TEK INSTRUCTION MANUAL

Part No. 070-2505-00
Product Group 84

603A MONITOR WITH OPTIONS

Tektronix®
COMMITTED TO EXCELLENCE

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Please Check for CHANGE INFORMATION at the Rear of This Manual

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Tektronix
COMMITTED TO EXCELLENCE

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WARNING

This equipment generates, uses, and can radiate radio frequency energy and may cause interference to radio communications if not installed and used in accordance with the instruction manual. It has been tested and found to comply with the limits for Class B computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when this equipment is operated in a commercial environment. Operation in a residential area is likely to cause interference in which case the users at their own expense must take whatever measures may be required to correct the interference.

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WARNING

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

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OPERATORS SAFETY SUMMARY

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

TERMS

In This Manual

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

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

As Marked on Equipment

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

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

SYMBOLS

In This Manual

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

As Marked on Equipment

⚡ DANGER — High voltage.

⏚ Protective ground (earth) terminal.

⚠ ATTENTION — refer to manual.

Power Source

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

Grounding the Product

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

Use the Proper Power Cord

Use only the power cord and connector specified for your product.
Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see Servicing information.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your product, and which is identical in type, voltage rating, and current rating.

Refer fuse replacement to qualified service personnel.

Do Not Operate In Explosive Atmospheres

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

Do Not Remove Covers or Panels

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

Medical-Dental Applications

Do not use the amplifer INPUTS for direct patient connection. Signal currents at these connectors, as well as leakage currents, may exceed values considered non-hazardous for direct patient connection.

Although this instrument is not to be used for direct patient connection, interconnecting this Monitor with other equipment can result in application of excess current to the patient. It is extremely important that the equipment be interconnected in accordance with NFPA 76B-T, **Tentative Standard for the Safe Use of Electricity in Patient Care Areas of Health Care Facilities**, section 3038, "Signal Transmission Between Appliances".

Do not operate this instrument in the presence of flammable gases or anesthetics. Explosion can result from operation in such an environment.

Limit Input Signal Voltage

To avoid electric-shock hazard, do not apply input signals of more than 25 volts (dc + peak ac). However, should fault conditions occur, the instrument is protected for application of input signals up to 100 volts (dc + peak ac).

Exercise Care With Intensity Level

Exercise care in establishing the correct display intensity; a high-amplitude Z-Axis input signal, combined with an excessively high setting of the INTENSITY control, may damage the crt phosphor. Therefore, set the INTENSITY control for just enough display intensity for good visibility.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

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

Use Care When Servicing With Power On

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

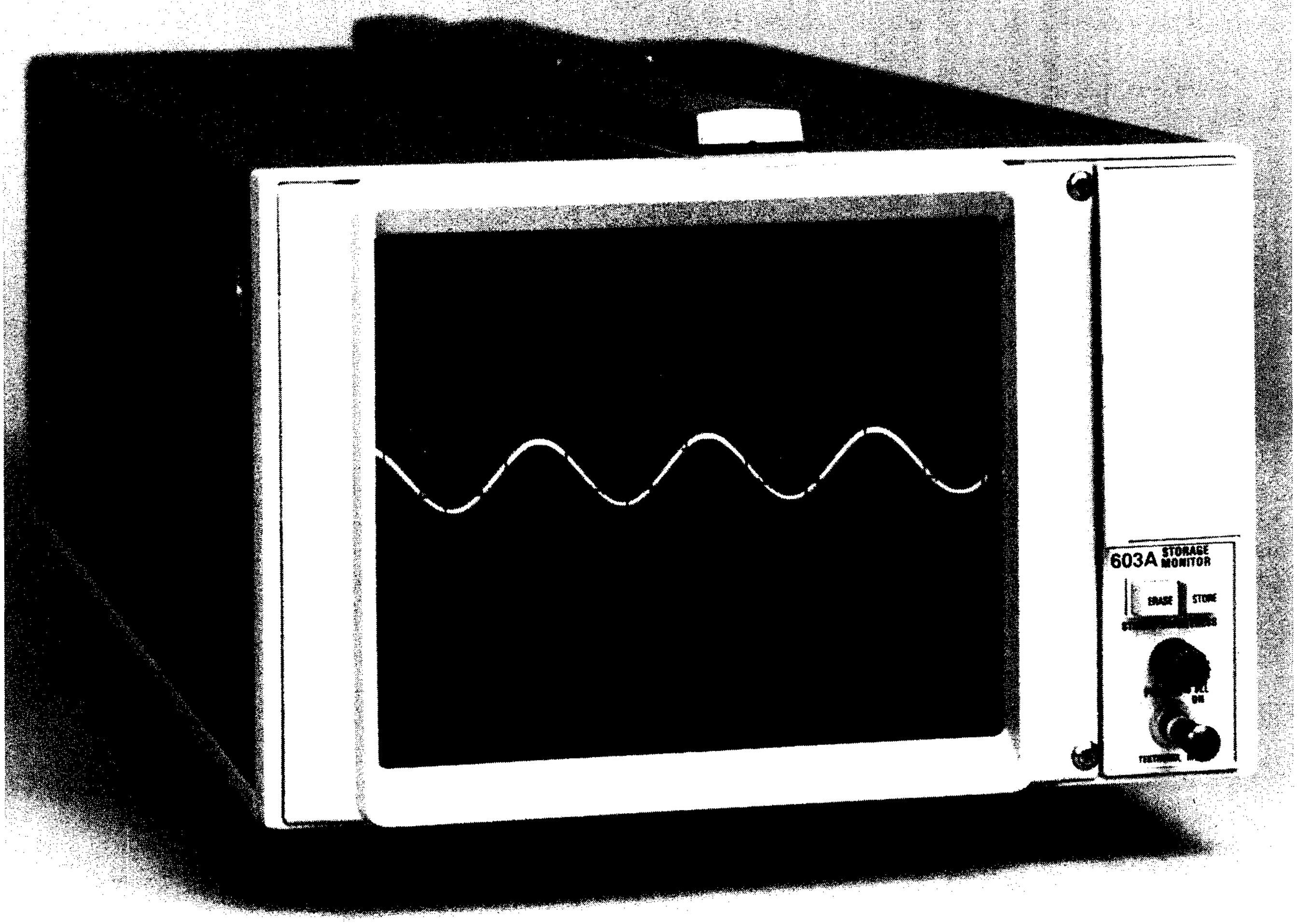
Disconnect power before removing protective panels, soldering, or replacing components.

Power Source

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

Crt Handling

Use care when handling a crt. Breakage of the crt causes a high-velocity scattering of glass fragments (implosion). Protective clothing and safety glasses should be worn. Avoid striking the crt on any object which might cause it to crack or implode. When storing a crt, place it in a protective carton or set it face down in a protected location on a smooth surface with a soft mat under the faceplate.



2505-01

603A Storage Monitor, shown with Option 1 and Option 23.

PART I
OPERATOR'S INFORMATION

GENERAL INFORMATION

INTRODUCTION

Use of This Manual

This instruction manual is divided into two parts for the convenience and safety of the user. Part I contains operating instructions and other information useful in applying the instrument to your measurement and monitoring requirements. Part II provides servicing information for the 603A Storage Display Unit.

Operator's Information—Part I

The Operator's Information portion of this manual includes all information needed to make best use of the instrument. The information in Part I is intended for use by both operating and service personnel.

Controls and connectors are described, and a functional check procedure serves to familiarize the user with operating techniques. The procedure can also be used for incoming inspection to verify proper operation. Operating information for the various available instrument options is included in this part of the manual.

The Specification for the 603A, including electrical, environmental, and phsyical characteristics, is located in this portion.

Service Information—Part II

Information included in this part of the manual is intended exclusively for use by qualified service personnel. Part II includes a detailed check of instrument performance, adjustments, installation, theory of operation, maintenance, schematic diagrams, circuit board illustrations, and electrical and mechanical replacement parts lists.

Schematic diagrams are located near the rear of the manual, and can be folded out for reference while reading other parts of the manual, such as theory of operation. The reference designators and symbols used on the schematics are defined on the first page of the Diagrams and Circuit Board Illustrations (Section 10).

All abbreviations used in this manual, with the exception of the parts lists and schematic diagrams, comply with the American National Standards Institute Y1.1-1972 publication. The parts lists are computer printouts, and use computer-supplied abbreviations. Descriptions and information on the various options available for the 603A Storage Display Unit are located in Section 8 of this manual.

INSTRUMENT DESCRIPTION

The TEKTRONIX 603A Storage Display Unit is a compact, solid-state instrument featuring a Tektronix-developed bistable storage cathode-ray tube. The instrument provides accurate displays of information from the X (horizontal), Y (vertical), and Z (intensity) signal inputs.

The display unit provides a bright display of analog data in a large screen area (6 1/2 inches diagonal). Resolution is excellent for most monitor uses, including alpha numeric applications. The 603A is well suited for many display applications in ultrasonic detection systems, electron microscope systems, radiation and thermal scanning systems, speech therapy, mechanical pressure, volume, shock and vibration analysis, and medical, dental, and biophysical systems.

The 603A is particularly well suited to provide displays of alpha numeric and graphic information from computers and other data-transmission systems. Functioning as a preview monitor, the 603A provides a stored display of information for study before taking a photograph; or, when many repetitions of an event are performed, each may be stored and scrutinized before deciding to photograph, eliminating the need to record every occurrence. This saves both time and film. The 603A storage tube (crt) allows a display to be held for up to an hour at normal stored brightness, and up to ten hours at low-brightness settings.

The compact size of the 603A permits mounting two instruments side-by-side in a standard 19-inch instrument rack, requiring only 5 1/4 inches of vertical rack space. The instrument can be operated from either a 120-volt or a 220-volt (nominal) line-voltage source.

A broad selection of instrument options are available with the 603A to tailor the instrument to the particular use. See the Options (Section 8) in this manual for a complete listing. Optional accessories are also available to extend the application area of the instrument. See Optional Accessories in this section and the current Tektronix catalog.

Ambient Temperature Considerations

This instrument can be operated where the ambient air temperature is between 0° and +50° C (+32° and +122° F), and can be stored in ambient temperatures between −40° and +70°C (−40° and +158°F). After being stored in temperatures beyond the above operating limits, allow the chassis temperature to return to within the operating limits before applying power. Allowing the instrument to operate at an ambient temperature substantially higher than that specified may result in poor reliablity as well as inaccurate performance.

When the 603A is mounted in a rack with other equipment, it is important that the ambient temperature surrounding the instrument does not exceed +50°C (+122°F). Additional clearance or forced ventilation methods (fan) may be needed to maintain ambient temperatures below this upper limit. Reliability and performance of the 603A will be affected if the ventilation holes in the protective cabinet panels (if used) are obstructed, or if the instrument is operated at an ambient temperature that is higher than specified. Other environments and mounting configurations may require additional cooling measures.

Damage Inspection

When unpacking the 603A from the shipping carton, carefully remove the instrument from the carton and inspect for any possible damage incurred during shipment. Report any damage or shortage to the carrier as soon as possible.

Save the shipping carton in case it is needed to repackage the instrument for subsequent shipment.

Standard Accessories

Standard accessories supplied with the 603A can be found listed on the last page of the Replaceable Mechanical Parts list illustrations in the rear of this manual.

Optional Accessories

A variety of optional accessories and peripheral equipment is available to extend the usefulness of your monitor, such as trace-recording cameras, special rackmounting hardware, light filters and graticules, etc. See your current Tektronix catalog for a complete listing, or contact your local Tektronix Field Engineer or representative for technical assistance.

REPACKAGING FOR SHIPMENT

If this instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address), and the name of an individual at your firm that can be contacted in case of questions. Include the complete instrument serial number and a description of the service required.

If the instrument is to be shipped long distances by commercial transportation, repackage it in the original manner for maximum protection. Save and re-use the carton and packing in which your instrument was originally shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of at least six inches more than the instrument dimensions (see Fig. 3-1 in Specification). Cushion the instrument by tightly packing three inches of dunnage or urethane foam between the carton and the instrument, on all sides. Seal the carton with shipping tape or an industrial stapler.

The carton test strength requirement for your instrument is 275 pounds.

Scan by Zenith

OPERATING INSTRUCTIONS

CONTROLS AND CONNECTORS

Controls and connectors necessary for operation of the 603A Storage Display unit are located on the front and rear panels of the instrument. To make full use of the capabilities of this instrument, the operator should be familiar with the function and use of each external control and connector. The front-panel controls are shown in Fig. 2-1. The rear-panel controls and connectors are shown in Fig. 2-2. Some controls and connectors shown relate to available options for the 603A, and may be included in your instrument. Options are indicated in the following text, by option number. These option numbers correspond to the option numbers on the rear of your display unit.

Front-Panel Controls

This is a brief description of the function or operation of the front-panel controls. See Fig. 2-1.

(1) POWER — Controls ac power to the instrument. Power is on when the pushbutton is pulled out.

(2) STORE — Pushbutton selects storage operation when pushed in and non-storage operation when in the out position. (This button must be in to enable remote control of storage operation.)

(3) STORED BRIGHTNESS — This control varies the intensity of the stored information, and permits extended retention of stored information.

For this control to function, the crt writing beam must be cut off, or pin 20 (Enable/Disable) of the Remote Program Connector (see Option 10) must be at TTL 0 level.

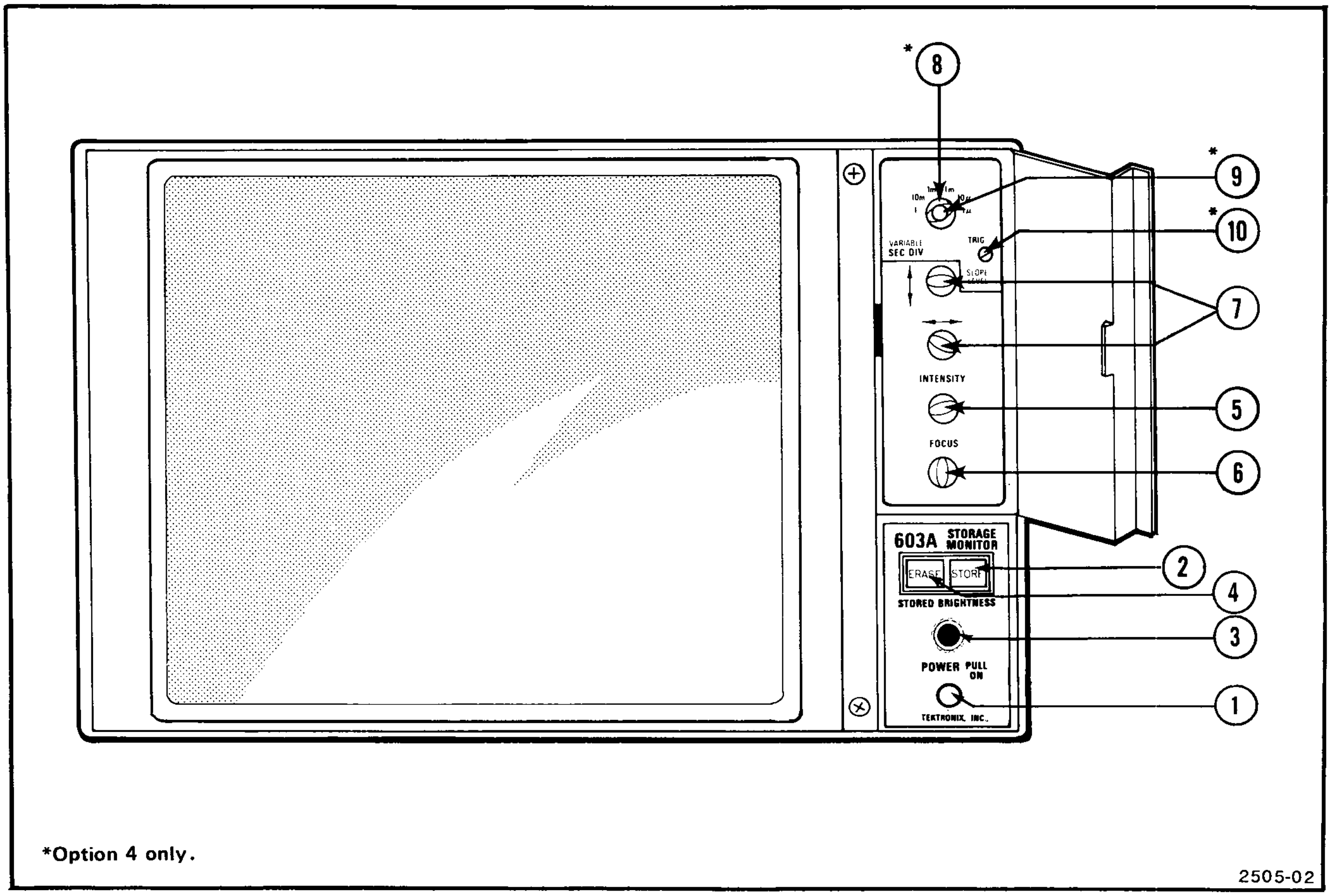


Fig. 2-1. Front-panel controls (includes Option 4).

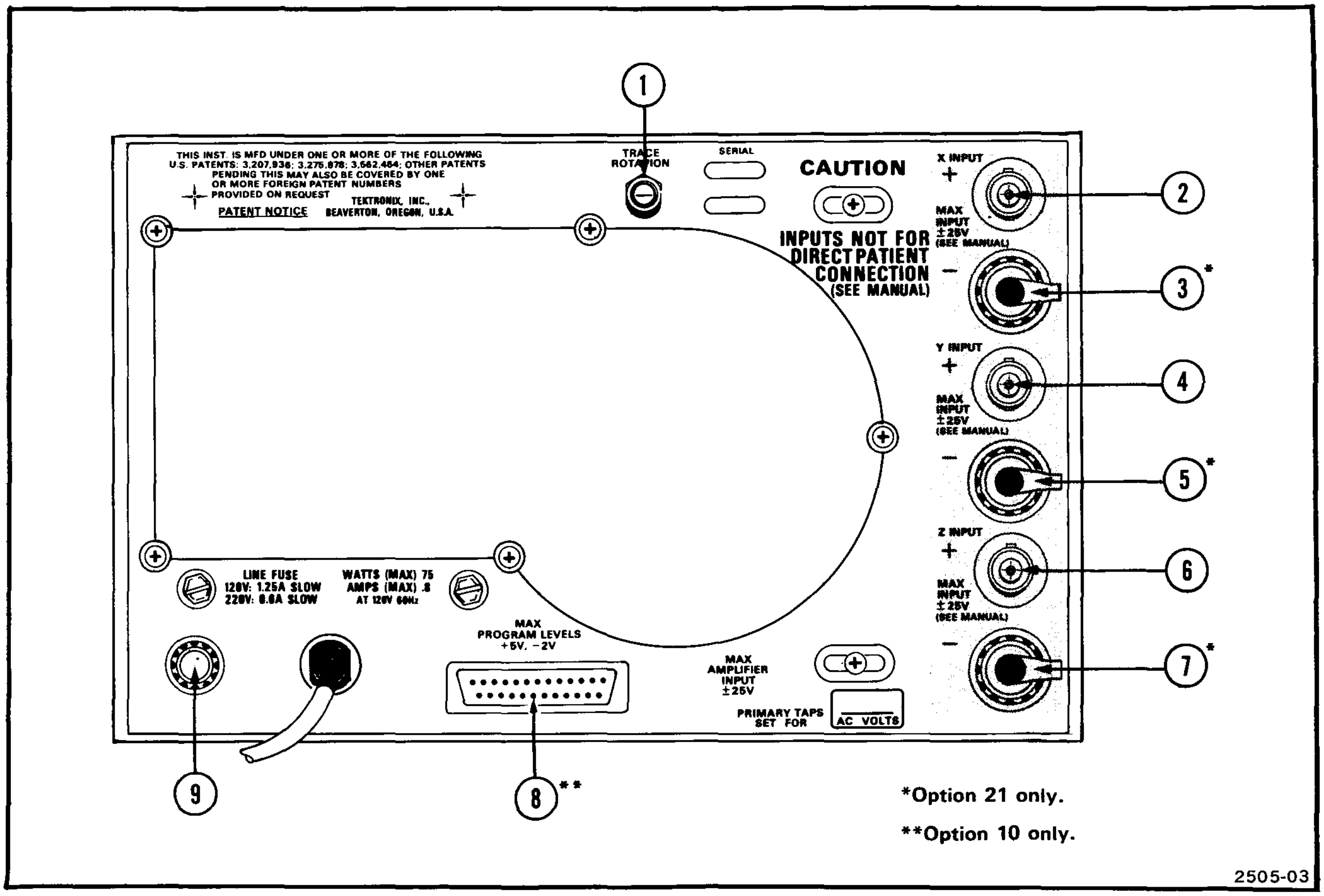


Fig. 2-2. Rear-panel controls and connectors (includes Options 10 and 21).

Certain combinations of conditions (such as a low duty-cycle Z-axis input) may allow this control to function partially. During the time that information is being written on the storage target, this control must be disabled either by the Z-axis level (normal internal connection), by having the control fully clockwise, or by a 1 level on pin 20 of the Remote Program Connector. If information is stored at a brightness level less than maximum, double-imaging will likely occur at the edges of the display because of internal crt modulation effects. See "Flood-Gun Cathode Control" in the Theory of Operation section.

This control can be used in conjunction with external circuitry for a Hold-View mode (with Option 10, Remote Program Connector). See information under Remote Operation, later in this section.

(4) ERASE — Momentary-contact pushbutton initiates erasure of display information stored on the screen.

(5) INTENSITY — Control varies the brightness of a non-stored display.

(6) FOCUS — Control provides adjustment to obtain a well-defined display.

(7) Position — Two controls position the writing beam or display. The Vertical (Y) control positions the crt beam in the Y axis. The Horizontal (X) control positions the crt beam in the X axis. Arrows indicate the axis controlled.

@

Time Base Sweep (These controls are included on the Option 4 version only)

(8) SEC/DIV — Selects one of six calibrated sweep rates from 0.1 second/division to 1 μs/division in decade steps (Option 1, 8 X 10 scribed graticule available). VARIABLE control must be fully clockwise for indicated sweep rate.

(9) VARIABLE — Screwdriver adjustment concentric with the SEC/DIV switch. Provides uncalibrated, continuously variable sweep rates between calibrated steps. Extends the slowest sweep-rate range to 1 second/division.

(10) TRIG SLOPE/LEVEL — Screwdriver adjust that selects the slope and level of the vertical signal from which the sweep is triggered.

Rear-Panel Controls and Connectors

All signal connections to the monitor are made through bnc coaxial connectors located on the rear panel of the instrument (see Figure 2-2). In addition, for Option 10 versions only, a Remote Program connector on the rear panel provides direct connections to the positive (+) inputs of the X, Y, and Z amplifiers from a remote location. Also, storage operation can be controlled from a remote location via this connector.

(1) TRACE ROTATION — Screwdriver adjustment to align the trace with the crt horizontal axis.

X INPUT

(2) +X — Bnc input connector. A positive signal applied deflects the beam to the right; a negative signal deflects the beam to the left.

(3) −X (Option 21) — Bnc input connector. A positive signal applied deflects the beam to the left; a negative signal deflects the beam to the right. Used in conjunction with the +X INPUT for differential operation.

(4) Y INPUT

+Y — Bnc input connector. A positive signal applied deflects the beam up; a negative signal deflects the beam down.

(5) −Y (Option 21) — Bnc input connector. A positive signal applied deflects the beam down; a negative signal deflects the beam up. Used in conjunction with the +Y INPUT for differential operation.

Z INPUT

(6) +Z — Bnc input connector. Provides a linear function to control display brightness. A positive signal applied increases display brightness; a negative signal decreases display brightness.

(7) −Z (Option 21) — Bnc input connector. Provides a linear function to control display brightness. A positive signal applied decreases display brightness; a negative signal increases display brightness. Used in conjunction with the +Z INPUT for differential operation.

(8) REMOTE PROGRAM (Option 10) — Twenty-five pin connector that provides remote inputs and outputs. See Operating Information for Options, and Section 8, Options for further information.

(9) Line Fuse — Line-voltage fuse to protect the instrument from excessive line-voltage surges or shorts within the instrument. (Line fuse is located inside the instrument for Option 6 instruments).[1]

[1]Refer qualified service personnel to the servicing information sections (PART II) of this manual for further information.

DETAILED OPERATING INFORMATION

Input Signal Requirements

The horizontal (X) and vertical (Y) deflection factors are set by the factory to a nominal 1 volt for full scale deflection on each axis. Thus, as shipped, the input signal requirements are 0.125 volt for each division (one-half inch) of vertical deflection, and 0.1 volt for each division of horizontal deflection.

NOTE

The Functional Check procedure may be used to determine if the horizontal and vertical deflection factors of your particular instrument meet those set at the factory, as stated above.

The best transient response from the 603A Display Unit is achieved when the input signal amplitude to the vertical or horizontal INPUT is no greater than that sufficient to provide full-screen deflection.

WARNING

To avoid electric shock, do not apply input signals of more than 25 volts (dc plus peak ac). Should fault conditions occur, however, the instrument is protected for application of input signals up to 100 volts (dc plus peak ac).

