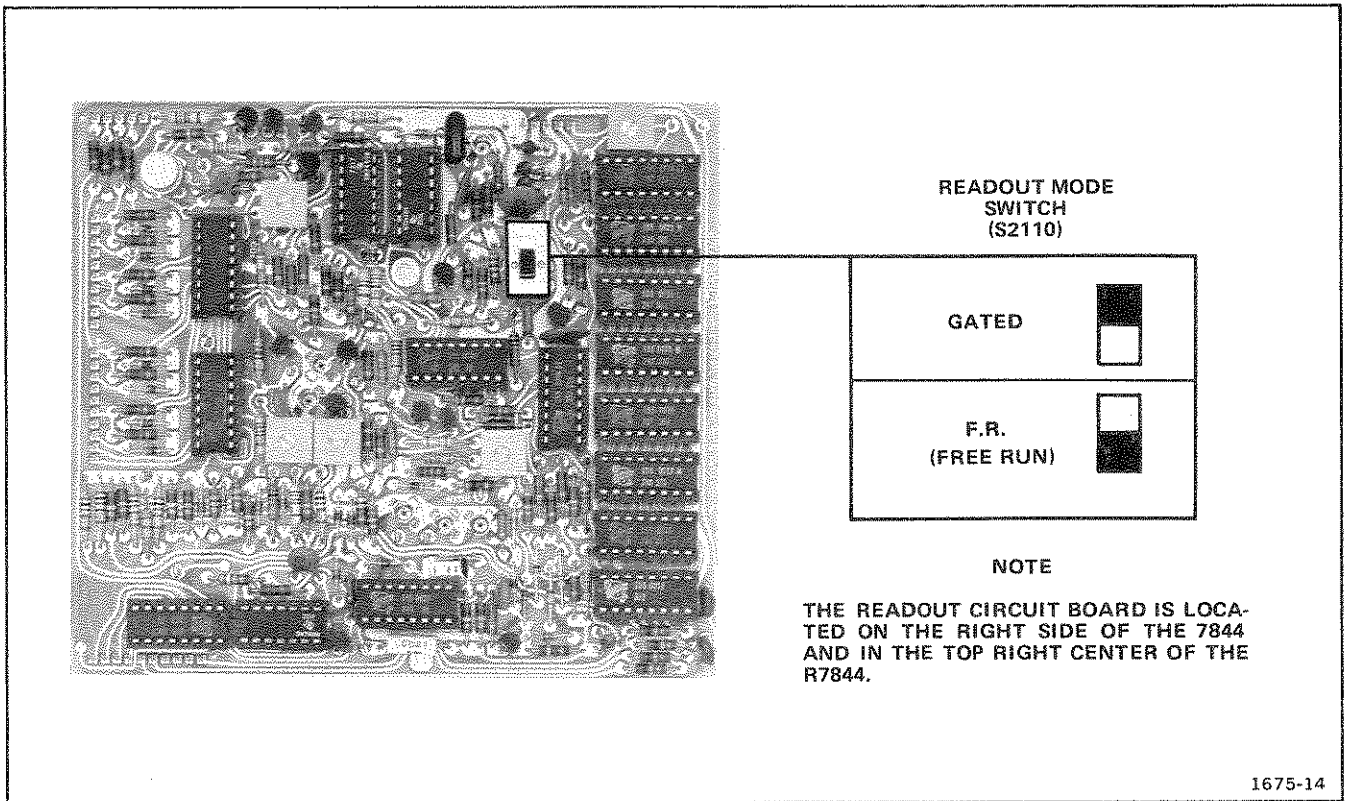


Fig. 4-1. Location of Readout Mode Switch on the Readout circuit board.

Display Photography

The 7844/R7844 Option 22 increases the photographic writing speed for single-sweep photography of fast transient signals. To use the writing speed enhancer, set the READOUT INTENSITY/PULSED ENHANCER control to the PULSED detent. Set the ENHANCER PRESET by experimenting with the waveform photograph. When the ENHANCER PRESET level is low (counterclockwise) the photograph background will appear black and the fast-rising portions of the waveform may not develop. As the ENHANCER PRESET level is increased (in a clockwise direction) the photograph background will approach grey and the additional light supplied by raster scanning should produce a visible image on the fast-rising portions of the photograph. However, if the ENHANCER PRESET level is set too high, the background exposure approaches the trace exposure which makes the photograph unusable.

If the photographic application does not require enhancement and pulsed readout operation is desired, the ENHANCER PRESET control can be set counterclockwise to eliminate the raster scan display. Another method to produce pulsed readout without the raster scan display, is to set the front-panel READOUT INTENSITY/PULSED ENHANCER control out of switch detent (non-pulsed operation) and set the internal Readout Mode Switch to Beam 2 Gated; however, the instrument cover must be removed to gain access to the switch. The internal Beam 2 Gated switch must be set to FR (Free Run) for normal operation of front-panel READOUT controls. See Fig. 4-1 for Readout Mode Switch location.

TABLE 4-1
Option Information Locator

Instrument Option	Manual Section	Location of Information
Option 3 (Provides emi shielding)	1 Operating Instructions	Plug-In Unit Emi information included in installation discussion.
		Light Filters Includes emi mesh filter information.
	2 Specification	Environmental Table 2-5 includes electro-magnetic interference characteristics.
Option 21 (Dedicated vertical system)	1 Operating Instructions	Features Includes Option 21 features.
		Controls and Connectors Fig. 1-1 includes controls and connectors information unique to Option 21.
		Familiarization Procedure Omit VERTICAL MODE switch and VERT SEP (1) settings from Set-Up Information and Set-Up Status. Omit steps 16, 17, and 18 from Vertical System Familiarization Procedure. The LEFT VERT unit controls vertical deflection of beam 1 and the RIGHT VERT unit controls vertical deflection of beam 2.
2 Specification	Electrical Vertical specifications, in Table 2-1 include Option 21 characteristics.	
Option 22 (Writing speed enhancer)	2 Specification	Electrical Display specifications, in Table 2-1 include photographic writing speed characteristics for Option 22.

TABLE 4-1 (cont.)
Option Information Locator

Instrument Options	Manual Section	Location of Information
Option 22 continued. (Writing speed enhancer)	4 Instrument Options	All Operating instructions, for Option 22, are included in this section.
Option 78 (P11 cathode-ray tube phosphor)	2 Specification	Electrical Display specifications in Table 2-1 include crt phosphor and photographic writing speed characteristics for Option 78.