With no signals applied to the Z INPUT connectors, the intensity of the display is controlled only by the front-panel INTENSITY control. The intensity range provided by this control is from no visual intensity (crt beam off) to full bright.

To control the intensity with an externally applied signal, set the INTENSITY control to about midrange. An internal gain control permits the Z-axis input requirement for full intensity control to be adjustable from +1 volt or less to +5 volts or more, depending on the exact setting of the INTENSITY control. A zero-volt input cuts off visual intensity when the INTENSITY control is at about midrange.

CAUTION

Exercise care in establishing the correct display intensity; a high-amplitude Z-axis input signal, combined with an excessively high setting of the INTENSITY control, may damage the crt phosphor. In any case, do not apply a Z-axis input signal with amplitudes exceeding 100 volts.

FUNCTIONAL CHECK

The following procedures are provided to aid in obtaining a display on the 603A Display Unit and may be used as a check of basic instrument operation. The procedures may be used for incoming inspection to verify proper operation, and may also be used by the operator for instrument familiarization. Only instrument functions, and not measurement quantities or specifications, are checked in these procedures. Therefore, a minimum amount of test equipment is required. If performing the Functional Check procedure reveals improper performance or instrument malfunction, first check the operation of associated equipment; then refer to qualified service personnel for repair or adjustment of the instrument.

The first of these procedures is intended for use in checking the standard 603A without options and in the non-store mode. The latter portion of the procedure checks storage operation of the 603A Storage Display Unit.

The second procedure checks operation of instruments equipped with Option 4 (Internal Sweep) and Option 21 (Differential Inputs). Use of other options is described under Operating Information for Options.

Test Equipment Required

The following test equipment was used as a basis to write the Functional Check Procedures. Other test equipment, which meets these requirments, may be substituted. When other equipment is used, the control settings or setup may need to be altered.

1. Power Module

   Description: TEKTRONIX TM 500-Series power module with one or more plug-in compartments.

   Type Used: TEKTRONIX TM 501 (used with the FG 503 Function Generator).

2. Function Generator

   Description: Frequency range, 1 Hz to 50 kHz; output amplitude, 1 V p-p into 50 Ω; waveform output, sine wave and square wave.

   Type Used: TEKTRONIX FG 503 Function Generator (used with the TM 501 Power Module).

3. Cables (3 Required)

   Description: Length, 42 inches (1 required), 18 inches (2 required); connectors, bnc.

   Type Used: Type RG-58/U, 50 Ω coaxial, Tektronix Part No. 012-0057-01 (42 inch); Tektronix Part No. 012-0076-00 (18 inch).

4. Tee Connector

   Description: Connectors, bnc-to-bnc.

   Type Used: bnc-to-bnc Tee connector, Tektronix Part No. 103-0030-00.

5. Dual-Input Coupler

   Description: Dual outputs from a single input; connectors, bnc.

   Type Used: Tektronix Part No. 067-0525-01 Calibration Fixture.

6. Adapter

   Description: Connectors, bnc female-to-bnc female.

   Type Used: Bnc female-to-bnc female, Tektronix Part No. 103-0028-00.

7. 50-Ohm Termination

   Description: Impedance, 50 Ω; connectors, bnc.

   Type Used: Tektronix Part No. 011-0049-01.

8. External Graticule (Not required if your instrument has Option 1 Internal Graticule.)

   Description: Graticule ruled in 8 vertical divisions and 10 horizontal divisions.

   Type Used: Tektronix Part No. 331-0303-00 External Graticule.

Preliminary Setup

1. Install the function generator in the power module and turn on the power module.

2. Connect the 603A power cord to a suitable ac power source.

NOTE

Check the line voltage information recorded on the rear panel. If the source voltage is not within this range, refer qualified service personnel to the servicing information sections (PART II) of this manual.

3. Open the access door on the front panel and set the controls as follows:

SEC/DIV (Option 4 only)	10 μ
Vertical & Horizontal Positions	Midrange
INTENSITY	Fully Counterclockwise
FOCUS	Midrange
STORE	Non-Store (button out)
STORED BRIGHTNESS	Fully Clockwise
POWER	ON (PULL)

NOTE

When first receiving the instrument, and when it has been turned off for two weeks or more, proceed as follows:

Turn the STORED BRIGHTNESS control fully clockwise. Place the push-push STORE pushbutton in the depressed position (in). Pull the POWER switch to the ON position and note that after a short delay, the screen will become fully illuminated. Leave the instrument in this mode for five minutes before erasing or selecting the non-store mode. This procedure reduces the ion content in the crt and increases crt life.

4. Allow at least five minutes for the instrument to warm up.

5. Proceed to the appropriate Functional Check procedure for your instrument.

NOTE

Your instrument may contain any of several available optional additions or changes (Options). Refer qualified service personnel to the servicing information sections (PART II) of this manual to determine if your instrument includes Option 22 (internal switchable 1:1 or 5:1 attenuators). If included, the attenuators should be set at 1X by the service person.

If the instrument includes Option 4 (internal sweep), the Int Swp switch (located within the instrument), must be set to X-Y for Procedure 1, or to Y-T if Procedure 2 is to be performed. The switch setting should be checked by qualified service personnel only.

Procedure 1 (Without Option 4, Internal Sweep)

Display Functions

1. Perform the Preliminary Setup procedure.

NOTE

Install the external graticule over the faceplate unless your instrument includes Option 1, Internal Graticule.

2. Notice that a spot will appear on the crt, increasing in brightness as you slowly turn the INTENSITY control clockwise.

CAUTION

A high intensity level combined with a stationary spot will damage the crt phosphor. Therefore, set the INTENSITY control to the minimum necessary for good visibility.

3. Adjust the FOCUS control for a sharp, well-defined display.

4. Turn the Vertical and Horizontal Position controls and notice that the spot position can be controlled by both controls.

5. Set the function generator for a 1-volt (peak-to-peak), 50 kHz sine-wave output.

6. Connect the function generator output to the rear-panel +X INPUT connector via the 42-inch cable and the 50-ohm termination.

7. (Option 21 only.) Place the grounding cap on the −X INPUT connector.

8. Center the display with the Horizontal Position control, and set the trace on the center horizontal graticule line with the Vertical Position control.

9. Check that the rear-panel TRACE ROTATION adjustment will align the trace with the center horizontal graticule line.

Deflection and Z-Axis Functions

1. Perform the Preliminary Setup procedure.

2. Set the function generator for a 1-volt (peak-to-peak), 50 kHz sine-wave output.

3. Connect the function generator output to the rear-panel +X INPUT connector via the 42-inch cable and the 50-ohm termination.

4. (Option 21 only.) Place the grounding cap on the −X INPUT connector.

5. Center the display with the Horizontal Position control, and check for 10 divisions of horizontal deflection.

6. (Option 21 only—Steps 6 through 11.) Remove the grounding cap from the −X INPUT connector.

7. Disconnect the signal from the +X INPUT connector and apply it to the −X INPUT connector.

8. Place the grounding cap on the +X INPUT connector.

9. Center the display with the Horizontal Position control.

10. Check for 10 divisions of horizontal deflection.

11. Disconnect the signal from the −X INPUT connector.

12. Connect the function generator output signal to the +Y INPUT connector.

13. (Option 21 only.) Place the grounding cap on the −Y INPUT connector.

14. Center the display on the crt with the Vertical Position control, and check the eight divisions of vertical deflection.

15. (Option 21 only—Steps 15 through 19.) Remove the grounding cap from the −Y INPUT connector.

16. Disconnect the signal from the +Y INPUT connector and apply it to the −Y INPUT connector.

17. Place the grounding cap on the +Y INPUT connector.

18. Center the display on the crt with the Vertical Position control.

19. Check for eight divisions of vertical deflection.

20. Adjust the INTENSITY control for a barely-visible display.

21. (Option 21 only.) Remove the grounding caps from the +X INPUT and the +Z INPUT connectors. Disconnect the signal from the −Y INPUT connector.

22. Connect the function generator output to the +X INPUT and the +Z INPUT connectors via the 42-inch cable, 50-ohm termination, bnc-to-bnc adapter, bnc Tee connector, and the two 18-inch cables.

23. (Option 21 only.) Place the grounding caps on the −X INPUT and the −Z INPUT connectors.

24. Notice that the right end of the crt display becomes brighter, and that the left end disappears.

25. (Option 21 only—Steps 25 through 28.) Remove the grounding cap from the −Z INPUT connector.

26. Disconnect the signal from the +Z INPUT connector and apply it to the −Z INPUT connector.

27. Place the grounding cap on the +Z INPUT connector.

28. Notice that the left end of the crt display becomes brighter, and that the right end disappears.

29. Disconnect the function generator.

Storage Functions

The remaining steps of this procedure check storage operation of the 603A.

30. Perform the Preliminary Setup procedure.

31. (Option 21 only.) Place the grounding caps on the −X INPUT, −Y INPUT, and −Z INPUT connectors.

32. Set the function generator for a 1-volt (peak-to-peak), 100-Hz, sine-wave output.

33. Check that the STORED BRIGHTNESS control is set fully clockwise, and press in the STORE pushbutton. Press the ERASE pushbutton to remove the accumulated charge from the storage screen. A background glow should be present on the screen.

34. Connect the function generator output to the rear-panel +X INPUT connector via the 42-inch cable and the 50-ohm termination.

35. Check for a stored display by disconnecting the signal from the +X INPUT connector. A horizontal trace should be stored on the screen.

NOTE

If the INTENSITY control is set too low, the information will not store, or will only partially store. Optimum setting of the INTENSITY control is reached when the information stores uniformly.

36. With the input signal disconnected, and a trace stored on the screen, check that the brightness of the stored display can be controlled by the STORED BRIGHTNESS control.

37. Press the ERASE pushbutton and check that the stored display is completely removed. Maximum viewing time of a stored display at full brightness is one hour; at low brightness, it can be held for up to ten hours.

This completes the Functional Check procedure for the 603A Storage Display Unit without Option 4 (internal sweep).

Procedure 2 (With Option 4, Internal Sweep)

NOTE

The following procedure applies to the Option 4 version of the 603A that has been properly set for internal sweep operation. Refer qualified service personnel to the servicing information sections (PART II) of this manual to determine if the internal sweep has been connected. (The internal Norm/Auto switch should be set to Auto.)

Display Functions

1. Perform the Preliminary Setup procedure.

2. Notice that a horizontal trace will appear on the crt, increasing in brightness as you slowly turn the INTENSITY control clockwise.

3. Adjust the FOCUS control for a sharp, well-defined trace.

4. Turn the Vertical and Horizontal Position controls and notice that the trace position can be controlled by both Position controls.

5. Center the display with the Horizontal Position control. Set the trace on the center horizontal graticule line with the Vertical Position control.

6. Check that the rear-panel TRACE ROTATION adjustment will align the trace with the center horizontal graticule line.

Deflection and Z-Axis Functions

1. Perform the Preliminary Setup procedure.

2. Set the function generator for a 1-volt (peak-to-peak), 50 kHz sine-wave output.

3. Connect the function generator output to the rear-panel +Y INPUT connector via the 42-inch cable and the 50-ohm termination.

4. Center the display with the Vertical Position control. If necessary, adjust the TRIG SLOPE/LEVEL control for a stable display.

5. Check for eight divisions of vertical deflection.

6. (Option 21 only—Steps 6 through 11.) Remove the grounding cap from the −Y INPUT connector.

7. Disconnect the signal from the +Y INPUT connector and connect it to the −Y INPUT connector.

8. Place the grounding cap on the +Y INPUT connector.

9. Center the display with the Vertical Position control. If necessary, adjust the TRIG SLOPE/LEVEL control for a stable display.

10. Check for eight divisions of vertical deflection.

11. Remove the grounding caps from the +Y INPUT and +Z INPUT connectors. Disconnect the signal from the −Y INPUT connector.

12. Connect the function generator output to the +Y INPUT and the +Z INPUT connectors via the 42-inch cable, 50-ohm termination, bnc-to-bnc adapter, bnc Tee connector, and the two 18-inch cables.

13. (Option 21 only.) Place the grounding caps on the −Y INPUT and the −Z INPUT connectors.

14. Notice that only the top portion of the display is visible.

15. (Option 21 only—Steps 15 through 20.) Remove the grounding cap from the −Z INPUT connector.

16. Disconnect the signal from the +Z INPUT connector and connect it to the −Z INPUT connector.

17. Place the grounding cap on the +Z INPUT connector.

18. Notice that only the bottom portion of the display is visible.

19. Disconnect the function generator.

20. Replace the grounding caps on the −X INPUT, −Y INPUT and −Z INPUT connectors.

Storage Functions

The remaining steps of this procedure check storage operation of the 603A Storage Display Unit.

21. Perform the Preliminary Setup procedure.

22. Set the function generator for a 1-volt (peak-to-peak), 50 kHz, sine-wave output.

23. Check that the STORED BRIGHTNESS control is set fully clockwise, and press in the STORE pushbutton. Press the ERASE pushbutton to remove the accumulated charge from the storage screen. A background glow should appear, with a stored trace across the screen.

24. Connect the function generator output to the rear-panel +Y INPUT connector via the 42-inch cable and the 50-ohm termination.

25. Set the STORE pushbutton to the out position (non-store). Center the display with the Position controls, and if necessary, adjust the TRIG SLOPE/LEVEL control for a stable display.

26. Press in the STORE pushbutton, and momentarily depress the ERASE pushbutton.

27. Check for a stored display by disconnecting the signal from the +Y INPUT connector. The sine-wave display should be stored on the screen. A horizontal trace will also appear on the screen due to the free-running time base (sweep).

NOTE

If the INTENSITY control is set too low, the display will not store, or will only partially store. Optimum setting of the INTENSITY control is reached when the information stores uniformly.

28. With the input signal disconnected, and the sine-wave waveform stored on the screen, check that the brightness of the stored display can be controlled by the STORED BRIGHTNESS control.

29. Press the ERASE pushbutton and check that the stored display is completely removed. The horizontal trace will reappear on the screen due to the repetitive free-running time base. Maximum viewing time of a stored display at full brightness is one hour; at low brightness, it can be held for up to ten hours.

This completes the Functional Check procedure for the 603A Storage Display Unit with Option 4 (internal sweep).

Remote Operation (Option 10)

The Remote Program connector, located on the rear panel, provides direct connections to the positive (+) inputs of the X, Y, and Z amplifiers from a remote location. Also, storage operation of the 603A Storage Display Unit can be controlled from a remote location; however, the front-panel controls of the instrument override the remote inputs. All inputs and outputs are TTL compatible.

NOTE

Wiring details for the Remote Program connector are located in the servicing information sections (PART II) of this manual. Refer qualified service personnel to these sections for wiring instructions or maintenance problems relating to this connector.

The following storage functions can be remotely controlled via the Remote Program connector:

Remote Erase. Stored display will be erased when a remote contact is closed to ground, or logical 0 (TTL) is applied.

Remote Non-Store. Closing the remote contact to ground or applying a logical 0 (TTL) allows the storage crt to operate in the non-store mode.

Erase Interval. During the erase interval, a negative-going pulse, logical 0 (TTL), is present at this contact. This can be used to notify associated equipment that information stored on the 603A screen is being erased.

Variable Brightness Enable/Disable. This input line permits switching stored brightness from full bright to the level established by the front-panel STORED BRIGHTNESS control when a remote contact is closed to ground or when a logical 0 (TTL) is applied.

Application of a logical 1 (TTL) disables the front-panel STORED BRIGHTNESS control, even though the crt beam is at writing intensity. This mode is useful only when the spot is stationary.

CARE OF STORAGE SCREEN

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

1. Use the minimum beam intensity required to produce a clear, well-defined display. Excessive beam intensity may permanently damage the crt, particularly if a bright spot is allowed to remain stationary on the display area, or if excessive intensity is used for slowly scanning displays.

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

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

4. Turn the STORED BRIGHTNESS control fully counterclockwise (with no application of a new event to be stored) when storing a display for an extended period of time. This will extend the time that the event can be stored, as well as prolonging useful crt life.

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

STORAGE OPERATION

The storage crt in the 603A allows a display to be retained for detailed study at the operator's convenience. Displays viewed at full stored brightness level can be retained up to on hour. Longer storage periods can be obtained by setting the stored brightness to lower levels. With the STORED BRIGHTNESS control fully counterclockwise, the storage period can be extended to ten hours.

To obtain a stored display of a repetitive event, start with the STORE pushbutton in the out position (non-store). Set the STORED BRIGHTNESS control fully clockwise. Apply the signal to be displayed and stored, and set the INTENSITY control to a normal viewing level. Center the display with the Vertical and Horizontal Position controls, and set the FOCUS control for a sharp, well-defined trace.

Press in the STORE pushbutton, and press the ERASE pushbutton to remove any accumulated charge from the storage screen. The stored image should now appear on the screen. The signal may then be removed and the display should remain stored. Set the STORED BRIGHTNESS control to the desired viewing level. (For longest storage times, keep the STORED BRIGHTNESS control set to the lowest necessary level.)

NOTE

If the INTENSITY control is set too low, the display will not store, or will only partially store. Optimum setting of the INTENSITY control is reached when the information stores uniformly.

A stored display is erased by pressing the ERASE pushbutton.

To store a single-occurrence event, the storage controls must be properly set up before applying the signal. With no signal input, the procedure is much the same as for a repetitive signal, except that the INTENSITY control is set for a moderately bright spot (be careful not to burn the crt phosphor), and the spot is then centered with the Position controls. Set the STORED BRIGHTNESS control fully clockwise and press in the STORE pushbutton. Then apply the single-shot signal. The display should now be stored, and the STORED BRIGHTNESS can be set to the desired viewing level.

OPERATING INFORMATION FOR OPTIONS

Option 4 Internal Time Base

Option 4 includes a circuit board that contains triggering, sweep generating, and unblanking circuitry. It also includes a front-panel switch to set the calibrated sweep rate, an uncalibrated variable control to vary the sweep rate, and a screwdriver adjustment to select the slope and level of the triggering signal that initiates the sweep.

Internally-located switching and connections must be set for YT mode before using the internal time base.

NOTE

Refer all internal changes required to qualified service personnel. Instructions on changing from XY to YT mode are located in the servicing information sections (PART II) of this manual.

In addition to internal switching and connection changes as described, an internal switch (Trig Mode) is provided to allow flexibility in triggering operation. This switch has two positions (Norm and Auto), that function as follows:

Norm (normal mode). In this position, the sweep is held off until a triggering signal occurs. When the triggering signal (a sample of the Y input signal) reaches the slope and level selected by the front-panel TRIG SLOPE/LEVEL control, a sweep is initiated. Unblanking is initiated concurrently with the sweep sawtooth. This mode is useful in some applications of the 603A, such as storing a single-shot event when no zero-signal baseline storage is desired along with the stored signal. This mode is also normally necessary when viewing or storing signals with a repetition rate slower than approximately 20 Hz.

Auto (automatic mode). This mode provides a base-line trace (free-running) in the absence of a triggering signal. This is useful for setting positioning, intensity, and focus of the trace. For any triggering signal above a 20 Hz repetition rate, the sweep it initiated when the input signal passes through the slope and level selected by the front-panel TRIG SLOPE/LEVEL control.

The front-panel SEC/DIV switch provides six calibrated sweep rates from 0.1 second to 1 μs/div in decade steps (VARIABLE control in the fully clockwise position). The VARIABLE control provides uncalibrated sweep rates between the calibrated settings of the SEC/DIV switch, extending the slowest sweep rate to at least 1 second/division.

When making time measurements using the graticule, the area between the second and tenth vertical lines provides the most linear measurement. (See Fig. 2-3.) Therefore, the first and last divisions of the display should not be used for making accurate time measurements. Position the start of the display to be measured to the second vertical graticule line. Then, set the SEC/DIV switch so that the end of the display measurement section falls between the second and tenth vertical graticule lines.

Option 21 Full Differential Inputs

Option 21 adds −X, −Y, and −Z INPUT connectors to the 603A Storage Display Unit rear panel, to work in conjunction with the existing +X, +Y, and +Z INPUTs and thus provide differential input operation.

With differential operation, the X, Y, and Z output amplifier stages see only the differences between the signals applied to the + and − inputs (+X and −X, +Y and −Y, or +Z and −Z INPUTs).

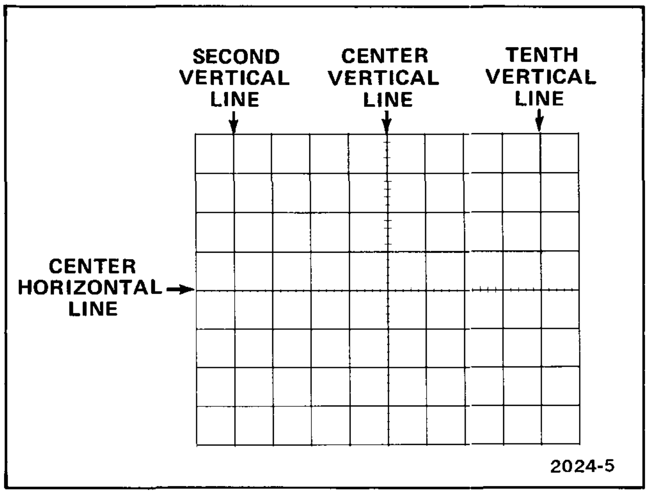


Fig. 2-3. Measurement lines on the 603A graticule.

This mode of operation has several useful applications. For example, if a signal to be displayed has, in addition to the desired signal, a relatively large hum component (e.g., desired signal of 0.5-volt amplitude, hum signal of 1-volt amplitude), viewing and measurement of the desired signal becomes difficult, if not impossible.

The hum component can be practically eliminated with differential operation. First, the desired signal (with hum) is applied to one of the inputs; for example, the +Y INPUT. Then, the hum signal only (from some appropriate point in your circuitry) is applied to the −Y INPUT. If your device employs balanced (push-pull) circuitry, each side of the push-pull stage can be connected (with hum component) to an input, improving results even more.

The common-mode rejection ratio (cmrr) for signals up to 100 kHz is 100:1. This refers to the ability of the differential amplifier to reject unwanted (common-mode) signals. In the example above, the 1-volt hum signal in differential operation becomes the equivalent of 10 mV in amplitude (1 V÷100 = 0.01, or 10 mV). The equivalent 10 mV hum component, compared with the 500 mV desired signal, becomes much less objectionable than with single-ended operation.

NOTE

For the common-mode rejection ratio (cmrr) of 100:1 to apply, the hum component at both input connectors must be the same in amplitude and phase.

For all common-mode differential applications, the common-mode dynamic range limitations must be considered. Exceeding the dynamic range limitations will result in a sharp decline in common-mode rejection ratio. The common-mode dynamic range for non-attenuated signals is +3 V or −3 V peak or less. If your instrument includes Option 22 (switchable 1:1 or 5:1 attenuator), the common-mode dynamic range with 5:1 attenuation is +15 V or −15 V. Cmrr non-attenuated is 100:1 to 100 kHz, and 50:1 with 5X attenuation.

Another use for differential mode of operation is in nullifying the effects of a dc component which may be present along with the signal of interest. For relatively high frequencies, the dc component can be blocked by coupling the input signal through a capacitor of appropriate value. However, for very low-frequency signals, this is frequently impractical. Signal amplitude losses due to the increasing reactance of the capacitor at low frequencies, plus significant phase shift, make calibrated measurements impossible.

The effect of the dc component can be eliminated by applying a matching dc level to the other differential input (the one not used for the input signal). This is easily accomplished by connecting a relatively high resistance potentiometer (i.e., 100 kΩ) across a dc supply, such as a battery or regulated supply, and connecting the potentiometer center arm to the other input. The potentiometer can then be set to position the display on the screen. The dc source should be somewhat higher in level than the signal dc level to provide sufficient adjustment range. However, the source should never be higher than a few volts over the common-mode dynamic range, as described above.

WARNING

Making connection to dc supplies, especially within the monitor or other electronic equipment, involves exposure to dangerous electrical shock. This type of connection, or any other procedure requiring access to the interior of the instrument, should be referred to qualified service personnel.

A variation of the technique just described can be used to measure or observe low-amplitude phenomena occurring on a higher amplitude waveform. This particular application is commonly referred to as differential comparator operation.

For this application, the deflection factor is normally set to the most sensitive level. (A qualified service person can make an internal adjustment to set the deflection factor to 62.5 mV/div.) Then, the signal to be checked, which may be as great as +3 V or −3 V (equivalent to 48 divisions of deflection), is applied to one of the differential inputs. A dc level from the center arm of a potentiometer (connected across a stable dc supply as described above) is applied to the other differential input. An accurate dc voltmeter should be connected between the center arm of the potentiometer and ground.

Set the potentiometer so that some reference point on the waveform is on the graticule centerline. This point is usually the zero-signal level point. If the waveform has no dc level, or a very low-level dc component, the best procedure is to set the potentiometer to 0 V output, and use the monitor's position control to set the zero-signal level to graticule center. Then, adjust the potentiometer to the level that places the point of interest on to the graticule centerline. The amplitude at which this phenomenon occurs can now be read directly from the dc voltmeter. Also, considerable magnification of the area being observed has occurred, permitting detailed study of the phenomenon.

Differential inputs can also be used to double the sensitivity for observing the output of equipment with push-pull (positive and negative) outputs. The deflection factors for vertical (Y) and horizontal (X) amplifiers, as stated in Specification, Section 3 of this manual, refers to single-ended operation. For single-ended inputs, the amplifiers are internally adjustable for a deflection factor of 0.5 V or less full screen to 2.5 V or more full screen. With balanced push-pull input signals, the range becomes 0.25 V or less to 1.25 V or more full scale (31.25 mV/div to 156.25 mV/div vertically, and 25 mV/div to 125 mV/div horizontally).

Option 22 X and Y Switchable Input Attenuators

Option 22 adds internal 1:1 or 5:1 switchable attenuators to the Vertical (Y) and Horizontal (X) input amplifiers.

The attenuators extend the signal range over which the instrument may be used to at least 12.5 V full scale. Range in common-mode operation is also extended to permit rejection of common-mode signals as great as +15 V or −15 V. Attenuation is selected by the positions of two internally-located switches.

WARNING

Changing of the positions of the X and Y attenuator switches necessitates working within the instrument with protective cabinet panels (if included) removed. To avoid dangerous electrical shock, refer all internal changes to qualified service personnel.

SPECIFICATION

The electrical characteristics listed in Table 3-1 apply when the following conditions are met: (1) The instrument must have been adjusted at an ambient temperature between +15°C and +25°C (+59°F and +77°F), (2) the instrument must be operating in an ambient temperature between 0°C and +50°C (+32°F and +122°F), and (3) the instrument must have been operating for at least 20 minutes before checking specification.

Items listed in the Performance Requirements column of the Electrical Characteristics are varified by completing the Performance Check in Section 4 of this manual. Items listed in the Supplemental Information column are not verified in the Performance Check; they are either explanatory notes, performance characteristics for which no limits are specified, or characteristics that are impractical to check in routine maintenance.

Table 3-1

ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information	Perf. Ch. Step No.
VERTICAL AND HORIZONTAL AMPLIFIERS			
Deflection Factor			
Vertical (Y)	Adjustable from 0.5 V, or less, to at least 2.5 V full scale.	Nominally set for 1 V full screen. Range of at least 6.25 mV/div to 312.5 mV/div.	C1
Horizontal (X)	Adjustable from 0.5 V, or less, to at least 2.5 V full scale.	Nominally set for 1 V full screen. Range of at least 50 mV/div to 250 mV/div.	C5
Attenuators (Option 22)	Internal 1X—5X step attenuator extends deflection factor range to at least 12.5 V full scale.		C2, C6
Polarity		Substantiated by other checks.	
+Y INPUT	Positive signal applied deflects beam up; negative signal deflects beam down.		
−Y INPUT (Option 21)	Positive signal applied deflects beam down; negative signal deflects beam up.		
+X INPUT	Positive signal applied deflects beam to the right; negative signal deflects beam to the left.		
−X INPUT (Option 21)	Positive signal applied deflects beam to the left; negative signal deflects beam to the right.		

Table 3-1 (cont)

Characteristic	Performance Requirement	Supplemental Information	Perf. Ch. Step No.
Settling Time	Spot must reach new writing position within 1 μs from any on-screen position.		C4, C8
Bandwidth (80% Full-Screen Reference Signal)	Dc to at least 2 MHz at −3 dB point.		C9
Risetime		0.18 μs or less (10%-90%).	
Phase Difference (Dc to 500 kHz)	1° or less between X and Y amplifiers. X and Y amplifier gain (V/div) must be set for the same deflection factor.		C10
Common-Mode Rejection (Option 21)			
Attenuator at 1X	At least 100:1 cmr ratio to 100 kHz with input signals of ±3 V or less.		C3, C7
Attenuator at 5X (Option 22)	At least 50:1 cmr ratio to 100 kHz with input signals of ±15 V or less.		C3, C7
Position Stability		0.1 division or less (0.050 inch or less) per hour after 20-minute warmup.	
Position Range	Front-panel controls allow spot to be set anywhere within the viewing area.	Approximately ±12 divisions from screen center.	Substantiated by other checks.
Input R and C (Both Inputs)		1 MΩ, within 1%, paralleled by 47 pF or less.	
Maximum Nondestructive Input Voltage (Fault Condition Only)		+100 V or −100 V (dc plus peak ac).	

Z-AXIS AMPLIFIER

Characteristic	Performance Requirement	Supplemental Information	Perf. Ch. Step No.
Bandwidth	Dc to at least 5 MHz (at −3 dB).		D2
Risetime		70 ns or less (10%-90%).	
Common-Mode Rejection (Option 21)	At least 100:1 cmr ratio to 100 kHz with input signals of ±5 V or less.		D3

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Table 3-1 (cont)

Characteristic	Performance Requirement	Supplemental Information	Perf. Ch. Step No.
Input R and C		1 MΩ, within 1%, paralleled by 47 pF or less.	
Maximum Nondestructive Input Voltage (Fault Condition Only)		+100 V or −100 V (dc plus peak ac) when INTENSITY control is fully counterclockwise. See Caution in Operating Instructions.	
Polarity			
+Z INPUT	Positive signal applied brightens spot; negative signal dims spot.	Substantiated by other checks.	
−Z INPUT (Option 21)	Positive signal applied dims spot; negative signal brightens spot.		
Useful Input Voltage			
+Z INPUT	Adjustable. With Z Gain at maximum no more than +1 V will provide full intensity.	INTENSITY control range is one volt.	D1
	With Z Gain at minimum, at least +5 V is required to produce full intensity.	INTENSITY control range is five volts.	D1
−Z INPUT (Option 21)	Adjustable. With Z Gain at maximum, no more than −1 V will provide full intensity.	INTENSITY control range is one volt. Substantiated by other checks.	D1
	With Z Gain at minimum, at least −5 V is required to produce full intensity.	INTENSITY control range is five volts. Substantiated by other checks.	D1

CATHODE-RAY TUBE DISPLAY

Crt Screen Size		6 1/2-inches (diagonal).	
Display Quality Area		8 X 10 divisions (4 X 5 inches).	
Geometry (Within Graticule Area)	Bowing or tilt is 0.1 division (0.050 inch) or less.		B4
Display Linearity (Vertical and Horizontal)		No more than 5% difference between any two divisions.	
Accelerating Potential	3.5 kV.		A3

Table 3-1 (cont)

Characteristic	Performance Requirement	Supplemental Information	Perf. Ch. Step No.
Phosphor			
Standard		Similar to P1.	
Deflection		Electrostatic.	
Maximum Spot Size		25 mils. (0.025-inch).	
Resolution (Non-Store)		128 line pairs vertically; 160 line pairs horizontally.	
Storage Display			
Stored Resolution		80 line pairs vertically; 100 line pairs horizontally.	
Writing Speed (Standard)		At least 20 divisions per ms.	
Writing Speed (Option 2)		At least 200 divisions per ms with optional fast-writing crt.	
Storage Time		1 hour at full stored brightness.	
Erase Time		Approximately 250 ms.	
Graticule			
Standard		External. Lined in 8 X 10 divisions. Non-illuminated.	
Option 1		Internal. Lined in 8 X 10 divisions. Non-illuminated.	

POWER SOURCE

Line Voltage (ac, rms)		120 Vac nominal	
Low (100 Vac)		90 to 110 Vac.	
Medium (110 Vac)		99 to 121 Vac.	
High (120 Vac)		108 to 132 Vac.	
		220 Vac nominal	
Low (200 Vac)		180 to 220 Vac.	
Medium (220 Vac)		198 to 242 Vac.	
High (240 Vac)		216 to 264 Vac.	

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Table 3-1 (cont)

Characteristic	Performance Requirement	Supplemental Information	Perf. Ch. Step No.
Line Fuse Data			
120 Vac Nominal		1.25 A Slow-Blow.	
220 Vac Nominal		0.6 A Slow-Blow.	
Line Frequency		48 to 440 Hz.	
Power Supplies	**Tolerance**		
−30 V dc	Adjustable to −30 V dc.		A1, A2
+15 V dc	+14.7 V to +15.3 V.		A1
+215 V dc	+208.5 V to +221.5 V		A1
+360 V dc (603)	+342 V to +378 V.		A1
−3450 V dc	±170 V.		A3

OPTION 4 SWEEP SYSTEM

Characteristic	Performance Requirement	Supplemental Information	Perf. Ch. Step No.
Sweep Range	100 ms/div to 1 μs/div.	Decade steps.	F3
Sweep Accuracy Over Center 8 Divisions	Within 3%.	VARIABLE fully clockwise.	F3
Linearity of Any 2 Division Portion Within Center 8 Divisions		Within 2%, except for first 5% of total sweep length.	
VARIABLE (Uncalibrated)	Provides continuously variable sweep rates between calibrated settings.	Decreases each sweep rate setting by at least 10:1. Extends slowest rate to at least 1 s/div.	F4
Triggering Sensitivity (Repetitive Signals)	Requires at least 0.5 division vertical deflection from dc to 2 MHz.		F2

Table 3-2

ENVIRONMENTAL CHARACTERISTICS

Characteristic	Information
NOTE This instrument will meet the electrical characteristics given in the Performance Requirement column of Table 3-1 over the following environmental limits.	
Temperature	
Operating	0° to +50°C (+32° to +122°F).
Nonoperating	−40° to +70°C (−40° to +158°F).
Altitude	
Operating	To 4.6 km (15,000 ft.).
Nonoperating	To 12.6 km (50,000 ft.).
Humidity	To 95% at 40°C.
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.

Table 3-3

PHYSICAL CHARACTERISTICS

Characteristic	Information
Dimensions	See Fig. 3-1.
Net Weight	About 7.9 kg (17.5 pounds).
Shipping Weight	About 10.4 kg (23 pounds).

@

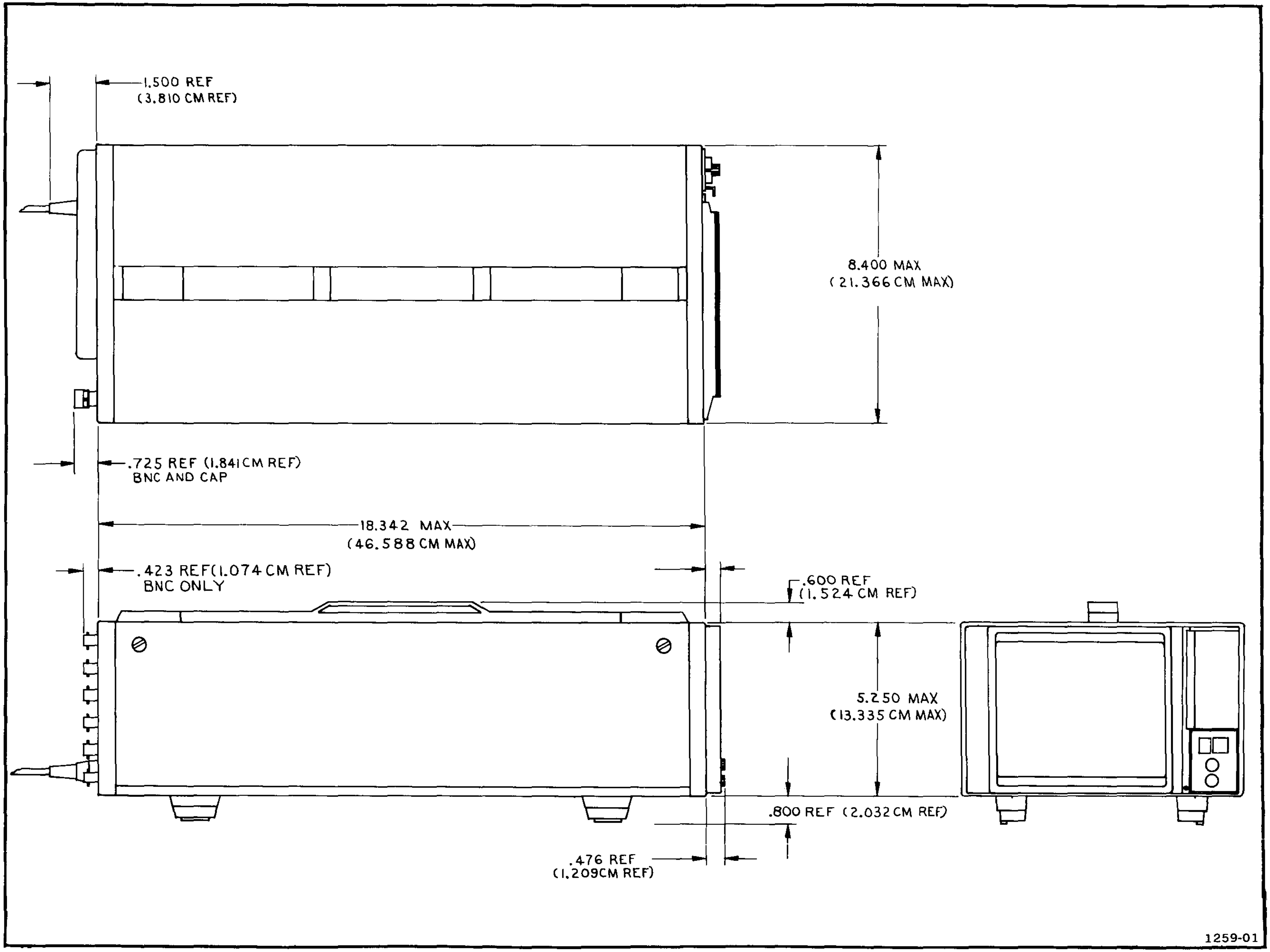

Fig. 3-1. Overall dimensions, with cabinet, feet, and handle.

WARNING

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. REFER TO OPERATORS SAFETY SUMMARY AND SERVICE SAFETY SUMMARY PRIOR TO PERFORMING ANY SERVICE.

PART II
SERVICE INFORMATION

PERFORMANCE CHECK/ ADJUSTMENT

This section provides information necessary to: (1) verify that this instrument meets the performance requirements for the electrical specifications in Section 3, Specification, (2) verify that all controls function properly, and (3) perform all internal adjustments. A separate Functional Check procedure, in the Operating Instructions section, can be used to only check the functions of the front- and rear-panel controls and connectors.

PRELIMINARY INFORMATION

Adjustment Interval

To maintain instrument accuracy, check the performance of the 603A every 1000 hours of operation, or every six months if used infrequently. Before performing a complete adjustment procedure, thoroughly clean and inspect this instrument as outlined in Section 7, Maintenance.

Tektronix Field Service

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

Using This Procedure

This Performance Check and Adjustment procedure can be used either for complete adjustment or as a check of instrument performance. The procedures are divided into functional block subsections (e.g., A. Power Supply, B. Crt Circuit, etc.). The order in which the subsections and steps appear is the recommended sequence for a complete performance check and adjustment of the instrument. Each subsection can be performed independently. Any step (A1, A2, B1, B2, etc.) within any subsection can also be performed independently, which makes it possible to check any parameter or touch up any adjustment following a repair. Refer to the following discussion for instructions on a complete or partial check and adjustment.

Index

An index listing all steps precedes the procedure to aid in locating Performance Check and Adjustment steps.

Performance Check

Instrument performance can be checked by performing the complete Performance Check and Adjustment procedure, and omitting only the ADJUST parts of the steps.

Adjustment

Completion of each step in the Performance Check and Adjustment procedure ensures that the instrument is correctly adjusted and performing within specified limits. Where possible, instrument performance is checked before an adjustment is made. For best overall performance, make each adjustment to the exact setting indicated when performing the complete adjustment procedure.

Partial Procedures

The following procedure is written to completely check and adjust the 603A Storage Monitor to the Specification in Section 3. If the applications for which the instrument is used do not require the full available performance, the procedure and the required equipment list can be shortened accordingly.

A partial performance check and adjustment may be desirable after replacing components, or to touch up the adjustment of a portion of the instrument. To check or adjust only part of the instrument, refer to the Test Equipment Required list and the Performance Check and Adjustment Procedure Index to determine necessary equipment and location of appropriate steps to be performed. Also, when performing each step, note the Equipment Required list that immediately precedes each step. To avoid unnecessary adjustment of other parts of the circuitry, adjust only if the tolerance given in each CHECK is not met.

The alphabetical instructions under each step (a., b., c., etc.) may contain CHECK, ADJUST, or INTERACTION as the first word of the instruction. These terms are defined as follows:

1. CHECK—indicates that the instruction accomplishes a performance requirement check. If the parameter checked does not meet or exceed the indicated limits, an adjustment is normally required.

2. ADJUST—describes which adjustment to make and the desired result. It is not recommended that adjustments be made unless a previous CHECK instruction indicates that an adjustment is necessary.

3. INTERACTION—indicates that the adjustment described in the preceding instruction interacts with other circuit adjustments. The nature of the interaction is described and reference is made to the procedure(s) affected.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1 is required for a complete performance check and adjustment of this instrument. The specifications given in Table 4-1 for test equipment are the minimum required to check the Specification in Section 3. Detailed operating instructions for test equipment are omitted in this procedure. Refer to the test equipment instruction manual if more information is needed.

Test Equipment Alternatives

The test equipment listed in the Examples of Applicable Test Equipment column, Table 4-1, is required to check and adjust this instrument. The Performance Check/Adjustment procedure in this manual was performed using the equipment indicated in this column. If other equipment is substituted, control settings or setups may need to be altered. If the exact item of equipment given as an example is not available, refer to the Minimum Specifications column to determine if other equipment may be substituted. Then, check the Purpose column. If you determine that your measurement requirements will not be affected, the item and corresponding step(s) can be deleted.

Table 4-1

TEST EQUIPMENT

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
Test Oscilloscope (with 10X probe)	Bandwidth, dc to at least 8 MHz; deflection factor, 0.2 to 5 V/div within 2%; sweep rate, 0.5 ms to 20 μs/div.	Adjust vertical, horizontal, and Z-axis gain and compensation. Check phase difference, horizontal, vertical, and Z-axis bandwidth.	TEKTRONIX 5440 Oscilloscope with 5A45 Amplifier, 5B40 Time Base, and P6105 10X 1-meter probe.
Precision Dc Voltmeter	Measurement range, −30 to +380 V; measurement accuracy, within 0.1%.	Adjust −30 V supply and crt bias. Check low-voltage supplies. Adjust collimation.	TEKTRONIX DM 502 Digital Multimeter (operates in TM 500-series power modules).
Dc Voltmeter	Measurement range, −3280 to −3620 V; accuracy, within 3%.	Adjust −3450 V supply.	a. Triplett Model 630-NA. b. Simpson Model 262.
Ramp Generator	Ramp duration, 10 μs to 5 ms within 3%; ramp amplitude, +1 to +3 V into 50 Ω; external trigger input, compatible with square-wave generator trigger output; gate output, 1 to 3 V into 1 MΩ.	Adjust TRACE ROTATION, geometry; storage level, vertical, horizontal, and Z-axis gain and compensation. Check horizontal, vertical, and Z-Axis bandwidth; check horizontal and vertical settling time.	TEKTRONIX RG 501 Ramp Generator (operates in TM 500-series power module).

Table 4-1 (cont)

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
Calibration Generator	Amplitude Calibrator Mode: Frequency, approx. 1 kHz; amplitude, 0.5 to 5 V into 1 MΩ; accuracy, within 0.25%. Pulse Mode—High Amplitude Output: Frequency, 1 kHz to 100 kHz; amplitude, 0.5 to 5 V into 50 Ω; risetime, 10 ns or less into 50 Ω.	Adjust vertical, horizontal, and Z-axis gain, HF compensation, and vertical, horizontal attenuator compen- (Option 22). Check horizontal and vertical settling time.	TEKTRONIX PG 506 Calibration Generator (operates in TM 500-series power module).
Sine-Wave Generator	Frequency range, 350 kHz to at least 5 MHz; reference frequency, 50 kHz; amplitude, 0.5 to 5 V into 50 Ω; amplitude accuracy, constant within 5% of reference as output frequency changes.	Check horizontal, vertical, and Z-axis bandwidth; horizontal and vertical phase difference; adjust Z-axis and check Option 4 sweep generator trigger slope/level.	TEKTRONIX SG 503 Leveled Sine-Wave Generator (operates in TM 500-series power module).
Time-Mark Generator (Required for Option 4 only)	Marker output, 1 μs to 0.1 s accuracy, within 1%.	Check Option 4 sweep timing.	TEKTRONIX TG 501 Time Mark Generator (operates in TM 500-series power module).
Function Generator (Required for Options 21 and 22 only)	Frequency, 100 kHz; waveforms, sine, triangular, square; amplitude range, 5 to 15 V (p-p).	Check common-mode rejection of the vertical, horizontal, and Z-axis amplifiers in Option 21 instruments.	TEKTRONIX FG 503 Function Generator (operates in TM 500-series power module).
Power Module Mainframe (TM 500-series)	Capable of powering 3 to 6 TM 500-series test instruments.	Provide housing and power for test signal generators and precision dc voltmeter.	TEKTRONIX TM 503, TM 504, or TM 506 Power Module.
50-Ohm 5X Attenuator	Impedance, 50 Ω within 2%; connectors, bnc.	Adjust horizontal, vertical, and Z-axis gain and compensation.	Tektronix Part No. 011-0060-02.
50-Ohm Termination	Impedance, 50 Ω within 2%; connectors, bnc.	Adjust Option 4 sweep timing. Check common-mode rejection and bandwidth of the horizontal, vertical, and Z-axis amplifiers. Check horizontal and vertical phase differences.	Tektronix Part No. 011-0049-01.
Bnc Tee Connector	Connectors, bnc.	Adjust horizontal, vertical, and Z-axis gain.	Tektronix Part No. 103-0030-00.

Table 4-1 (cont)

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
Dual-Input Coupler	Connectors, bnc.	Check horizontal, vertical, and Z-axis common-mode rejection, horizontal and vertical phase difference.	TEKTRONIX 067-0525-01 Calibration Fixture.
50-Ohm Cables (4)	Impedance, 50 Ω; length, 42 inches; connectors, bnc.	Provide signal interconnections.	Tektronix Part No. 012-0057-01.
Screwdriver	3-inch shaft, 3/32-inch bit.	Adjust variable resistors.	Xcelite R3323.
Low-Capacitance Screwdriver	3-3/4 -inch shaft.	Adjust variable capacitors.	Tektronix Part No. 003-0675-00.

PERFORMANCE CHECK AND ADJUSTMENT PROCEDURE INDEX

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PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at any ambient temperature from 0°C to +50°C unless otherwise stated. Adjustments must be performed at an ambient temperature from +20°C to +30°C for specified accuracies.

1. Check that the internal Line-Voltage Selector block has been set for the correct input line voltage (see Section 5, Installation).

2. Check that the crt has an 8 X 10 division scribed graticule (standard accessory) over the display area, unless your instrument has Option 1, Internal Graticule.

3. (Options 6, 23, or 28.) Remove the cabinet panels (see Section 7, Maintenance) to gain access to the internal controls and test points.

4. Connect the instrument to the line-voltage source.

5. Apply power to the 603A and all test equipment to be used, and allow at least 20 minutes warm-up time.

6. Set the controls as follows:

NOTE

Refer to the Internal Control and Selector Locations pullout page in Section 10, Diagrams and Circuit Board Illustrations, for the locations of the internal switches and selector plugs.

Internal

Int Swp S350 (Option 4 only) . . . . X-Y (down position)

Int Blank Plug P558 (Option 4 only) . . . . Install dummy plug

WARNING

The finned transistor heat sinks on the Deflection Amplifier board are elevated to as much as +215 volts. To avoid a potential shock hazard, always turn the instrument power off before changing the settings of the switches on the Deflection Amplifier board.

X and Y Atten (all) (Option 22 only) . . . . 1X (up position)

Front Panel

POWER	On (button out)
STORE	Non-store (button out)
STORED BRIGHTNESS	Fully clockwise
INTENSITY	Fully counter-clockwise
FOCUS	Midrange
Vertical Position	Midrange
Horizontal Position	Midrange

A. POWER SUPPLIES

Equipment Required

1. Precision dc voltmeter (low-voltage supplies)
2. Dc voltmeter (high-voltage supply)

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams and Circuit Board Illustration section.

NOTE

Perform the Preliminary Procedure before making the following checks and adjustments.

A1. Check Power Supply Output Voltages

a. Connect the precision dc voltmeter between the appropriate voltage test points and ground.

b. CHECK—the voltmeter reading for the output voltage range for each supply as listed in Table 4-2:

Table 4-2

POWER SUPPLY OUTPUT VOLTAGE

Supply	Output Voltage Range
+15 V	+14.7 V to +15.3 V
−30 V	−29.85 V to −30.15 V (Adjusted for −30.00 V in step A2)
+215 V	+209.5 V to +221.5 V
+360 V	+342 V to +378 V

A2. Adjust −30-Volt Supply (R878)

a. Connect the precision dc voltmeter between the −30-volt test point and ground.

b. ADJUST—R878 (−30 V) for a voltmeter reading of exactly −30.00 volts.

c. INTERACTION—Any change in the −30-volt supply beyond the limits in Table 4-2 may affect the operation of all circuits in the instrument.

d. Disconnect the precision dc voltmeter.

A3. Check High-Voltage Supply

WARNING

Turn off instrument power when connecting and disconnecting the dc voltmeter. Potentially dangerous electrical shock hazards exist at several points on the High-Voltage and Regulator board and the crt socket.

a. Connect the dc voltmeter (20 kΩ/volt VOM set to measure at least −3620 volts) between ground and the −3450-volt test point (pin 2 of the crt base-pin socket). Remove protective cap over crt socket.

b. CHECK—for a voltmeter reading of −3280 volts to −3620 volts.

A4. Adjust High-Voltage Supply (R575)

a. ADJUST—R575 (HV Adj) for exactly −3450 volts.

b. Turn off the instrument power and disconnect the voltmeter. (Replace protective cap over crt socket.)

B. CRT CIRCUIT

Equipment Required

1. Precision dc voltmeter
2. Ramp Generator
3. 50-ohm cable

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams and Circuit Board Illustrations section.

NOTE

Perform the Preliminary Procedure before making the following checks and adjustments.

CAUTION

Do not allow a high-intensity spot to remain stationary on the crt. The crt phosphor could be permanently damaged.

B1. Adjust Crt Bias (Cutoff, R588)

a. Set the INTENSITY and Position controls for a visible dot on the crt.

b. Connect the precision dc voltmeter between ground and the collectors of Z-axis Amplifier output transistors Q554 and Q556.

c. Set the INTENSITY control for a voltmeter reading of +10 volts. Disconnect the voltmeter.

d. ADJUST—R588 (Cutoff) until the trace just disappears.

e. Set the INTENSITY control for a visible dot.

B2. Adjust Astigmatism (R594)

a. Set the front-panel FOCUS control fully clockwise.

b. ADJUST—R594 (Astig) for a round dot.

c. Set the FOCUS control for optimum dot definition.

NOTE

For critical applications, slight readjustment of R594 (Astig) may improve dot definition.

B3. Adjust TRACE ROTATION (R598)

a. Apply a 1-volt positive-going, 5 ms duration ramp signal from the ramp generator to the +X INPUT connector.

b. Set the ramp generator amplitude for a 10-division horizontal trace on the crt.

c. Position the trace to the graticule horizontal center line.

d. ADJUST—R598 (TRACE ROTATION), located on the rear panel, to align the trace with the graticule horizontal center line.

B4. Adjust Geometry (R596)

a. Position the trace to the top graticule line, then to the bottom graticule line.

b. CHECK—the trace for 0.1 division, or less, of bowing at the top and bottom graticule lines.

c. ADJUST—R596 (Geom) for minimum trace bowing at the top and bottom graticule lines.

d. Disconnect the ramp generator from the +X INPUT connector and connect it to the +Y INPUT connector.

e. Position the trace to the left edge of the graticule, then to the right edge.

f. CHECK—the trace for 0.1 division, or less, or bowing at the left and right edges of the graticule.

g. If necessary, readjust R596 (GEOM) for minimum trace bowing at the left and right edges of the graticule. Repeat parts (a) through (g) of this step as necessary until optimum geometry is achieved.

h. Disconnect the ramp generator.

C. VERTICAL (Y) AND HORIZONTAL (X) AMPLIFIERS

Equipment Required

1. Test oscilloscope
2. Ramp Generator
3. Calibration generator
4. Sine-wave generator
5. Function generator
6. Bnc Tee connector
7. Dual-input coupler
8. 50-ohm cables (3)
9. 50-ohm termination

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams and Circuit Board Illustrations section.

NOTE

Perform the Preliminary Procedure before making the following checks and adjustments.

C1. Adjust Vertical (Y) Axis Gain (R125), Sensitivity Correction (R715), and HF Compensation (C168)

NOTE

The Y Gain is normally set to provide full-screen deflection, depending upon the input signal amplitude. The following procedure adjusts the Y Gain so that 1 volt provides eight divisions of deflection. Be sure to place grounding caps on unused inputs if your instrument includes Option 21 (Full Differential Inputs).

WARNING

The finned transistor heat sinks on the Deflection Amplifier board are elevated to as much as +215 volts. To avoid a potential shock hazard, always turn the instrument power off before changing the settings of the switches on the Deflection Amplifier board.

a. (Option 22 only)—Check that X and Y attenuator switches (S310 and S330, S110 and S130) are all in the 1X (up) position.

b. Apply a positive-going, 5 ms duration ramp at approximately 2 volts amplitude from the ramp generator to the rear-panel +X INPUT connector.

c. Connect the calibration generator Ampl Output through a bnc Tee connector to the rear-panel +Y INPUT connector. Set the calibration generator mode to Std Ampl (standard amplitude) output.

d. Connect the ramp generator external triggering input to the bnc Tee connector at the output of the calibration generator.

e. Set the calibration generator output amplitude to 1 volt, and check that the variable amplitude control is pushed in (calibrated output position).

f. Set the ramp generator triggering controls for a stable display on the 603A Storage Display unit.

g. ADJUST—R125 (Y Gain) for an eight-division square-wave display on the 603A.

h. Push in the STORE button.

i. ADJUST—R715 (Sens. Corr.) for an eight-division square-wave display on the 603A.

j. Return the STORE button to the non-store mode (out position).

k. Set the calibration generator mode to High Ampl (high amplitude) and set the Period control to 10 μs (100 kHz), with the Variable control fully ccw.

l. Terminate the signal at the 603A +Y INPUT connector into 50 Ω.

m. Set the calibration generator Pulse Amplitude control for a six-division display on the 603A. Set the ramp generator controls for a triggered, 50 μs duration ramp output. The ramp amplitude should be set to provide 3 to 4 cycles of square-wave display on the 603A.

n. ADJUST—C168 (HF Comp) for an optimum square front corner on the 603A display (see Fig. 4-1). For best accuracy, position the display corner of interest to graticule center.

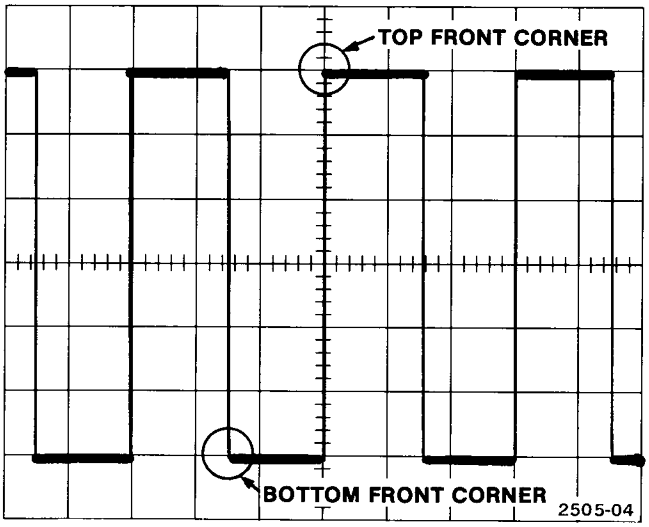


Fig. 4-1. Typical display for adjusting vertical compensation.

C2. Adjust Vertical (Y) Attenuator Compensation (C110 and C130) (Options 21 and 22)

NOTE

The following procedure includes the adjustment for both the standard and the Option 21 instrument (differential inputs). If your instrument does not include Option 21, disregard those subparts referring to the −Y INPUT, S130, and C130.

a. Set S110 (+Y Atten) to the 5X (down) position.

b. (Option 21 only). Set S130 (−Y Atten) to the 5X (down) position.

c. Set the calibration generator Period control to 1 ms (1 kHz), with the Variable control fully ccw (calibrated). Set the Pulse Amplitude control for a six-division display on the 603A.

d. Set the ramp generator for a triggered, positive-going, 5 ms duration ramp at approximately 2 volts in amplitude.

e. ADJUST—C110 (+Y Atten Comp) for an optimum square top front corner on the 603A display (see Fig. 4-1). For best accuracy, position the display corner of interest to graticule center.

f. (Option 21 only, parts f through h.) Disconnect the signal from the +Y INPUT connector, and connect it to the −Y INPUT connector. (The grounding cap should be placed on the +Y INPUT connector.)

g. ADJUST—C130 (−Y Atten Comp) for an optimum square bottom front corner on the 603A display (see Fig. 4-1). For best accuracy, position the display corner of interest to graticule center.

h. Disconnect the signal from the −Y INPUT connector, and set S130 (−Y Atten) to the 1X (up) position.

i. Set S110 (+Y Atten) to the 1X (up) position.

C3. Check Vertical (Y) Common-Mode Rejection (Options 21 and 22)

NOTE

The following procedure includes the check for both the standard and the Option 22 instrument (with 5X attenuators). If your instrument does not include Option 22, disregard those subparts referring to use of attenuators.

a. Connect the function generator output to the test oscilloscope input via a 50-ohm cable.

b. Set the function-generator controls for a 100-kHz, 3-volt (p-p) sine wave as indicated on the test oscilloscope.

c. Disconnect the sine-wave from the test oscilloscope and connect it (using the dual-input coupler) to both the +Y and −Y INPUT connectors on the 603A.

d. With the ramp-generator output connected to the +X INPUT, set the generator controls for a 10 ms duration ramp with an amplitude of approximately 2 volts (to fill the screen horizontally).

e. CHECK—for 0.48 division, or less, or free-running vertical display on the 603A (position as necessary).

f. (Option 22 only, parts f through i.) Set S110 (+Y Atten) and S130 (−Y Atten) to the 5X (down) position.

g. Connect the function-generator output to the test oscilloscope input via a 50-ohm cable, and set the generator output to 15-volts (p-p). Reconnect the function-generator output to both the +Y and −Y INPUT connectors, using the dual-input coupler.

h. CHECK—for 0.5 division, or less, of free-running vertical display on the 603A (position as necessary).

i. Set S110 and S130 to the 1X (up) position, and disconnect the X and Y input signals.

C4. Check Vertical Settling Time

a. Connect the ramp generator gate output to the +Z INPUT connector. Check that a grounding cap is on the −Z INPUT connector. (Option 21 only.)

b. Set the ramp generator duration for a 10 μs ramp, connect the output to the +X INPUT, and set the output amplitude for exactly 10 divisions of trace length.

c. Connect the calibration generator trigger output to the ramp generator trigger input, and set the ramp generator trigger controls for a triggered output.

d. Connect the calibration generator fast-rise positive-going output to the +Y INPUT via a 50-ohm cable and 50-ohm termination. Set the calibration generator amplitude for eight divisions of vertical display, and the frequency range to 100 kHz. Then, set the variable frequency control to obtain a display of approximately 1 cycle.

e. CHECK—that the time for the leading edge of the square wave to travel from the zero percent level to the 100 percent level (within a trace width, 0.025-inch) is 1 microsecond (1 division) or less. See Fig. 4-2.

f. Disconnect the test equipment from the X, Y, and Z INPUT connectors.

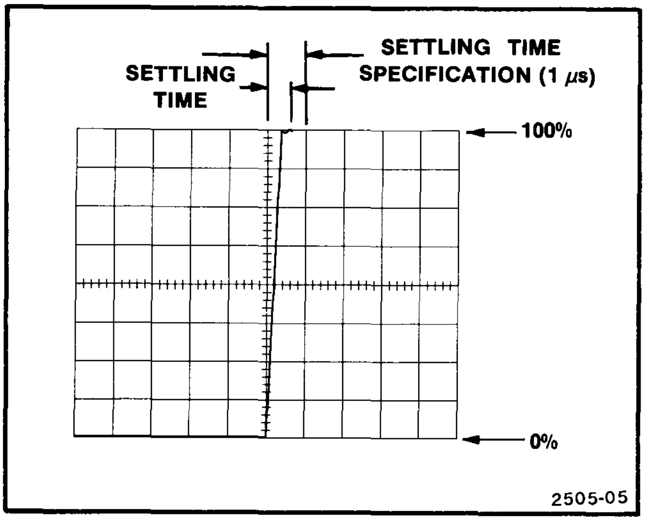


Fig. 4-2. Typical crt display for vertical settling time measurement (settling time includes corner distortion).

C5. Adjust Horizontal (X) Axis Gain (R325) and HF Compensation (C368)

NOTE

The X Gain is normally set to provide 10 divisions of deflection, depending upon the input signal amplitude. The following procedure adjusts the X Gain so that 1 volt provides 10 divisions of deflection. If the gain adjustment is changed, the X attenuator compensation (Option 22 instruments) should be readjusted to optimize square-wave response.

WARNING

The finned transistor heat sinks on the Deflection Amplifier board are elevated to as much as +215 volts. To avoid a potential shock hazard, always turn the instrument power off before changing the settings of the switches on the Deflection Amplifier board.

a. (Option 22 only.)—Check that X and Y attenuator switches (S310 and S330, S110 and S130) are all in the 1X (up) position.

b. Apply a positive-going, 5 ms duration ramp at approximately 2 volts amplitude from the ramp generator to the +Y INPUT connector.

c. Connect the calibration generator Ampl Output through a bnc Tee connector to the +X INPUT connector. Set the calibration generator mode to Std Ampl (standard amplitude).

d. Connect the ramp generator external triggering input to the bnc Tee connector at the output of the calibration generator.

e. Set the calibration generator output amplitude to 1 volt, and check that the variable amplitude control is pushed in (calibrated output position).

f. Set the ramp generator triggering controls for a stable display on the 603A Storage Display unit.

g. ADJUST—R325 (X Gain) for a 10-division display on the 603A.

h. Set the calibration generator mode to High Ampl (high amplitude) and set the Period control to 10 μs (100 kHz), with the Variable control fully ccw.

i. Terminate the signal at the 603A +X INPUT connector into 50 Ω.

j. Set the calibration generator Pulse Amplitude control for a six-division display on the 603A. Set the ramp generator controls for a triggered, 50 μs duration ramp output. The ramp amplitude should be set to provide 3 to 4 cycles of square-wave display on the 603A.

k. ADJUST—C368 (HF Comp) for an optimum square right front corner on the 603A display (see Fig. 4-3). For best accuracy, position the display corner of interest to graticule center.

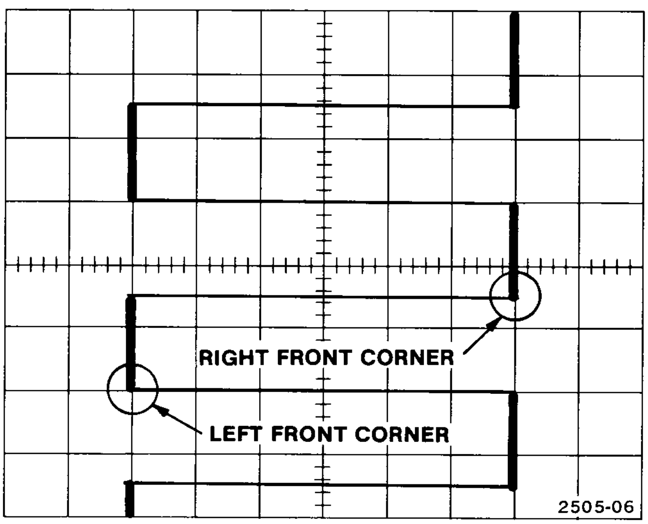


Fig. 4-3. Typical display for adjusting horizontal compensation.

C6. Adjust Horizontal (X) Attenuator Compensation (C310 and C330) (Options 21 and 22)

NOTE

The following procedure includes the adjustment for both the standard and the Option 21 instrument (differential inputs). If your instrument does not include Option 21, disregard those subparts referring to the −X INPUT, S330, and C330.

a. Set S310 (+X Atten) to the 5X (down) position.

b. (Option 21 only). Set S330 (−X Atten) to the 5X (down) position.

c. Set the calibration generator Period control to 1 ms (1 kHz), with the Variable control fully ccw (calibrated). Set the Pulse Amplitude control for an eight-division display on the 603A.

d. Set the ramp generator for a triggered, positive-going, 5 ms duration ramp at approximately 2 volts in amplitude.

e. ADJUST—C310 (+X Atten Comp) for an optimum square right front corner on the 603A display (see Fig. 4-3). For best accuracy, position the display corner of interest to graticule center.

f. (Option 21 only, parts f through h.) Disconnect the signal from the +X INPUT connector, and connect it to the −X INPUT connector. (The grounding cap should be placed on the +X INPUT connector).

g. ADJUST—C330 (−X Atten Comp) for an optimum square left front corner on the 603A display (see Fig. 4-3). For best accuracy, position the display corner of interest to graticule center.

h. Disconnect the signal from the −X INPUT connector, and set S330 (−X Atten) to the 1X (up) position.

i. Set S310 (+X Atten) to the 1X (up) position.

C7. Check Horizontal (X) Common-Mode Rejection (Options 21 and 22)

NOTE

The following procedure includes the check for both the standard and the Option 22 instrument (with 5X attenuators). If your instrument does not include Option 22, disregard those subparts referring to use of attenuators.

a. Connect the function-generator output to the test oscilloscope input via a 50-ohm cable.

b. Set the function generator controls for a 100 kHz, 3-volt (p-p) sine wave as indicated on the test oscilloscope.

c. Disconnect the sine-wave signal from the test oscilloscope and connect it (using the dual-input coupler) to both the +X and −X INPUT connectors on the 603A.

d. With the ramp-generator output connected to the +Y INPUT, set the generator controls for a 10 ms duration ramp with an amplitude of approximately 2 volts (to fill the screen vertically).

e. CHECK—for 0.48 division, or less, or free-running horizontal display on the 603A (position as necessary).

f. (Option 22 only, parts f through i). Set S310 (+X Atten) and S330 (−X Atten) to the 5X (down) position.

g. Connect the function-generator output to the test oscilloscope input via a 50-ohm cable, and set the generator output to 15-volts (p-p). Reconnect the function-generator output to both the +X and −X INPUT connectors, using the dual-input coupler.

h. CHECK—for 0.5 division, or less, or free-running horizontal display on the 603A (position as necessary).

i. Set S310 and S330 to the 1X (up) position, and disconnect the X and Y input signals.

C8. Check Horizontal Settling Time

a. Connect the ramp generator gate output to the +Z INPUT connector. Check that a grounding cap is on the −Z INPUT connector. (Option 21 only.)

b. Set the ramp generator duration for an 8 μs ramp, connect the output to the +Y INPUT, and set the output amplitude for exactly eight divisions of trace length.

c. Connect the calibration generator trigger output to the ramp generator trigger input, and set the ramp generator trigger controls for a triggered output.

d. Connect the calibration generator fast-rise positive-going output to the +X INPUT via a 50-ohm cable and 50-ohm termination. Set the calibration generator amplitude for 10 divisions of horizontal display, and the frequency range to 100 kHz. Then, set the variable frequency control to obtain a display of approximately 1 cycle.

e. CHECK—that the time for the leading edge of the square wave to travel from the zero percent level to the 100 percent level (within a trace width, 0.025-inch) is 1 microsecond (1 division) or less. See Fig. 4-4.

f. Disconnect the test equipment from the X, Y, and Z INPUT connectors.

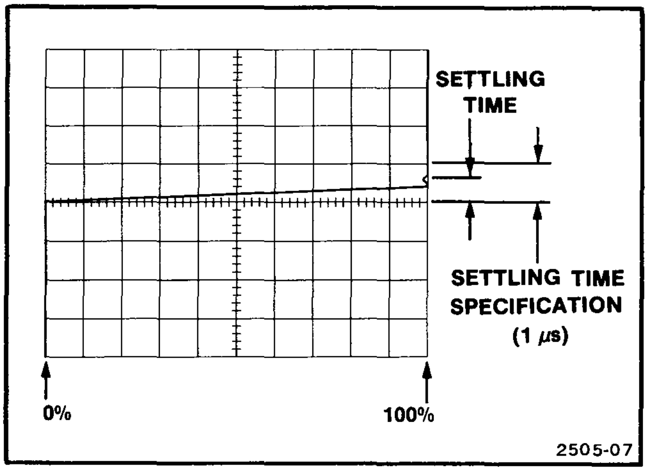


Fig. 4-4. Typical crt display for horizontal settling time measurement (settling time includes corner distortion).

C9. Check Vertical (Y) and Horizontal (X) Bandwidth

a. Connect the ramp generator to the +X INPUT connector, set the ramp duration to 10 ms, and set the ramp amplitude to approximately 2 volts (to fill the screen horizontally).

b. Connect the sine-wave generator output to the +Y INPUT connector via a 50 Ω cable and 50 Ω termination. Set the generator frequency to 50 kHz.

c. Set the sine-wave generator amplitude and the 603A vertical position control for a centered 6.4-division display.

d. Slowly increase the sine-wave generator frequency until the vertical display amplitude is 4.5 divisions.

e. CHECK—that the sine-wave generator frequency is at least 2 MHz. The frequency reading is the vertical (Y) axis bandwidth.

f. Disconnect the ramp generator from the +X INPUT, and disconnect the sine-wave generator from the +Y INPUT.

g. Connect the ramp-generator output to the +Y INPUT connector.

h. Connect the sine-wave generator to the +X INPUT connector.

i. Set the sine-wave generator frequency to 50 kHz. Set the sine-wave generator amplitude and the 603A horizontal position control for a centered eight-division display.

j. Slowly increase the sine-wave generator frequency until the horizontal display amplitude is 5.66 divisions.

k. CHECK—That the sine-wave generator frequency is at least 2 MHz. The frequency reading is the horizontal (x) axis bandwidth.

l. Disconnect the ramp generator from the +Y INPUT, and disconnect the sine-wave generator from the +X INPUT.

C10. Check Vertical (Y) and Horizontal (X) Phase Difference

a. Connect the sinewave generator to both the +Y INPUT and +X INPUT connectors, using the dual-input coupler.

b. Set the sine-wave generator frequency to 50 kHz.

c. Set the sine-wave generator amplitude and the 603A Position controls for an eight-division diagonal display as shown in Fig. 4-5.

d. Set the sine-wave generator frequency to 500 kHz.

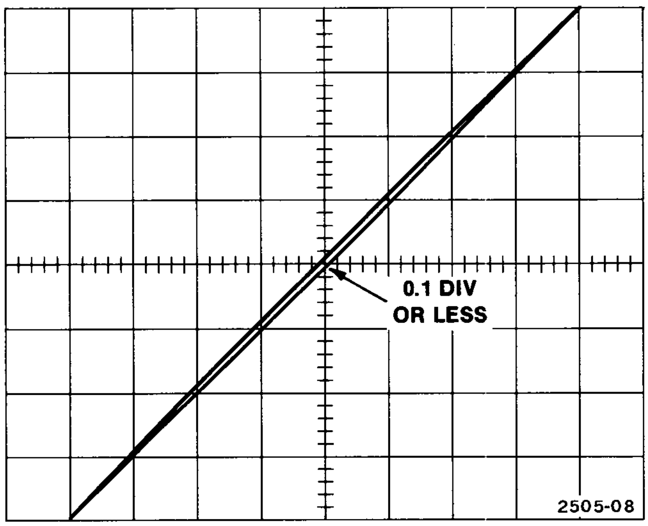


Fig. 4-5. Typical display of horizontal and vertical phase difference.

e. CHECK—that the diameter of the displayed ellipse, measured vertically at the center of the graticule, is 0.1 division or less (see Fig. 4-5). If necessary, adjust C168 (vertical HF Comp) and C368 (horizontal HF Comp) slightly to reduce phase shift.

f. INTERACTION—C168 and C368 affect frequency response of the vertical and horizontal amplifiers. If adjustment was necessary in part (e), repeat Steps C1, C5, and C9 to obtain minimum phase shift with best frequency response.

g. Disconnect the sine-wave generator from the +Y INPUT and +X INPUT connectors.

D. Z-AXIS AMPLIFIER

Equipment Required

1. Test oscilloscope
2. Ramp generator
3. Calibration generator
4. Sine-wave generator
5. Function generator
6. Bnc Tee connector
7. Dual-input coupler
8. 50-ohm cables (3)
9. 50-ohm termination

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagram and Circuit Board illustrations section.

NOTE

Perform the Preliminary Procedure before making the following checks and adjustments.

D1. Adjust Z-Axis Gain (R512) and HF Compensation (C560)

NOTE

In this step, the test oscilloscope is used as the amplitude-measurement standard. The accuracy of the adjustment of Z-axis gain is determined by the test oscilloscope vertical sensitivity calibration.

a. Connect the calibration generator Ampl Output through a 50-ohm cable to the test oscilloscope vertical input. (Do not terminate the cable.) Set the calibration generator mode to Std Ampl (standard amplitude). Set the Amplitude control to 1 V.

b. Set the test oscilloscope vertical deflection factor to 200 mV/div and the sweep rate to 500 μs/div.

c. Set the test oscilloscope gain for precisely 5 divisions of deflection.

d. Disconnect the cable from the calibration generator Ampl Output, and connect it to the sine-wave generator Output connector via bnc Tee connector.

e. At the test oscilloscope vertical input, attach a 50-ohm termination to the cable end, and reconnect to the vertical input. Leave the vertical deflection factor at 200 mV/div, and change the sweep rate to 20 μs/div.

f. Set the sine-wave generator frequency to 50 kHz. Set the output amplitude for precisely five divisions of deflection on the test oscilloscope. This calibrates the sine-wave generator for a 1-volt output.

g. Apply a positive-going, 200 μs duration ramp signal, approximately 1 volt in amplitude, to the +X INPUT connector on the 603A. (Set the ramp amplitude to fill the screen horizontally.)

h. Connect a 50-ohm cable from the Tee connector on the sine-wave generator to the ramp generator external triggering input. Set the ramp generator controls for triggered operation.

i. Disconnect the cable with termination from the test oscilloscope vertical input, and connect it (with the termination still attached) to the 603A +Z INPUT connector.

j. Set the 603A INTENSITY control to the fully clockwise position.

NOTE

If your instrument includes Option 21 (Differential Inputs), check to be sure that a grounding cap is installed on the −Z INPUT connector.

k. ADJUST—R512 (Z Gain) for bright line segments that are completely blanked between each segment.

NOTE

The preceding procedure sets the Z-axis Amplifier gain for a full intensity range of 1 volt. This procedure can be repeated for any input voltage up to 5 volts to provide the desired Z-axis sensitivity.

l. Reduce the 603A display intensity, and disconnect the sine-wave generator from the +Z INPUT connector.

m. Set the test oscilloscope deflection factor for 5 volts/div (including attenuation of 10X probe), and the sweep rate for 2 μs/div.

n. Connect the 10X probe from the test oscilloscope vertical input to the junction of the collectors of Z-axis Amplifier output transistors Q554 and Q556.

o. Set the 603A INTENSITY control for a +10-volt dc level at the collector junction of Q554—Q556 as indicated on the test oscilloscope.

p. Connect a 50-ohm cable from the calibration generator Ampl Output connector to the 603A +Z-AXIS INPUT connector. Do not terminate the cable. Set the calibration generator mode to High Ampl, and the Period to 10 μs (100 kHz).

q. Set the calibration generator Pulse Amplitude control for a four-division display on the test oscilloscope.

r. ADJUST—C560 (Z HF Comp) for a optimum square front corner on the test oscilloscope display.

D2. Check Z-Axis Bandwidth

a. Disconnect the calibration generator from the +Z INPUT connector.

b. Set the 603A INTENSITY control for a +30-volt dc level at the junction of the collectors of Q554 and Q556 as indicated on the test oscilloscope.

c. Connect the output of the sine-wave generator to the 603A +Z INPUT, using a 50-ohm cable and 50-ohm termination.

d. Set the sine-wave generatior frequency to 50 kHz, and set the output amplitude for an eight-division free-running display on the test oscilloscope.

e. Slowly increase the sine-wave generator frequency until the test oscilloscope display amplitude is 5.66 divisions. This is the upper −3 dB point of the bandwidth.

f. CHECK—that the sine-wave generator frequency is at least 5 mHz.

D3. Check Z-Axis Amplifier Common-Mode Rejection (Option 21 only)

NOTE

Z-Axis Gain must be set for 1 volt = full intensity when performing this step.

a. Connect the function generator output to the test oscilloscope vertical input via a 50-ohm cable with a 50-ohm termination.

b. Set the function generator controls for a 100 kHz, 5-volt (p-p) sine wave as indicated on the test oscilloscope.

c. Set the INTENSITY control on the 603A so that the trace just disappears.

d. Connect the 10X probe from the test oscilloscope vertical input to the junction of the collectors of Z-Axis Amplifier output transistors Q554 and Q556.

e. Set the test oscilloscope vertical for ac coupling and the deflection factor for 1-volt/div (including 10X attenuation of probe). Set the sweep rate to 10 μs/div.

f. Connect the function generator output to the +Z INPUT and the −Z INPUT connectors with a 50-ohm cable, 50-ohm termination, and a dual-input coupler.

g. CHECK—that the test oscilloscope display amplitude is 2.1 divisions (2.1 volts, p-p) or less.

h. Disconnect all test equipment.

E. STORAGE CIRCUIT

Equipment Required

1. Ramp generator
2. Precision dc voltmeter
3. 50-ohm cable

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams and Circuit Board Illustrations section.

NOTE

Perform the Preliminary Procedure before making the following checks and adjustments.

E1. Check/Adjust Storage Level (R670)

a. Apply a 10 ms duration, automatically triggered, positive-going ramp from a ramp generator to the +X INPUT connector.

b. Push the front-panel STORE button in.

c. Connect the precision dc voltmeter between the flood-gun cathodes (pin 3 of P735) and the Store Level test point (TP680). Record the voltmeter reading so that, if necessary, the operating level can be returned to the original setting.

NOTE

If crt performance has been satisfactory, no adjustment of the Store Level control is necessary. Proceed to the Collimation adjustment (R730).

For replacement crt's, an information card is provided to show the optimum levels established by the factory for the individual crt. All voltage levels associated with storage operation are made with respect to the flood-gun cathodes.

d. Locate the Writing Threshold (minimum store level) as follows:

1. Turn the INTENSITY control clockwise until the trace starts to defocus rapidly. Press the ERASE button to prepare the target area for storage.

2. Write about three lines per vertical division across the screen by slewing the free-running trace vertically with the vertical position control.

3. Carefully check the written lines for breaks or gaps of 0.025 inch or more. If no breaks or gaps are evident after 10 seconds, adjust R670 (Store Level) to reduce the operating level by 5 volts (below that noted in part c).

4. Press the ERASE button twice, wait 10 seconds, then write again (same as in part d2). Check for breaks or gaps.

5. Repeat this procedure of decreasing the operating voltage level in 5-volt steps until breaks of about 0.025 inch occur. This is the writing Threshold. Record the voltage and reset the Store Level control to the level recorded in part c.

NOTE

Do not change the INTENSITY or FOCUS control settings.

e. Locate the Upper Writing Limit (maximum store level) as follows:

1. Press the ERASE button, and again write about three lines per vertical division. Carefully check the stored lines and background for trace spreading or background fade-up. If no trace spreading or background fade-up is evident after 10 seconds, adjust R670 (Store Level) to increase the operating level by 5 volts.

2. Press the ERASE button twice, wait 10 seconds, then write again (same as in part d2). Check for spreading or fade-up.

3. Repeat this procedure until trace spreading of about 0.025 inch (or background fade-up) occurs. This is the Upper Writing Limit. Record this voltage.

f. ADJUST—R670 (Store Level) for an operating point (Storage Level) midway between the Upper Writing Limit (from part e2) and the Writing Threshold (from part d5).

g. INTERACTION—Collimation and gain are affected if the change in operating level is significant. The Collimation (CE 1) adjustment and Sens Corr (R715) adjustment in Step C1, part j should be checked following any significant change in operating level.

E2. Adjust Collimation (CE 1, R730)

a. Move the positive lead of the precision dc voltmeter from TP680 to CE 1 test point TP725.

b. Write the entire screen area by slowly positioning the trace vertically. If the screen fails to write (store), adjust the INTENSITY control slightly clockwise and repeat the process until the screen is fully written. Then, turn the INTENSITY control fully counterclockwise.

c. Record the voltmeter reading before an adjustment is made so that, if necessary, the collimation voltage can be returned to its original setting.

d. With the screen fully written, turn R730 (CE 1) fully counterclockwise, noting that the screen edges are brightened and pulled in.

e. ADJUST—R730 (CE 1) clockwise to the point where the bright area just covers the graticule area.

f. Press the ERASE button and disconnect the precision dc voltmeter.

g. INTERACTION—Storage capabilities and display geometry should be rechecked if a significant change was made in the collimation voltage.

E3. Adjust Non-Store (R700)

a. Write the entire screen area by slowly positioning the trace vertically.

b. ADJUST—R700 (Non-Store) so the background glow quickly (less than 1 second) disappears when the screen is placed in the non-store mode (STORE button out). Repeat this step as necessary to achieve correct adjustment of R700.

F. SWEEP GENERATOR (OPTION 4)

Equipment Required

1. Sine-wave generator
2. Time-mark generator
3. 50-ohm cable
4. 50-ohm termination

BEFORE YOU BEGIN, see **TEST POINT AND ADJUSTMENT LOCATIONS** in the Diagrams and Circuit Board Illustrations section.

NOTE

Perform the Preliminary Procedure before making the following checks and adjustments.

F1. Adjust Sweep Length (R915)

a. Set the Option 4 controls and plug jumper as follows:

Int Swp S350 (Deflection Amplifier board)	YT (up position)
Trig Mode S909 (Sweep board)	Auto (rear position)
SEC/DIV	1 μ
VARIABLE	Fully clockwise (calibrated)
TRIG SLOPE/LEVEL	Centered
Sweep board plug-jumper (Storage board)	Replace dummy plug P558 with wired plug P558 (see Section 5, Installation).

b. Set the INTENSITY control for a barely visible trace.

c. ADJUST—R915 (Swp Length) for a sweep length of approximately 10.5 divisions.

F2. Check TRIGger SLOPE/LEVEL and Mode

a. Apply a 2 MHz sine-wave signal from the sine-wave generator to the +Y INPUT connector via 50 Ω cable and 50 Ω termination.

b. Set the sine-wave generator amplitude for a 0.5 division display.

c. CHECK—that a stable jitter-free display can be obtained by turning the TRIG SLOPE/LEVEL control.

d. CHECK—for a free-running display when the TRIG SLOPE/LEVEL control is set fully clockwise and fully counterclockwise.

e. Set S909 (Trig Mode) to Norm (forward position).

f. CHECK—that a stable display can be obtained by turning the TRIG SLOPE/LEVEL control.

g. CHECK—for no display when the TRIG SLOPE/LEVEL control is set fully clockwise and fully counterclockwise.

h. Set S909 (Trig Mode) to Auto. Set the TRIG SLOPE/LEVEL for a stable display.

i. Disconnect the sine-wave generator.

F3. Check/Adjust Sweep Timing (R965)

a. Set the SEC/DIV switch to 1 m.

b. Apply 1 ms markers from the time-mark generator through the 50-ohm termination to the +Y INPUT connector.

c. Set the time-mark generator amplitude (or attach attenuators) for a two- to six-division display.

d. Set the TRIG SLOPE/LEVEL control as necessary for a stable display.

e. Position the first time marker to the left edge of the graticule and check for 1 time mark per graticule division.

f. CHECK—that the distance between the second and tenth time marker is eight divisions within 0.24 division (3%).

g. ADJUST—R965 (Swp Cal) so that the second and tenth time marks are exactly eight divisions apart.

h. CHECK—remaining SEC/DIV switch positions with time markers that correspond to each switch position. The distance between the second and tenth marker at each SEC/DIV switch position should be eight divisions within 0.24 division (3%).

F4. Check VARIABLE Time/Division

a. Set the time-mark generator for 0.1 ms markers.

b. Set the SEC/DIV switch to 0.1 m and check for 1 time marker per division.

c. Set the front-panel VARIABLE adjustment fully counterclockwise.

d. Set the SEC/DIV switch to 10 μ.

e. CHECK—for at least 1 time marker per graticule division.

f. Disconnect all test equipment.

NOTE

If this 603A is to be used for X-Y operation, return the Int Swp switch (S350) to the X-Y position and replace the wired P558 plug with the dummy P558 plug.

This completes the Performance Check and Adjustment Procedure.

INSTALLATION

This section of the manual contains information for installing the 603A, including selection of the line-voltage operating range, rackmounting information, and installation in patient-care facilities.

OPERATING POWER INFORMATION

This instrument can be operated from either a 120-volt or 220-volt nominal line-voltage source, and over a line frequency range of 48 to 440 Hz. In addition, three regulating ranges are provided for each nominal line-voltage source.

CAUTION

To prevent damage to the instrument, always check the line-voltage information recorded on the rear panel before applying power to the instrument.

Power Cord Information

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 polarized two-pole, three-terminal 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 into a mating outlet with a safety-earth contact.

Do not defeat the grounding connection. Any interruption of the grounding connection can create an electric-shock hazard. Before making external connections to this instrument, always ground the instrument first by connecting the power cord to a properly-mated power outlet.

Table 5-1

POWER-CORD CONDUCTOR IDENTIFICATION

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

The power-cord plug required depends upon the ac input voltage and the country in which the instrument is to be used. Should you require a power-cord plug other than that supplied with your instrument, refer to the standards listed in Table 5-2.

Table 5-2

LOCATION OF POWER-CORD CONFIGURATION INFORMATION

Nominal Line Voltage	Reference Standards
120 V ac	[1]ANSI C73.11 [2]NEMA 5-15-P (Hospital Grade)
220 V ac	ANSI C73.20 [3]AS C112 [4]BS 1363 [5]CEE 7, sheets IV, VI and VII NEMA 6-15-P

[1]**ANSI—American National Standard Institute**
[2]**NEMA—National Electrical Manufacturer's Association**
[3]**AS—Standards Association of Australia**
[4]**BS—British Standards Institution**
[5]**CEE—International Commission on Rules for the Approval of Equipment**

For medical-dental applications, use NEMA 5-15-P (Hospital Grade) plug for 120-volt operation, or NEMA 6-15-P plug for 220-volt operation.

Line-voltage and Regulating-range Selection

CAUTION

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

To select the correct nominal line voltage and regulating range, proceed as follows:

1. Disconnect the instrument from the power source.

2. If your instrument includes panel covers (Option 6, 23, or 28), remove the right side-panel to gain access to the Power Supply Rectifier board.

3. To convert from 120 volts to 220 volts (nominal) line voltage, or vice versa, remove the Line-Selector block from the square-pin connectors (see Fig. 5-1) and replace it with the unused block.

NOTE

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

The replaced block may be stored on the Rectifier circuit ,board, in the unused block position. Remove the line fuse from the fuse holder, and replace it with one having the correct rating (see Section 3, Specification, for proper fuses).

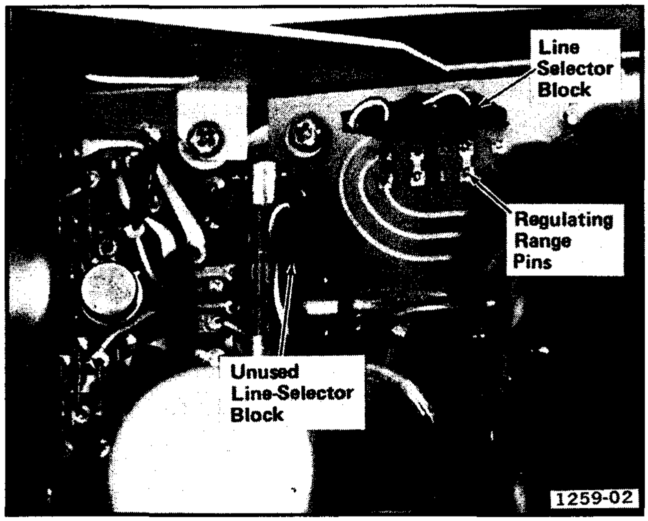


Fig. 5-1. Locations of the Line-Selector block on the Power Supply Rectifier board.

NOTE (Option 6 only)

The fuse is located under the power transformer inside the bottom cabinet cover, at the right rear of the instrument.

4. Change the line-cord power plug. For medical-dental applications, use NEMA configuration 6-15-P for 220 volts, and 5-15-P (Hospital Grade) for 120 volts. Examples of the plugs are: (a) Bryant 5666-N (Tektronix Part No. 131-1651-00) for 220-volt operation, and (b) Hubbell 8215-C (Tektronix Part No. 131-1703-00) for 120-volt operation.

5. To change regulating ranges, place the Line-Selector block on the desired set of square pins. Select a range that is centered about the average line voltage to which the instrument is to be connected. (See following Table 5-3.)

Table 5-3

LINE VOLTAGE REGULATING RANGE SELECTION

Line Selector Block Position	Regulating Range	
	120 Volts Nominal	220 Volts Nominal
L	90 Vac to 110 Vac	180 Vac to 220 Vac
M	99 Vac to 121 Vac	198 Vac to 242 Vac
H	108 Vac to 132 Vac	216 Vac to 264 Vac

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

7. Replace the side panel (if included) and apply power to the instrument.

INSTALLATION IN PATIENT-CARE FACILITIES

WARNING

Do not use the amplifier INPUTS for direct-patient connection. Signal currents at these connectors, as well as leakage currents, may exceed values considered non-hazardous for direct-patient connection.

WARNING

Although this Monitor is not to be connected directly to a patient, interconnecting this Monitor to other equipment can result in the application of excessive current to a patient. It is extremely important that the interconnection is made in accordance with NFPA 76B-T, Tentative Standard for the Safe Use of Electricity in Patient Care Areas of Health Care Facilities, section 3038, "Signal Transmission Between Appliances".

Among the situations involving the above-mentioned patient hazard is one in which two or more pieces of interconnected equipment are grounded at locations remote from one another. The standard mentioned in the preceding warning describes both this hazard and the appropriate corrective measures.

INPUT ATTENUATION SELECTION

X and Y Input Attenuation (Option 22)

If your instrument is equipped with Option 22, Extended X5 Gain Range, the Horizontal (X) and Vertical (Y) Amplifiers include a selectable 1:1 and 5:1 step attenuator in the input circuits. These attenuators are set in the 1X position when shipped from the factory. When set in the 5X position, these attenuators extend the deflection factor range of the appropriate amplifier to at least 12.5 volts, for full-screen signal deflection. Refer to the Test Point and Adjustment Locations foldout page in section 10, Diagrams and Circuit Board Illustrations, for position settings and location of the attenuator switches.

WARNING

The finned transistor heat sinks on the Deflection Amplifier board are elevated to as much as +215 volts. To avoid a potential shock hazard, always turn the instrument power off before changing the X and Y Atten switch settings.

Z-Axis Input Attenuation

CAUTION

Exercise care in establishing the correct display intensity; a high-amplitude Z-axis input signal, combined with an excessively high setting of the INTENSITY control, may damage the crt phosphor.

The Z-Axis Amplifier is shipped from the factory with 1X input attenuation and 1 MΩ input impedance. However, the attenuation and input impedance can be modified to suit a specific application. Posts, on the Z-Axis board, allow components in the input circuit to be changed without damage to the circuit board. Figure 5-2 illustrates the method used to modify input attenuation and input impedance of the +Z INPUT. If your instrument includes Option 21, Full Differential Inputs, the same method can be applied to modify the −Z INPUT. Refer to the Test Point and Adjustment Locations foldout page in section 10, Diagrams and Circuit Board Illustrations, for location of the Z-Axis attenuation components. Refer to your local Tektronix Field Office or representative for additional information.

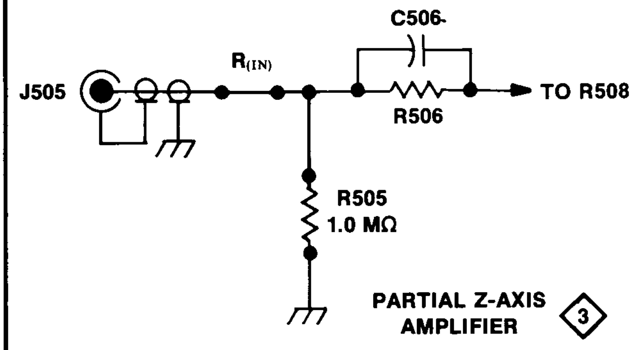
CONNECTING THE INTERNAL SWEEP (OPTION 4)

On instruments that are equipped with Option 4, Internal Time Base, internal switches are provided to connect the optional sweep generator circuit to the Horizontal (X) Amplifier. Also, a dummy plug on the Storage board must be replaced with an interconnecting plug to provide power to the Sweep board and to couple the sweep unblanking signal to the Z-Axis circuit. Refer to the Test Point and Adjustment Locations foldout page in section 10, Diagrams and Circuit Board Illustrations, for locations of the appropriate switches and interconnecting plug. Proceed as follows:

1. If your instrument includes Option 6, 23, or 28 (Panel Covers), remove both the left- and right-side panels to gain access.

2. Set S350 (XY-YT), located on the Deflection Amplifier board, to the YT (up) position.

1X ATTENUATION WITH 1 MΩ INPUT (STANDARD FROM FACTORY)



FORMULAS FOR DETERMINING INPUT IMPEDANCE AND ATTENUATION (10X ATTENUATION SHOWN)

$$R_{(IN)} + R505 = \text{INPUT IMPEDANCE}$$

$$900\ k + 100\ k = 1\ M\Omega\ \text{INPUT IMPEDANCE}$$

$$\frac{R_{(IN)} + R505}{R505} = \text{ATTENUATION}$$

$$\frac{100\ k\Omega + 900\ k\Omega}{100\ k\Omega} = 10X\ \text{ATTENUATION}$$

EXAMPLE OF 10X ATTENUATION (MODIFICATION REQUIRED BY CUSTOMER)

NOTE

THE ELECTRICAL VALUES ARE GIVEN ONLY TO ILLUSTRATE THE RATIO OF RESISTANCE NEEDED FOR 10X ATTENUATION.

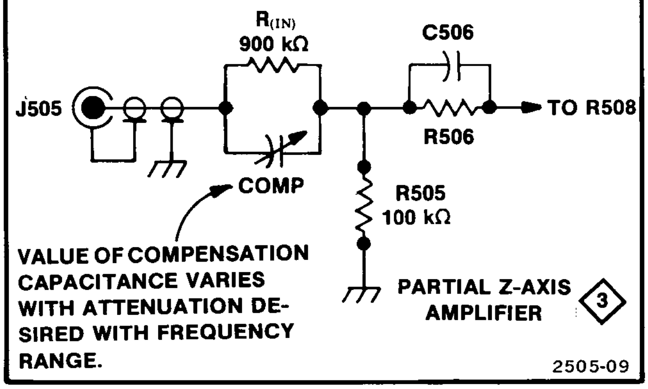


Fig. 5-2. Typical method used for modifying the Z-Axis input impedance and attenuation.

3. Set S909 (Trig Mode), located on the Sweep board, to the Auto (rear) position.

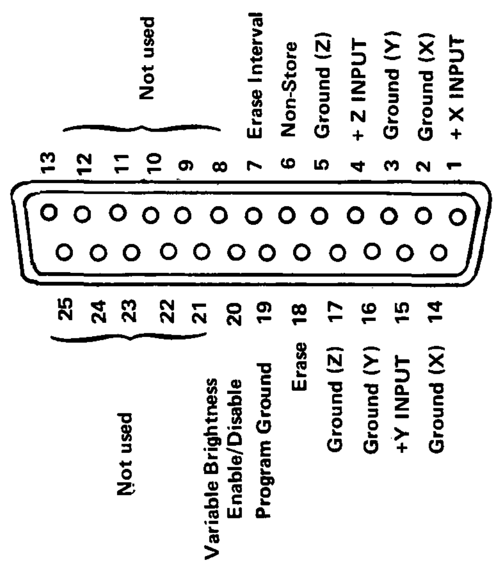
4. Replace the dummy plug, located on the Storage board, with the interconnecting plug P558. The interconnecting plug is taped on the top of the crt shield, alongside the Storage board. The dummy plug has a jumper between pins 2 and 8.

5. Replace the left- and right-side panels (if included).

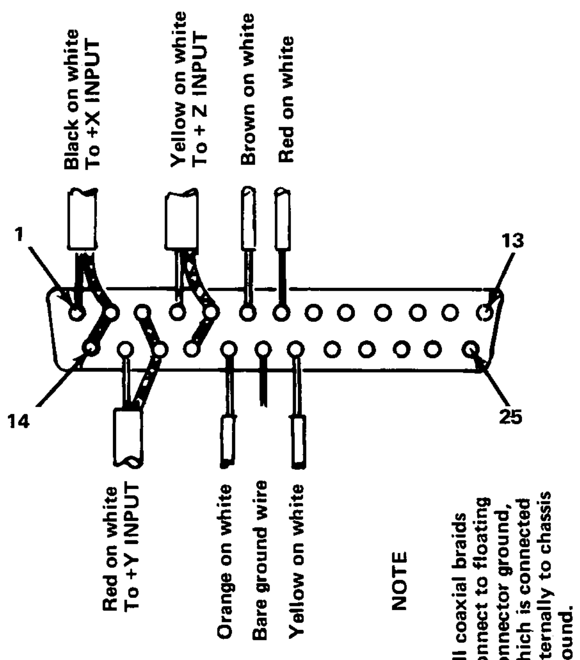
REMOTE PROGRAM INPUTS (OPTION 10)

On instruments that are equipped with Option 10, a Remote Program Connector (J200) is located on the instrument rear panel. This connector provides direct connections to the positive (+) inputs of the X, Y, and Z amplifiers from a remote location. Also, storage operation can be remotely controlled via this connector.

Figure 5-3 shows connection details for the Remote Program Connector. A mating male plug connector is supplied as an accessory with instruments having Option 10. Table 5-4 lists the programmable storage functions vs logic levels. A logical 0 (TTL) can be obtained by a switch closure to ground.



As seen from the rear panel.



As seen from inside the instrument.

NOTE

All coaxial braids connect to floating connector ground, which is connected internally to chassis ground.

The switching requirements (voltage levels, loading, drive, etc.) of remote-controlled functions can be satisfied by a TTL circuit.

TTL-Compatible Logic Levels:

	VOLTS	CURRENT
Logical 1 =	+2 V +5 V	@1 mA @0 mA
Logical 0 =	0 V +0.8 V	0 mA 10 mA

1259-03

Fig. 5-3. Remote Program Connector (J200) data.

Table 5-4

STORAGE PROGRAM FUNCTIONS VS LOGIC LEVELS

Pin	Function	Logical 1	Logical 0
6	Remote Non-store		Non-Store mode.
7	Erase Interval		"0" output during erase interval.
18	Remote Erase		Erases display.
20	Variable Brightness Enable/Disable	Disables STORED BRIGHTNESS control.	Switches stored brightness from full bright to the level set by the STORED BRIGHTNESS control.

RACKMOUNTING INFORMATION

The 603A can be operated in a standard 19-inch instrument rack with front- and rear-rail holes that conform to universal hole spacing. Kits are available to convert the 603A from the cabinet to a rackmounted configuration, and vice versa. Detailed rackmounting instructions are included in the kits. The following is a brief description of each conversion kit available. Consult your local Tektronix Field Office or representative for additional information.

CAUTION

Reliability and performance of the 603A will be affected if the ventilation holes in the protective panels (Option 6, 23, or 28 instruments) are obstructed, or if the 603A is operated in an ambient temperature higher than +50° C. See information under Ventilation Requirements.

Cabinet-to-Rackmount Conversion

Tektronix Part 040-0600-00. Mounts two 603A Storage Monitors side-by-side in a standard 19-inch wide rack. The kit comes equipped with a slide-out assembly and includes the securing hardware. Complete rackmounting instructions are included with each kit.

Tektronix Part 040-0601-00. Mounts one 603A Storage Monitor in a standard 19-inch wide rack. The kit is equipped with a slide-out assembly, securing hardware, and a blank front panel to cover the second instrument-opening in the rack. Complete rackmounting instructions are included with each kit.

Tektronix Part 040-0624-01. Converts one TM 503 Power Module and one 603A Storage Monitor to mount side-by-side in a standard 19-inch wide instrument rack. The kit includes a slide-out assembly and securing hardware. Complete rackmounting instructions are included with each kit.

Rackmount-to-Cabinet Conversion

Tektronix Part 040-0602-00. Converts one 603A Storage Monitor from a rackmount configuration to a cabinet configuration. Complete instructions are included with each kit.

Instrument Dimensions

Figure 5-4 shows the major dimensions needed for rackmounting the 603A. A detailed dimensional drawing is shown on the Detailed Dimensions Drawing foldout page in section 10, Diagrams and Circuit Board Illustrations.

Slide-Out Tracks Information

The slide-out tracks provided in the conversion kits permit this instrument to be extended out of the rack for maintenance without removing it from the rack. Be sure the power cord and signal cables are long enough to allow operation in the extended position. Refer to the instructions in the appropriate rackmount kit for additional information.

Removing or Installing the Instrument

After initial installation and adjustment of the slide-out tracks, the instrument can be removed or installed by following the instructions given in Fig. 5-5. No further adjustments are required under normal conditions.

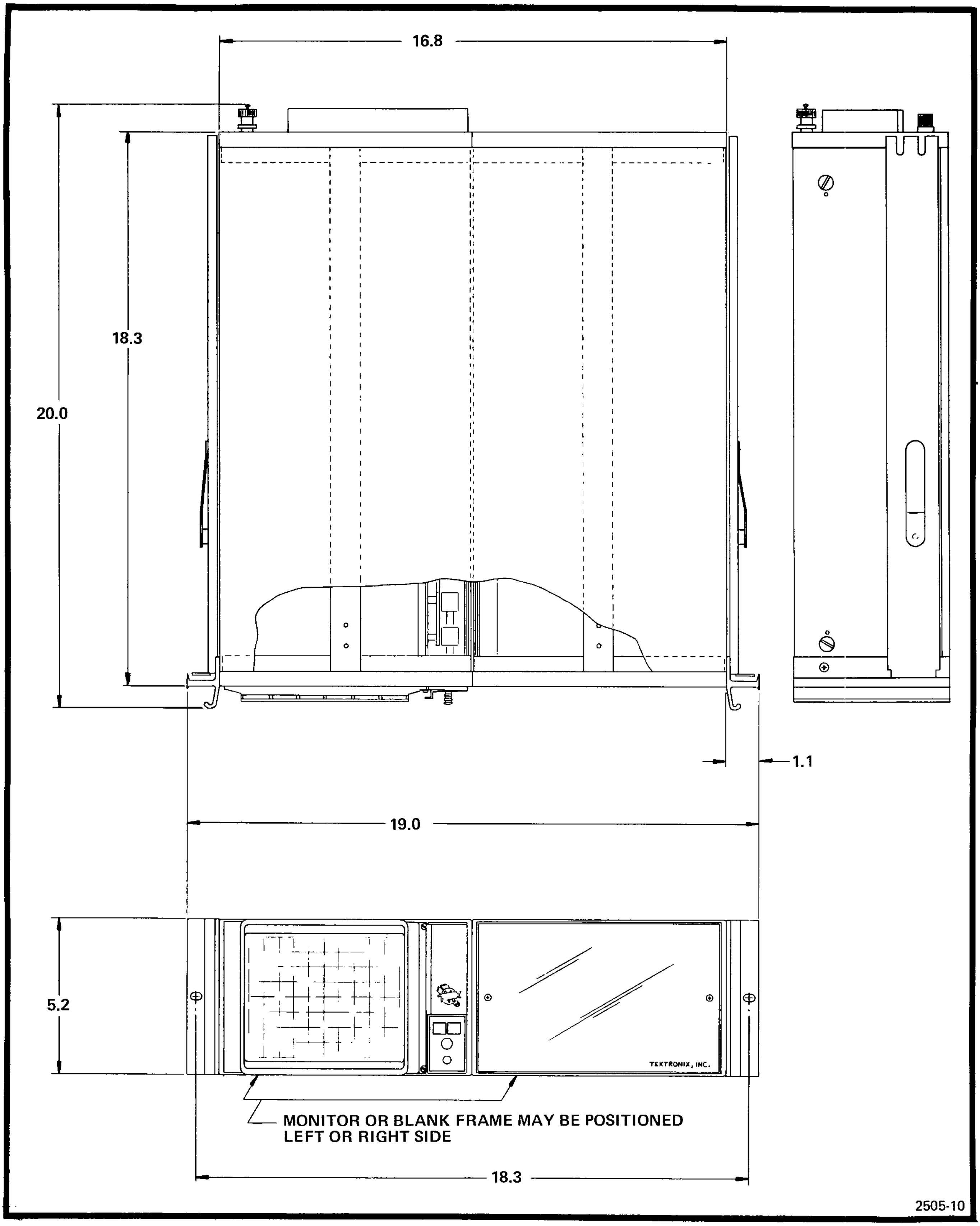


Fig. 5-4. Major dimensions needed to rackmount the 603A.

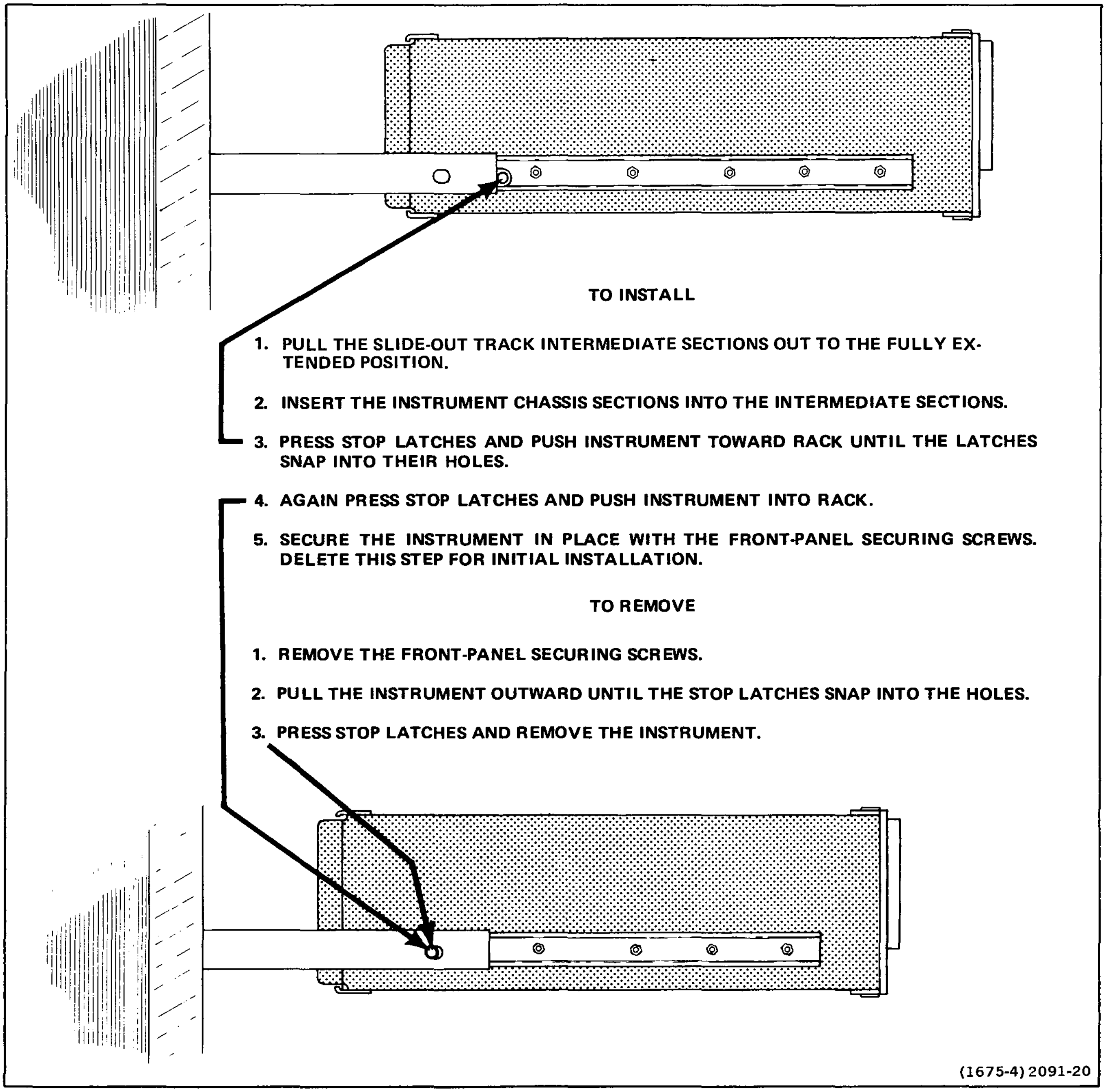


Fig. 5-5. Installing and removing a rackmounted instrument.

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.

Ventilation Requirements

When the 603A Storage Monitor is mounted in a rack with other equipment, it is important that the temperature surrounding the monitor does not exceed +50°C. Additional clearance or forced ventilation methods (fan) may need to be employed to maintain the ambient temperature below +50°C. Reliability and performance will be adversely affected if the monitor is operated at an ambient temperature higher than +50°C.

THEORY OF OPERATION

This section of the manual describes the circuitry in the 603A Display Monitor. The description begins with a discussion of the instrument operation using the block diagram, and then continues in detail, showing the relationships between the stages in each major circuit. Schematics with waveforms and voltage levels and the complete block diagram are given on pullout pages in Section 10 of this manual. Major stages are outlined on the schematics with wide shaded lines. The stage names are in shaded boxes within each outlined stage. Refer to these schematics throughout the following discussions for specific electrical values and relationships.

NOTE

The Theory of Operation for available electrical options is included in the following text. The information that relates to a particular option is preceded by the appropriate option number.

BLOCK DIAGRAM

The following discussion is provided to aid in understanding the overall concept of the 603A before the individual circuits are described in detail. A basic block diagram is shown in Fig. 6-1.

Vertical (Y) and horizontal (X) signals to be displayed on the monitor screen are supplied to the Deflection Amplifiers through the appropriate Y and X INPUT connectors. The Deflection Amplifiers process the input signals and provide push-pull outputs to drive the deflection plates of the cathode-ray tube. Both Deflection Amplifiers contain position and gain controls.

The Z-Axis Amplifier controls the display intensity by providing a voltage to drive the cathode-ray tube control grid. Input signals are applied to the Z INPUT connector.

The Storage Circuit provides the voltage levels necessary to operate the storage elements associated with the storage cathode-ray tube in the 603A. The circuit includes the erase-pulse generator for erasing stored information and a multivibrator which permits the flood-gun duty cycle to be varied.

The Power Supply circuit provides the low-voltage operating power for the circuitry in the 603A monitor. Electronic regulation is used to provide stable, low-ripple output voltages.

The Crt Circuit produces the high voltage (about −3450 volts) and contains the controls necessary for operation of the cathode-ray tube.

Option 4 Internal Sweep. This circuitry produces a positive-going sawtooth voltage which is amplified by the Horizontal Deflection Amplifier to provide linear sweep deflection in the cathode-ray tube. A negative-going gate is produced at the same time to unblank the cathode-ray tube.

Scan by Zenith

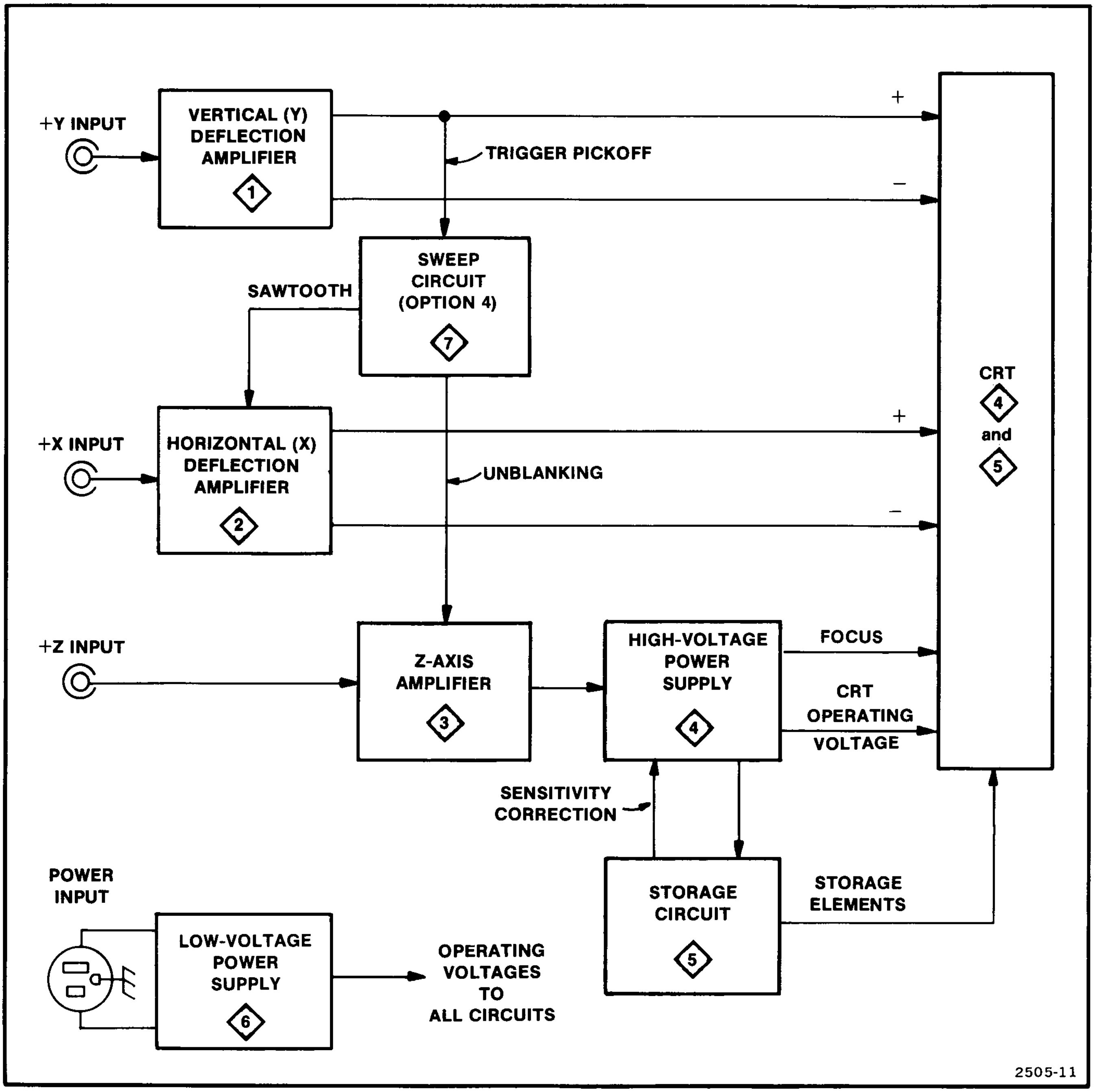


Fig. 6-1. 603A Basic block diagram.

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DETAILED CIRCUIT DESCRIPTION

Complete schematic diagrams are provided in Section 10, Diagrams and Circuit Board Illustrations. The numbers inside the diamond after a heading in the following discussions refer to the schematic diagram for that circuit. The schematic diagrams contain wide shaded borders around the major stages of the individual circuits to aid in locating the components mentioned in the following discussions. The name of each stage, given in a shaded box on the diagram, matches the subheading in the discussion of that schematic diagram.

VERTICAL (Y) DEFLECTION AMPLIFIER ◇1

The Vertical (Y) Deflection Amplifier processes the Y input signals and provides amplification to drive the vertical deflection plates of the cathode-ray tube. A schematic diagram of the Vertical (Y) Deflection Amplifier is shown on diagram 1. A detailed block diagram, showing each major stage of the amplifier, is superimposed on the schematic with wide shaded lines to conveniently locate the components mentioned here. The stage names (given as sub-headings in the following discussion) can be found in the shaded boxes on diagram 1.

Input Attenuators (Option 22 only)

An internal switch (S110, and S130 with Option 21) allows either 1X or 5X attenuation of the input signal before it is applied to the Y Preamplifier(s). The 5X position of each attenuator is a frequency-compensated voltage divider. These step attenuators are set in the 1X position when shipped from the factory. For optimum frequency-response of the amplifier, both attenuators should be set in the same position.

Differential Inputs (Option 21 only)

This option consists primarily of an added bnc connector (J130) to permit application of signals to the minus (−) input of the Vertical (Y) Deflection Amplifier, thus providing differential operation. With this option, the gate of Q120B receives drive from the −INPUT connector.

The instrument is shipped from the factory prepared for single-ended operation with a grounding cap connected to the −INPUT of the amplifier.

Y Preamplifier

The Y Preamplifier employs a pair of field-effect transistors (FETs) to provide a high input impedance and temperature stability. This stage consists of two identical feedback amplifiers (Q120A-Q152 and Q120B-Q156), which can be operated as either a paraphase amplifier (with single-ended input) or as a differential amplifier (with Option 21). A push-pull signal is produced at the collectors of Q152 and Q156. The FET gates are diode-clamped on negative-going overdrive signals to protect the field-effect transistors from excessive input voltages. R125 (Y Gain) provides an adjustable amplification factor to allow a crt full-scale deflection range of at least 0.5 to 2.5 volts. This adjustment is set by the factory to a nominal 1 volt for 8 divisions of deflection.

Single-Ended Operation

For this mode of operation and for instruments not equipped with Option 21 (Differential Inputs), input signals are applied to the +INPUT connector, J110.

NOTE

If your instrument is equipped with Option 10 (Remote Program Connector), the input signal can be applied via the Remote Program Connector, J200.

A positive-going signal applied to J110 appears positive-going at the gate of Q120A. The gate of Q120B remains at essentially 0 volts. Q120A inverts the signal and applies it to the base of Q152. The signal is again inverted to a positive-going change at the collector of Q152. At this point, the positive-going signal from Q152's collector is applied to the base of Q162, and back through R123/C123 to the source of Q120A, where it serves as negative feedback to ensure a highly-stabilized output.

The current through Q120A diverts current from the − (minus) side of the amplifier, causing a negative-going signal to appear at the base of Q182. Note that now we have a positive-going signal at the base of Q162, and a negative-going signal at the base of Q182. Through these stages (Q162-Q172 and Q182-Q192), and the rest of the amplifier, push-pull drive is maintained.

Differential Operation (Option 21)

For differential operation, signals are applied to both J110 (+INPUT) and J130 (−INPUT). Normally, these signals will be mainly identical in phase and amplitude, with any differences between the two signals being the signal to be observed. The two common-mode signals remain in phase and at about equal amplitudes throughout the amplifier, canceling at the amplifier output. (Common-mode rejection is limited by any difference in response in the positive and negative sides of the amplifier).

The difference of the signals applied to the + and −INPUT connectors is treated by the amplifier in the same manner as a single-ended input signal, previously described.

Trigger Pickoff (P/O Option 4)

In instruments equipped with Option 4 (Internal Sweep), the preamplifier output signal is picked off at the collector of Q152 and coupled (via the Storage Board) to the Sweep Board. This sample of the vertical signal serves as a trigger signal to initiate generation of a sweep sawtooth.

Vertical Positioning & Limiter

Vertical positioning is provided by front-panel control R175, through the current sources of Q172-Q192. The push-pull signals from the Y Preamplifier are applied to the Y Output Amplifier after being offset by this stage. This offset current, plus the signal current applied to the bases of Q162-Q182, drives Q202-Q208, which, in turn, drive the output stage Q222-Q226.

Y Output Amplifier

The Y Output Amplifier consists of two identical, non-inverting operation amplifiers connected in a differential configuration. For ease of explanation, only the + side will be discussed.

The bases of Q202 and Q208 are diode-protected by CR166, CR167, CR186, and CR187 to ensure quick overdrive recovery. The signal from the Y Preamplifier stage is amplified by Q162 and coupled to emitter follower Q202. The emitter follower drives the base of output transistor Q222. The output amplifier collector is diode-clamped by CR222 on negative-going overdrive signals.

The output signal at the collector of Q222 causes a change in the current through feedback resistor R165 that, due to the input signal, will just balance the current through Q162, thus holding the current through Q162 nearly constant.

The network consisting of R167, R168, C167, and C168 provides a means of adjusting the amplifier high-frequency response.

Q240 provides the reference level for clamping diode CR222, preventing the collector of Q222 from swinging below about +33 volts on negative-going overdrive signals.

HORIZONTAL (X) DEFLECTION AMPLIFIER ⟨2⟩

The Horizontal (X) Deflection Amplifier processes the X input signals and provides amplification to drive the horizontal deflection plates of the cathode-ray tube. A schematic diagram of the Horizontal (X) Deflection Amplifier is shown on diagram 2. A detailed block diagram, showing each major stage of the amplifier, is superimposed on the schematic with wide shaded lines to conveniently locate each stage. The stage names can be found in the shaded boxes on the schematic.

Operation of the Horizontal (X) Deflection Amplifier is identical to that of the Vertical (Y) Deflection Amplifier (previously described), with the exception of some circuitry that may exist between the Preamplifier and Positioning & Limiter stages. Therefore, this discussion will describe only the differences.

XY-YT Switching (P/O Option 4)

If your instrument includes Option 4 (Internal Sweep), the output signals from the + and − sides of the preamplifier, at the collectors of Q352 and Q356, are coupled to the XY contacts on S350. When S350 is in the XY position, the signals from the X Preamplifier are applied to the bases of Q362 and Q382, part of the X Positioning & Limiter stage. The signal is then treated in the same manner as the signal through the Y Positioning & Limiter stage.

When S350 is in the YT position, a positive-going ramp (sweep sawtooth) signal is coupled from the Sweep Board (via the Storage Board) to the base of Q362. The base of Q382 is grounded through R380 and the switch contacts of S350. The positive-going ramp is cross-coupled in the output stages to provide push-pull drive to the cathode-ray tube horizontal deflection plates.

Z-AXIS AMPLIFIER ⟨3⟩

The Z-Axis Amplifier circuit provides the drive signal to control the cathode-ray tube intensity. A schematic diagram of the Z-Axis Amplifier is shown on Diagram 3 at the rear of this manual. A detailed block diagram, showing each major stage, is superimposed on the schematic diagram with wide shaded lines. The stage names (given as sub-headings in the following discussion) can be found in the shaded boxes on diagram 3.

Inputs

Signals are applied to J505 (+Z INPUT). Provisions are made on the input line (wire straps) to permit installation of an attenuating resistor and to change the input impedance (see Z-Axis Input Attenuation Selection in Section 5, Installation).

Differential Inputs (Option 21 only)

This option consists primarily of an added bnc connector (J515) to permit application of signals to the minus (−) input of the Z-Axis Amplifier, thus providing differential operation. With this option, the gate of Q520B receives drive from the −INPUT connector.

The instrument is shipped from the factory prepared for single-ended operation with a grounding cap connected to the −INPUT of the amplifier.

Remote Program Connector (Option 10)

Instruments with this option are equipped with a Remote Program Connector (J200). The input signal can be applied to the Z-Axis Amplifier via this connector.

Z Preamplifier

The Z-Axis Preamplifier stage employes a matched pair of field-effect transistors to provide a high input impedance and temperature stability. This stage consists of two identical inverting feedback amplifiers, Q520A-Q526-Q534 and Q520B-Q528-Q536, which can be operated as either a paraphase amplifier (with single-ended input) or as a differential amplifier (with Option 21).

A single-ended output is produced at the collector of Q536, and is opposite in polarity to a signal applied to the +INPUT connector. Constant current for the stage is supplied by Q532.

The field-effect transistor gates are diode-clamped on negative-going overdrive signals, protecting the transistors in the preamplifier. Potentiometers R512 (Z Gain) provides an adjustable amplification factor to allow a full intensity control range when signals from +1 volt or less or +5 volts or more are applied to the +Z INPUT connector when the INTENSITY control (R562) is set to about midrange. Under this condition, a zero-volt input cuts off the display intensity to below the visible level.

Intensity and Limiter

Display intensity is varied by front-panel control R562 (INTENSITY), the current source of Q542. The signal from the Z Preamplifier is applied to the Z Output Amplifier after being offset by this stage. Diodes CR541 and CR542 prevent overdriving the Z Output Amplifier by limiting the signal excursion.

Z Output Amplifier

The Z Output Amplifier is a non-inverting operational amplifier consisting of Q544, Q554, and Q556. The feedback resistor is R556. Q554 and Q556 are connected as a collector-coupled complementary amplifier to provide a fast, linear output signal while consuming minimum quiescent power. The quiescent output level can be set by adjustment of the front-panel INTENSITY control, R562. The output is applied to the cathode-ray tube control grid circuit.

Unblanking (P/O Option 4)

If your instrument includes Option 4 (Internal Sweep), a negative unblanking pulse is applied, via P558 and R558, to the emitter of Q542. This pulse serves to brighten the trace during sweep time, thus causing the retrace time of the sweep to be blanked (not visible to the eye). The pulse is generated, along with the sweep sawtooth, on the Sweep Board.

CRT CIRCUIT 4

The Crt Circuit produces the high-voltage and provides the control circuits necessary for operation of the cathode-ray tube (crt). A schematic diagram of the Crt Circuit is shown on diagram 4. A detailed block diagram, showing each major stage of this circuit, is superimposed on the schematic diagram with wide shaded lines. The stage names (given as sub-headings in the following discussion) can be found in the shaded boxes on diagram 4.

High-Voltage Oscillator

A class C oscillator consisting of Q580 and its associated circuitry provides the drive for the high-voltage transformer, T580. When the instrument is first turned on, conduction of Q576 provides a base current path for Q580. The collector current of Q580 increases, producing an increased current in the Q580 base winding and causing increased conduction of Q580. Eventually, the rate of collector current increase in Q580 becomes less than that required to maintain the voltage across the collector winding, and the voltage drops as the field collapses. This turns off Q580 by way of feedback voltage to the base. Q580 remains off until the feedback voltage on the base is near the peak positive value again. The cycle repeats at a frequency of 40 to 50 kilohertz. The amplitude of sustained oscillation depends upon the average current delivered to the base of Q580, and finally, the average Q580 collector current.

High-Voltage Regulation

Regulation of the high-voltage supply is accomplished as follows: Feedback from the −3450-volt cathode supply is summed with a low-voltage level through the voltage divider consisting of resistors R573A, R573B, and R575 to establish the dc level at the base of Darlington transistor Q570. This sample of the output voltage is compared to the regulated +15 volts in the base circuit of Q570. Any changes in the high-voltage output are sensed by Q570, which produces an error signal to control the conduction of Q576. Q576 correspondingly produces a change in the average Q580 base current, nullifying the change in the high-voltage output and thus holding it constant. The dc level at the base of Q570 is adjusted by R575, HV Adj, to set the high-voltage output to exactly −3450 volts.

Electron Gun Cathode and Grid Supplies

Half-wave rectifier CR580 produces −3450 volts dc, which is filtered and applied to the cathode-ray tube cathode as the accelerating potential. The cathode heater is elevated to the cathode potential through R590.

Bias voltage for the grid is supplied by a dc restorer network consisting of CR566, CR567, and R565. The dc restorer has the −3450-volt cathode potential applied to it as a reference voltage, and it is driven by a varying voltage obtained from a tap on the secondary winding of T580. R588, Cutoff, provides a fine adjustment of the quiescent grid voltage to bias the electron gun just below cutoff when the Z-Axis Amplifier output is at its minimum quiescent level (INTENSITY control counterclockwise and no signals applied). A change in the Z-Axis Amplifier output produces an almost equal change of voltage on the control grid, allowing the Z-Axis Amplifier to control the cathode-ray tube beam current.

Crt Control Circuits

In addition to the INTENSITY control discussed in the Z-Axis Amplifier circuit, front-panel FOCUS and internal Astigmatism controls have been incorporated for arriving at an optimum cathode-ray tube display. FOCUS control R595 provides the correct voltage for the second anode of the cathode-ray tube. Proper voltage for the third anode is obtained by adjusting Astig control R594. In order to obtain optimum spot size and shape, both the FOCUS and Astig controls are adjusted to provide the proper electostatic lens configuration in the cathode-ray tube.

The Geom adjustment R596 varies the positive level on the horizontal deflection plate shields to control the overall geometry of the display. The TRACE ROTATION control, R598, permits adjustment of the dc current through beam-rotation coil L598 to align the display.

STORAGE CIRCUIT ⟨5⟩

The crt used in the 603A is a direct view, bistable storage cathode-ray tube. Only those elements associated with the storage capability of the cathode-ray tube are shown in the crt symbol on the right side of the Storage Circuit diagram. The writing gun, its deflection systems, and associated elements are discussed under Crt Circuit.

A schematic diagram of the Storage Circuit is shown on diagram 5. A detailed block diagram, showing each major stage of this circuit, is superimposed on the schematic diagram with wide shaded lines and is illustrated in this section as Fig. 6-2. The stage names (given as sub-headings in the following discussion) can be found in the shaded boxes on diagram 5.

Basic Storage Operation

Four low-energy electron guns (flood guns) provide full coverage of the large screen area. Quiescently, current is provided to the flood gun cathodes by the Flood Gun Cathode Supply.

The collimation electrode (CE) is a metallic band around the inner wall of the cathode-ray tube envelope. It produces an electrostatic field to distribute the flood-gun electrons uniformly over the storage target.

The storage screen consists of a thin tin-oxide layer called the target backplate, which is coated with an insulator material containing finely-ground phosphor particles, called the target. A positive voltage potential is applied to the backplate to establish the operating level of the tube, which is the difference in potential between the backplate and the flood-gun cathodes.

The target operates in a bistable mode because of the secondary emission properties of the insulator material. The first stable state is the 'rest' potential, at which the target has gathered low-energy flood-gun electrons, causing it to charge down to the flood-gun cathode potential. The second stable state is 'stored' state, at which the target (or portions of it) is shifted to the backplate potential by increasing the secondary emission.

While the flood guns do not have sufficient energy to shift the target to the stored state, they do supply sufficient energy to hold the target in the stored state after it has been shifted by the high-energy writing-gun beam (crt beam). This is because the landing energy of the flood electrons has increased with the increased potential difference between the flood-gun cathode and the target. These higher-energy electrons produce a visual display as long as the flood beam covers the target.

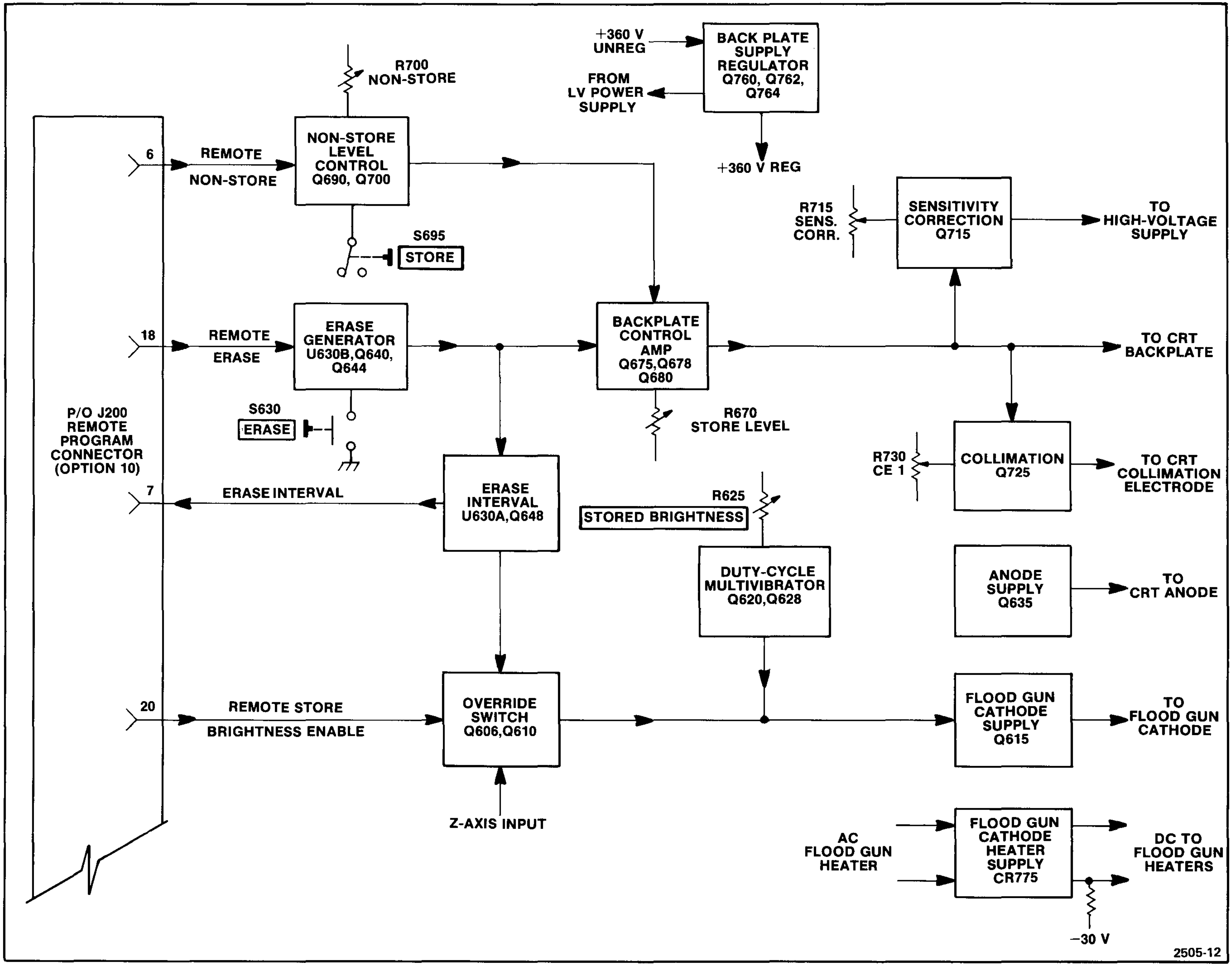


Fig. 6-2. Block diagram of 603A Storage circuit.

When the stored display is no longer needed, the information is erased by first shifting the entire target to the stored state, and then removing the charge. A positive-going short-duration pulse is first applied to the backplate, increasing the flood-gun electron landing energy and writing the entire target area.

Next, the backplate voltage is pulled well below the 'rest' potential of the target, which follows the backplate down due to its inherent capacitive coupling. Then, as the backplate is gradually returned to its quiescent potential, the target charges to the 'rest' potential and is ready to write again.

Flood-gun Cathode Heater Supply

The flood-gun cathode heaters receive an unfiltered, pulsating dc from full-wave rectifier CR775. This supply is elevated to the cathode potential (−30 volts) through R775.

Flood-gun Anode

The flood-gun anode potential is established by VR734 and supplied via emitter follower Q735.

Collimation Electrode

The collimation electrode potential is adjusted by R730, CE1, so that the flood electron trajectories cover the extreme edges of the target and so that uniformity of the target coverage is optimized. Emitter follower Q725 maintains a stable voltage on the collimation electrode and provides a low-impedance current path to absorb current variations.

Backplate Supply

A regulated +360-volt dc power supply provides the storage level for the cathode-ray tube, and ensures a potential sufficient for the erasure process.

Full-wave bridge rectifier CR820 through CR823 in the Power Supply circuit (diagram 6) provides the input voltage to the Backplate Supply Regulator.

Backplate Supply Regulator

The regulator consists of series-pass transistor Q762, emitter follower Q760, and error amplifier Q764. The +360-volt output is compared to the −30-volt reference at the base of Q764, which supplies correction bias to Q762. Operation of this feedback amplifier system is similar to that described for the −30-volt supply (Power Supply diagram 6). VR763 is a protection device for the transistors, and is normally operated in a region of its characteristic curve below its zener knee.

Backplate Control Amplifier

The high degree of control required of the target backplate is maintained by a feedback amplifier system consisting of Q675, Q678, and Q680. The operational amplifier summing point is at the base of Q675, and the feedback resistor is R672. Variable resistor R670, Store Level, provides an adjustment of the current to the null point, and hence sets the backplate voltage through R672 to an optimum storage level.

Sensitivity Corrector

When the 603A is operated in the store mode, the divider network in the High-Voltage Regulator circuit (diagram 4) is modified to shift the high voltage slightly, correcting for the deflection sensitivity changes that occur. The backplate voltage is applied through R716 to the base of Q715, removing the ground potential from the Q715 collector. R715 permits an adjustable sensitivity correction to be applied to the High-Voltage Regulator.

Erase Generator

The previously discussed Backplate Control Amplifier is driven by a monostable multivibrator when it is desired to erase a stored display. The multivibrator consists of Q640, which is normally on, and Q644, which is normally off. Q648 is part of the Erase Interval circuit and will be discussed later. All inputs of U630B are held high (+5 volts), keeping output pin 8 low. The multivibrator is switched by pushing the front-panel ERASE button. When any of the U630B input lines are pulled low, pin 8 snaps positive. The positive transition is coupled through C636 and CR636 to the base of Q644, causing the multivibrator to switch states. The negative-going step produced at the collector of Q644 causes a corresponding positive-going step at the output of the Backplate Control Amplifier. This positive-going step is applied to the target backplate, increasing the storage level and "writing" the entire target.

After an RC-controlled time of 10 ms, the multivibrator reverts to its quiescent state, producing a positive-going step at the collector of Q644 as the transistor turns off. This positive-going step is coupled through C644, and the backplate is pulled negative through the action of the control amplifier. The target is pulled well below its 'rest' potential. As C644 charges, the voltage at the cathode of CR664 decays from about +15 volts toward the −30-volt supply at an RC-controlled rate until it is clamped at ground by conduction of CR664. This action allows the target backplate to be raised slowly to its operating level, while the target remains at the flood-gun cathode potential. The total time from initiation of erasure to the ready-to-write condition is about 250 ms.

Flood-Gun Cathode Supply

Q615, quiescently operating at saturation, provides the current for the flood-gun cathodes, establishing a cathode potential of nearly −30 volts. Q615 is controlled by two circuits: collector-coupled miltivibrator Q620-Q628 and transistor switch Q610.

Duty Cycle Multivibrator

When Q628 is on (assuming Q610 is off), Q615 is saturated, and conducts flood-gun current.

Symmetry of the multivibrator is controlled by R622 and R625, STORED BRIGHTNESS. The STORED BRIGHTNESS control is adjustable to allow Q615 to conduct anywhere from 10% to 100%, which has the effect of varying the stored brightness.

Override Switch

When Q610 is turned on, it provides a control to override the multivibrator output and hold Q615 in its conduction state. A positive level from the output of the Z-Axis Circuit turns Q606 on, providing base current for Q610. Also, during the erase interval, CR608 provides base current for Q610.

Erase Interval

Normally, the output of U630A (pin 6) is held high by the low applied via CR652 to input pin 5. When the erase pulse is initiated, the 10-ms negative-going pulse at Q644 collector results in a corresponding positive-going pulse at the collector of Q648. This pulls pin 5 of U630A high, producing a low level at pin 6, thus turning on Q610. C652 holds pin 5 of U630A high for the total erase cycle.

Non-store Mode

In the non-store mode, the target is held below the 'rest' potential, allowing the cathode-ray tube to operate in the manner of a conventional cathode-ray tube. This feature prolongs the life of the storage tube. During storage operation, Q700 is held above cutoff and Q690 conducts. If S695 is set to the non-store mode (front-panel STORE button out), Q700 is biased into saturation. Its collector rises to essentially ground potential, cutting off Q690 and forcing current into the Backplate Control Amplifier null point (Q675 base) to pull the backplate negative. The backplate non-store level can be set by adjustment of R700, Non-Store.

Remote Programming (P/O Option 10)

Control of storage functions from a remote location can be achieved through use of the Remote Program Connector, J200 (Option 10). Functions controlled via the Remote Program Connector are as follows:

J200, Pin 6—Remote Non-Store. A TTL-compatible low level applied to this pin biases Q700 into saturation, providing the same operation as described when setting the front-panel STORE button to non-store.

J200, Pin 7—Erase Interval. During erasure, a 250-ms negative-going pulse (logical 0 TTL) is made available from the Erase Interval stage to notify associated equipment that the stored display is being erased.

J200, Pin 18—Remote Erase. A TTL-compatible low level applied to this pin pulls the input of U630B (pin 13) low, causing the same operation as pressing the front-panel ERASE button (described under Erase Generator).

J200, Pin 20—Remote Stored Brightness Enable. This input has two possible applications:

1. When abnormally low duty-cycle Z axis signals are applied to the Override Switch circuitry (via Q606) with no input to J200, pin 20, the dc or average voltage applied may be insufficient to disable the Duty Cycle Multivibrator, Q620, Q628. If the multivibrator continues to operate in the presence of a Z axis signal, a double image may occur due to horizontal modulation of the writing beam whenever the beam is away from center screen. This double-imaging may be prevented by applying a TTL-compatible high (no more than +5 volts) to J200 pin 20 during Z axis signal time. Removing the input to pin 20 will return control of the Q606 input to the Z axis amplifier. Grounding pin 20 will allow the STORED BRIGHTNESS control to operate regardless of the Z axis level.

2. J200 pin 20 may also be employed to provide a Hold-View feature for a display which is to be stored for extended periods of time. A TTL-compatible high (no more than +5 volts) may be applied to provide full brightness of the display, over-riding the STORED BRIGHTNESS control. Removing the TTL high level will return the brightness to the level determined by the STORED BRIGHTNESS (R625) setting (providing the Z axis level is at or near beam cutoff).

LOW VOLTAGE POWER SUPPLY & REGULATORS ⟨6⟩

The LV Power Supply circuitry provides the low-voltage operating power for the 603A Storage Monitor. Electronic regulation is used to provide stable, low-ripple output voltages. A schematic diagram of the Low-Voltage Power Supply is shown on diagram 6 at the rear of this manual. A detailed block diagram, showing each major stage of this circuit, is superimposed on the schematic with wide shaded lines. The stage names (given as sub-headings in the following discussion) can be found in the shaded blocks on diagram 6.

Power Input

Ac power is applied to the primary of transformer T800 through fuse F800, thermal cutout S801, POWER switch S800, and Line-Voltage Selector plug P810. The Line-Voltage Selector plug allows changing the primary-winding taps of T800 to meet different line-voltage and regulating range requirements. Line fuse F800 should be changed for each nominal line voltage (see Replaceable Electrical Parts list for correct value for either 120-volt or 240-volt nominal line voltage operation).

Thermal cutout S801 provides thermal protection for this instrument. If the internal temperature of the instrument exceeds a safe operating level, S801 opens to interrupt the applied ac power. When the temperature returns to a safe level, S801 automatically closes to re-apply the power.

Rectifiers and Filters

Full-wave bridge rectifiers and associated filter components in the secondaries of T800 provide filtered dc voltages for operation of the 603A or for regulation by the Low-Voltage Regulators. The unregulated +20-volt output and the +215-volt return from the +215-volt regulator are fuse-protected by F840 and F830 respectively.

+20-Volt Unregulated Supply

The +20-Volt Unregulated Supply provides unregulated power for the high-voltage transformer (T580) on diagram 4. Fuse F840 provides circuit protection in the event of an overload.

+360-Volt Unregulated Supply

The +360-Volt Unregulated Supply provides unregulated power for the +360-Volt Backplate Supply Regulator on diagram 5.

−30-Volt Unregulated Supply

The −30-Volt Regulated Supply, in addition to providing power to circuitry throughout the instrument, provides a reference-voltage source to establish operating levels for the feedback regulators in the +15-Volt and +215-Volt Regulated Supplies and the +360-Volt Backplate Supply Regulator on diagram 5. The regulator for the −30-Volt supply is a feedback amplifier system that operates between ground and the unregulated −38-volt output of bridge rectifier CR860 through CR863. Current to the load is delivered by the series-pass transistor Q860, which is located in the output side of the supply. The supply voltage is established by the drop across resistive-divider network R877, R878, and R879. The feedback through this network is compared to the reference level established at the emitter of Q870 by the voltage drop across VR870. Any variation in output voltage of the supply (due to ripple, change of current through the load, etc.), is immediately transmitted to the base of Q860, via Q875 and Q865, and nullified by a change in Q860 conduction, thus maintaining a steady, ripple-free output. The output of the supply is set to exactly −30 volts by adjustment of R878, −30 V Adjust. This control sets the conduction of Q870, which controls the bias levels of Q875 and Q865, and thus Q860. CR865 and Q865 provide short-circuit protection by limiting the current through Q860.

+15-Volt Regulated Supply

The regulator for the +15-volt supply consists of series-pass transistor Q840 and error-amplifier Q852. This is a feedback amplifier system similar in operation to that just described for the −30-Volt Regulated Supply. Q846 protects the supply in the event the output is shorted by limiting the current demanded from the series-pass transistor under excessive load. During normal operation, Q846 is biased off.

+215-Volt Regulated Supply

The regulator for the +215-volt supply consists of series-pass transistor Q836 and error amplifier Q830. Operation of this feedback amplifier system is similar to that described for the −30-volt supply. Fuse F830 provides circuit protection in the event of an overload or regulator malfunction.

Crt Heater Windings

Two separate secondary windings are provided for the cathode-ray tube writing-gun heater and the flood-gun heaters. The writing-gun heater is elevated to −3450 volts in the Crt Circuit to maintain a potential near that of the crt cathode. The flood-gun heaters are elevated to −30 volts on the Storage Circuit to maintain a potential near that of the flood-gun cathodes.

SWEEP CIRCUIT (OPTION 4) 7

The Sweep Circuit produces a sawtooth voltage, which is amplified in the Horizontal Deflection Amplifier (diagram 2) to provide linear sweep deflection in the cathode-ray tube. This circuitry also provides an unblanking signal which is coupled to the Z-Axis Amplifier output (diagram 3) and thence to the cathode-ray tube control grid to unblank the display during the sweep interval. A schematic diagram of the Sweep Circuit is shown on diagram 7 at the rear of this manual. A detailed block diagram, showing each major stage of this circuit, is superimposed on the schematic with wide shaded lines and is illustrated in this section as Fig. 6-3. The stage names (given as sub-headings in the following discussion) can be found in the shaded boxes on diagram 7.

Trigger and Sweep Generator

The Trigger and Sweep Generator is composed of Tektronix-manufactured integrated circuit U930 and its associated discrete circuit components. Integrated circuit U930 contains the trigger generator, the sweep-gating circuit, and an operational amplifier to form the basis of a miller integrator. Power is applied to pins 7 and 12 (+8.2 volts and −8.2 volts) to establish the operating levels within the device. An internal reference zener provides 6.4 volts between pins 8 and 9 for operation of external controls (TRIG SLOPE/LEVEL and Swp Length); pin 8 provides a level of two diode junctions above the negative level at pin 12.

Pins 10, 11, 13, and 14 are associated with the Trigger Generator portion of U930. The triggering signal, which is a sample of the vertical (Y) input signal picked off the + side of the Vertical (Y) Deflection Amplifier, is applied to a field effect transistor (FET) input of U930 at pin 13. Potentiometer R918 (TRIG SLOPE/LEVEL) at pin 14 controls internal comparators that determine the level and slope at which the internal schmitt multivibrator switches states, initiating a sweep trigger. Differentiating capacitor C912 at pin 11 determines the trigger-pulse width.

For normal triggered operation (Norm), −8.2 volts is applied to pin 10 to hold the internal bright-baseline auto circuit inactive. In this mode, when the triggering signal is

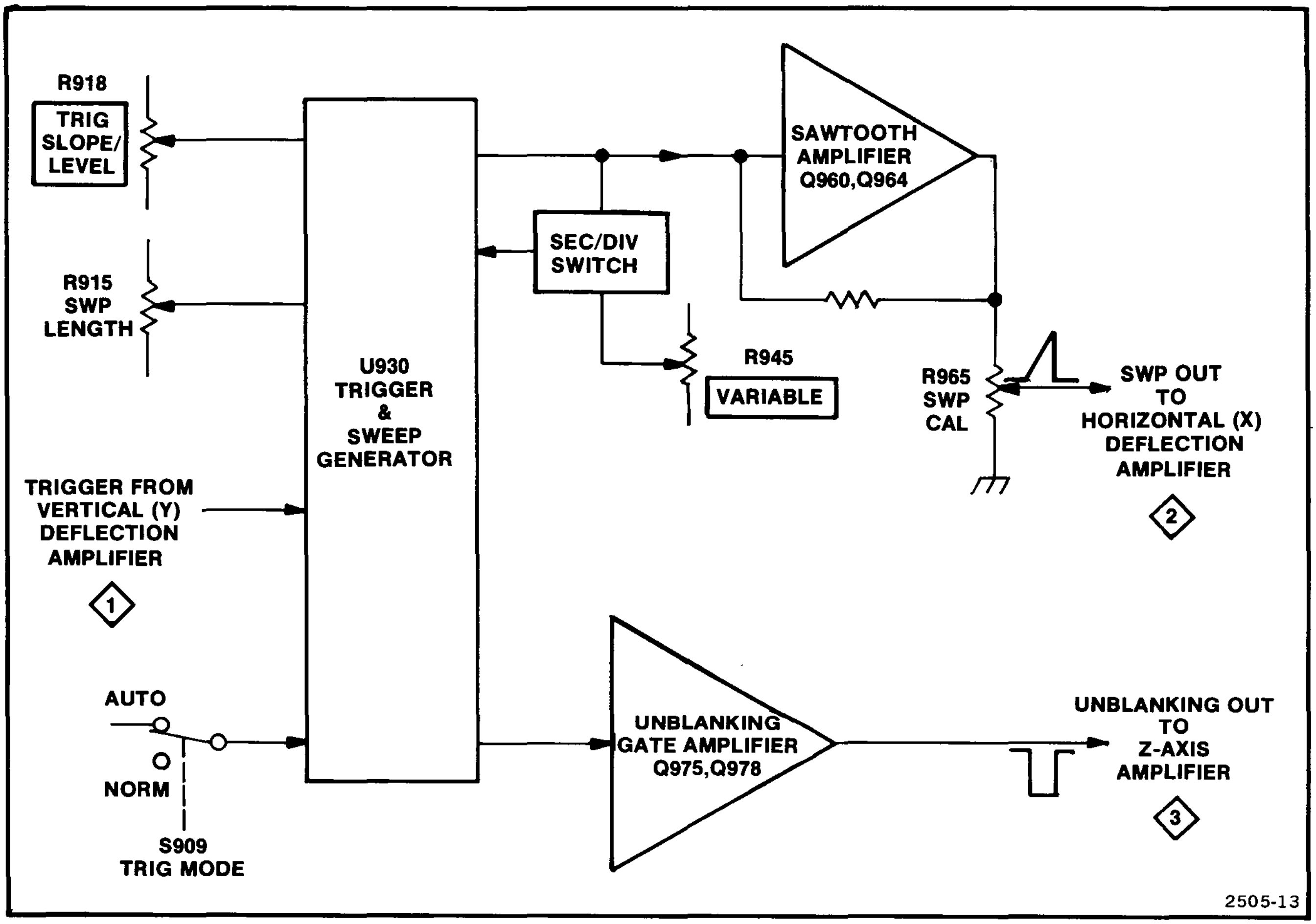


Fig. 6-3. Block diagram of Sweep circuit (Option 4).

lost, a sweep cannot be produced. When switch S909, Trig Mode (located on the Sweep Board), is set to Auto, the −8.2 volts is disconnected to permit a free-running sweep, or bright baseline, to be produced when the triggering signal is absent. Pin 10 moves positive as C910 charges, and this positive potential acts as the triggering signal. A new sweep will be initiated immediately following the sweep holdoff time. However, with S909 (Trig Mode) in the Auto position, any incoming trigger signal will discharge C910. If the signal is occurring at a rate greater than about 20 hertz, C910 will be held below the auto-trigger level to permit a triggered sweep to be produced.

Pins 1 through 6 and pin 16 are associated with the Sweep Generator portion of U930. Upon receipt of a trigger from the Trigger Generator, the sweep gate turns on. While the gate is on, CR930 is turned off by a high logic level at pin 2, allowing the current through external R_t components R930 and R945-R946 to be switched to timing capacitor (C_t) C930 (when R930-C930 are selected by the SEC/DIV switch S930). Pin 5 is the internal operational amplifier null point, thus the nearly constant timing current charges the capacitor linearly, producing a linear, negative-going sawtooth voltage at pin 4. When the sawtooth reaches a level determined by R915 (Swp Length), the sweep terminates. At this point, the sweep gate turns off, turning on CR930 and quickly discharging the timing capacitor. A short-duration trigger-lockout period (holdoff), to allow the sweep generator to reset and stabilize, is provided by C924 at pin 3. (Note that C925 is switched in parallel with C924 in the three slowest sweep ranges to increase holdoff).

Time/Div Switching

S930 (SEC/DIV) selects combinations of R_t and C_t (R930, R934, R938 and C930, C934, C938) to provide six decade ranges of time/division from 1 μs to 100 ms. R945 (VARIABLE) provides uncalibrated, continuously variable setting of the sweep rate between the calibrated range steps, and extends the slowest sweep rate to at least one second per division.

Sawtooth Amplifier

Operational amplifier system Q960 and Q964 provides amplification of the sweep sawtooth to a suitable amplitude to meet the sensitivity requirements of the Horizontal (X) Deflection Amplifier. Potentiometer R965, Swp Cal, permits calibrating the sweep to the cathode-ray tube graticule. The base of Q960 is the null point, R950 is the R_{in} element, and R955 is the feedback element. A positive-going sawtooth is produced at the emitter of Q964.

Unblanking-gate Output Amplifier

The negative-going gate produced at pin 16 of U930 is amplified by Q975 and Q978. The negative-going gate at the collector of Q978 is applied to R558 in the Z-Axis Amplifier (diagram 3) to turn on the cathode-ray tube during the sweep time. This serves to eliminate the sweep retrace from the display.

MAINTENANCE

This section of the manual contains information for performing preventive maintenance, troubleshooting, and corrective maintenance for the 603A.

PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of the instrument. The severity of the environment to which the instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is preceding electrical adjustment of the instrument.

CABINET PANEL REMOVAL

WARNING

Disconnect power to the instrument before removing the cabinet panels to avoid electric-shock hazard.

Options 6, 23, or 28 only. The cabinet panels are held in place by slotted fasteners. To remove the panels, turn each fastener counterclockwise a quarter turn with a large screwdriver. Lift the panels away. Always operate the instrument with the panels in place to protect the interior from dust. (Your instrument will have panels only with Options 6, 23, or 28.)

CLEANING

The 603A should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket which prevents efficient heat dissipation, and also provides an electrical conduction path which may result in instrument failure. Cabinet panels (Options 6, 23, or 28) will provide added protection against dust in the interior of the instrument.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Use a non-residue type of cleaner, preferably isopropyl alcohol, total denatured ethyl alcohol, or TP35. Before using any other type of cleaner, consult your Tektronix Service Center.

Exterior

Loose dust accumulated on the outside of the instrument can be removed with a soft cloth or small brush. The brush is particularly useful for dislodging dirt on and around the front-panel controls.

Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

Cathode-Ray Tube

Clean the crt faceplate with a soft, lint-free cloth dampened with denatured alcohol.

Interior

Cleaning the interior of the instrument should only be occasionally necessary. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (approximately 5 lb/in^2). Remove any dirt which remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces, or for cleaning more delicate circuit components.

CAUTION

Circuit boards and components must be dry before applying power to the instrument to prevent damage from electrical arcing.

The high-voltage circuits should receive special attention. Excessive dirt in this area may cause high-voltage arcing and result in improper instrument operation.

VISUAL INSPECTION

The 603A Monitor should be inspected occasionally for such defects as broken connections, improperly installed circuit boards, and heat-damaged parts. This is particulary true after cleaning the instrument, since physical damage can occur during the cleaning operation. The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged parts are found. Overheating usually indicates other trouble in the instrument; therefore, the cause of overheating must be corrected to prevent recurrence of the damage.

SEMICONDUCTOR CHECKS

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

PERIODIC ELECTRICAL ADJUSTMENT

To ensure accurate measurements, check the electrical adjustment of this instrument after each 1000 hours of operation, or every six months if used infrequently. In addition, replacement of components may necessitate adjustment of the affected circuits. Complete adjustment instructions are given in Section 4, Performance Check/Adjustment, in this manual. This procedure can be helpful in localizing certain troubles in the instrument, and in some cases, may correct them.

TROUBLESHOOTING

The following information is provided to facilitate troubleshooting of the 603A Monitor. Information contained in other sections of this manual should be used in conjunction with the following data to aid in locating a defective component. An understanding of the circuit operation is helpful in locating troubles. See Section 6, Theory of Operation, for this information.

TROUBLESHOOTING AIDS

Diagrams

Complete schematic diagrams are given on the foldout pages in Section 10, Diagrams and Circuit Board Illustrations. Schematic diagrams for the available Options are included on the standard schematics. The component circuit number and electrical value of each component in this instrument are shown on these diagrams. If a component circuit number is outlined with a gray box, this indicates that the value may have been different in an earlier serial number instrument. See the Replaceable Electrical Parts list for earlier values and serial number ranges. (See the first page of the Diagrams and Circuit Board Illustrations section for definitions of the reference designators and symbols used to identify components in this instrument.) Important voltages and numbered waveform test points are also shown on the diagrams. Important waveforms, and the numbered test points where they were obtained, are located adjacent to each diagram. On each diagram, each point where a waveform has been taken is indicated by the number of the waveform, enclosed in a hexagonal box. The portions of circuits mounted on circuit boards are enclosed with heavy, solid black lines. Each schematic diagram is divided into functional stage blocks, as indicated by the wide shaded lines. The name (functional) of each stage block is given within the shaded line area, with the title on a gray tint background. These functional blocks are described in detail in Section 6, Theory of Operation.

Circuit Board Illustrations

To aid in locating circuit boards, a circuit board location illustration appears on a tabbed foldout page (Fig. 10-8) in the rear of this manual. In addition, an illustration of the circuit board is included on the back of the foldout pages that precede the relevant diagrams, with the physical location of the components that appear on the schematic diagram identified.

Test Point and Adjustment Locations

To aid in locating test points and adjustable components called out in the Performance Check/Adjustment procedure, a "Test Point and Adjustment Locations" foldout page is provided in Section 10, Diagrams and Circuit Board Illustrations.

Component Color Coding

This instrument contains composition resistors, some metal-film resistors, and some wire-wound resistors. The resistance values of wire-wound resistors are usually printed on the component body. The resistance value of composition resistors and metal-film resistors are color coded on the components using the EIA color code (some metal-film resistors may have the value printed on the body). The color code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes, which consist of two significant figures, a multiplier, and a tolerance value (see Fig. 7-1). Metal-film resistors have five stripes consisting of three significant figures, a multiplier, and a tolerance value.

The values of common disc capacitors and small electrolytics are marked on the side of the component body. The white ceramic and epoxy-coated tantalum capacitors used in the instrument are color coded using a modified EIA code (see Fig. 7-1).

COLOR CODE

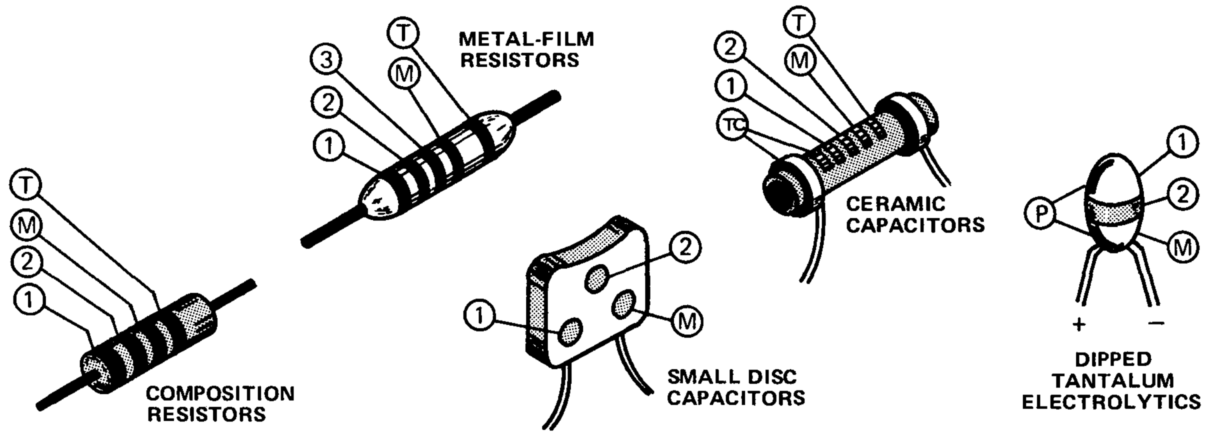
(1) (2) AND (3) - 1st, 2nd, AND 3rd SIGNIFICANT FIGS.

(M) - MULTIPLIER; (T) - TOLERANCE;

(TC) - TEMPERATURE COEFFICIENT.

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

(P) - POSITIVE (+) POLARITY AND VOLTAGE RATING.



COLOR	SIGNIFICANT FIGURES	RESISTORS MULTIPLIER (OHMS)	RESISTORS TOLERANCE	CAPACITORS MULTIPLIER (pF)	CAPACITORS TOLERANCE OVER 10pF	CAPACITORS TOLERANCE UNDER 10pF	DIPPED TANTALUM VOLTAGE RATING
BLACK	0	1	---	1	±20%	± 2pF	4VDC
BROWN	1	10	±1%	10	±1%	±0.1pF	6VDC
RED	2	10^2 or 100	±2%	10^2or 100	±2%	---	10VDC
ORANGE	3	10^3or 1 K	±3%	10^3 or 1000	±3%	---	15VDC
YELLOW	4	10^4 or 10K	±4%	10^4 or 10,000	+100% −0%	---	20VDC
GREEN	5	10^5 or 100 K	±1/2%	10^5or 100,000	±5%	±0.5pF	25VDC
BLUE	6	10^6 or 1 M	±1/4%	10^6 or 1,000,000	---	---	35VDC
VIOLET	7	---	±1/10%	10^7 or 10,000,000	---	---	50VDC
GRAY	8	---	---	10^{-2} or 0.01	+80% −20%	±0.25pF	---
WHITE	9	---	---	10^{-1} or 0.1	±10%	±1pF	3VDC
GOLD	---	10^{-1} or 0.1	±5%	---	---	---	---
SILVER	---	10^{-2} or 0.01	±10%	---	---	---	---
NONE	---	---	±20%	---	±10%	±1pF	---

(1862-74) 1866-57

Fig. 7-1. Color code for resistors and capacitors.

The cathode end of glass-encased diodes is indicated by a stripe, a series of stripes, or a dot. The cathode and anode ends of metal-encased diodes can be identified by the diode symbol marked on the body.

Semiconductor Lead Configurations

Figure 7-2 shows the lead configurations of the semiconductors used in the 603A Monitor.

Multi-Connector Holders

The multi-connector holders are keyed with two triangles, one on the holder and one on the circuit board. When a connection is made perpendicular to a circuit board surface, the orientation of the triangle on the end-lead multi-pin connector holder is determined by the placement of the multi-pin connector index (see Fig. 7-3).

Troubleshooting Equipment

The following equipment, in addition to that listed in the Performance Check/Adjustment section, is useful for troubleshooting the 603A Monitor:

Semiconductor Tester

Description: Dynamic-type tester.

Purpose: To test the semiconductors used in this instrument.

Recommended Type: TEKTRONIX Type 576 Curve Tracer or equivalent.

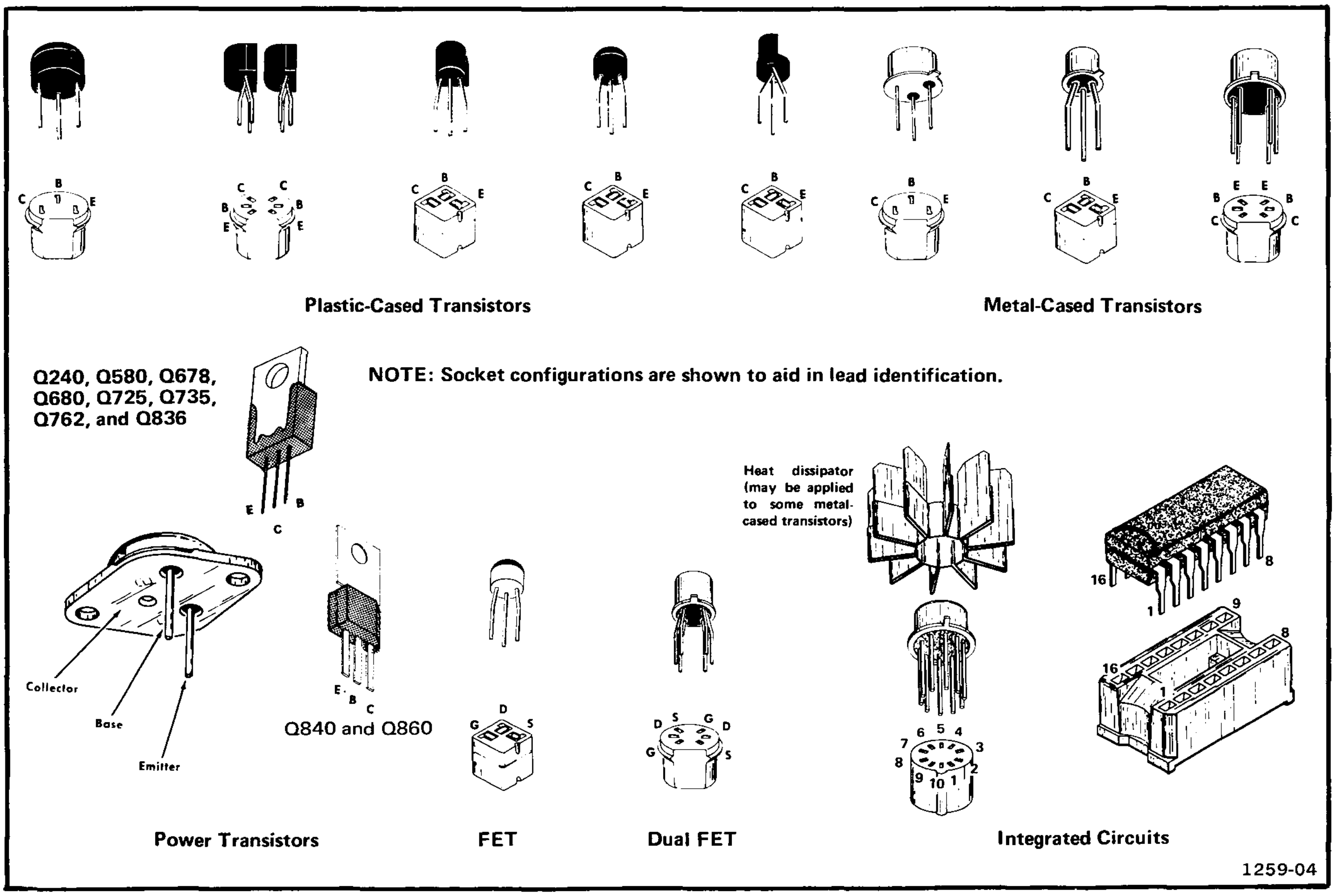


Fig. 7-2. Semiconductor lead configurations.

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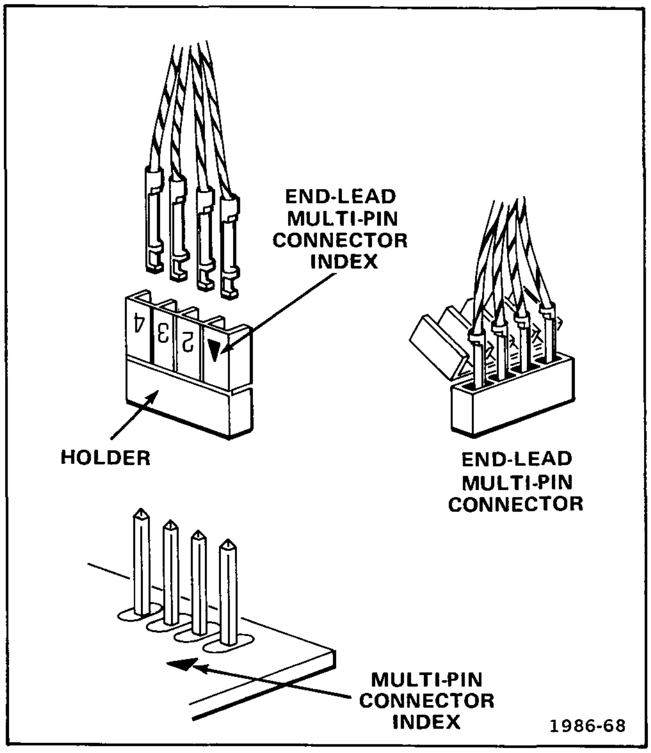

Fig. 7-3. Orientation of multi-connector holders.

Test Lead

Description: Flexible, insulated wire lead, approximately six inches long, equipped with insulated, miniature alligator clips at each end.

Purpose: To provide an easy means of checking balance in the vertical, horizontal, and Z-axis amplifiers.

Recommended Type: This test lead should be made up by the user.

TROUBLESHOOTING TECHNIQUES

This troubleshooting procedure is arranged so that the simple trouble possibilities are checked before proceeding with extensive troubleshooting. The first few checks assure proper connection, operation, and adjustment. If the trouble is located by performing these checks, the remaining steps aid in locating the defective component. When the defective component is located, replace it using the replacement procedure given under Component Replacement in this section.

1. Check Control Settings

Incorrect control settings can simulate a trouble that does not exist. If there is any question about the correct function or operation of any control on the 603A, refer to Section 2, Operating Instructions.

2. Check Associated Equipment

Before proceeding with troubleshooting, check that the equipment used with this instrument is operating correctly. Also, check that the input signals are properly connected and that the interconnecting cables are not defective. Check the line-voltage source.

WARNING

Although this instrument is not to be connected to a patient, interconnecting this monitor to other equipment can result in the application of excessive current to a patient. It is extremely important that the interconnection is made in accordance with NFPA 76B-T, Tentative Standard for the Safe Use of Electricity in Patient Care Areas of Health Care Facilities, section 3038, "Signal Transmission Between Appliances".

3. Visual Check

Visually check that portion of the instrument in which the trouble is located. Many troubles can be found by visible indications such as unsoldered connections, broken wires, damaged circuit boards, and damaged components.

4. Check Instrument Adjustment

Check the electrical adjustment of this instrument, or of the affected circuit if the trouble appears in one circuit. The apparent trouble may only be a result of misadjustment. Complete adjustment instructions are given in Section 4, Performance Check/Adjustment.

5. Isolate Trouble to a Circuit

To isolate trouble to a particular circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by taking voltage and waveform readings.

Incorrect operation of all circuits often indicates trouble in the power supplies. Check first for the correct output voltage of the individual supplies. A defective component elsewhere in the instrument can appear as a power-supply trouble and may also affect the operation of other circuits. For example, a shorted bypass or decoupling capacitor in a circuit other than the power supply could load down a supply, making trouble appear in several circuits. Table 7-1 lists the output voltage range and typical ripple of the power supplies in this instrument. These voltages are measured between the power-supply test points and ground (see the Test Point and Adjustment Locations foldout page in Section 10, Diagrams and Circuit Board

Table 7-1

POWER SUPPLY OUTPUT VOLTAGES AND RIPPLE

Power Supply	Test Point	Output Voltage Range	Typical Ripple (peak-to-peak)
+5 V	5	+4.9 V to +5.1 V	2 mV or less
+15 V	+15 V TP	+14.7 V to +15.3 V	2 mV or less
+20 V UNREG	F840	+18 V to +22 V	UNREG
−30 V (Adjustable)	−30 V TP	−29.9 V to −30.1 V	2 mV or less
−38 V UNREG	−38 V TP	−34.2 V to −41.8 V	UNREG
+215 V	+215 V TP	+208.5 V to +221.5 V	50 mV or less
+360 V	+360 V TP	+342 V to +378 V	100 mV or less

Illustrations, for test point locations). If the power-supply voltage and ripple is within the listed range, the supply can be assumed to be working correctly. If outside the range, the supply may be misadjusted or operating incorrectly. Use the procedure given in Section 4, Performance Check/Adjustment, to adjust the power supplies.

6. Check Voltages and Waveforms

Often, the defective component can be located by checking for the correct voltages or waveforms in the circuit. Typical voltages and waveforms are given in Section 10, Diagrams and Circuit Board Illustrations.

NOTE

Voltages and waveforms given in Section 10, Diagrams and Circuit Board Illustrations, are not absolute and may vary slightly between 603A Monitors. To obtain operating conditions similar to those used to make these readings, see the appropriate schematic.

7. Check Individual Components

The following procedures describe methods of checking individual components in the 603A Monitor. Components which are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of associated circuitry.

WARNING

To avoid electric shock, always disconnect the instrument from the power source before unsoldering or replacing components.

Fuses. Check for open fuses by checking the continuity with an ohmmeter. The location and rating of power-supply fuses is shown in Fig. 7-4.

Transistors. A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component for it (or one that has been checked previously). However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a

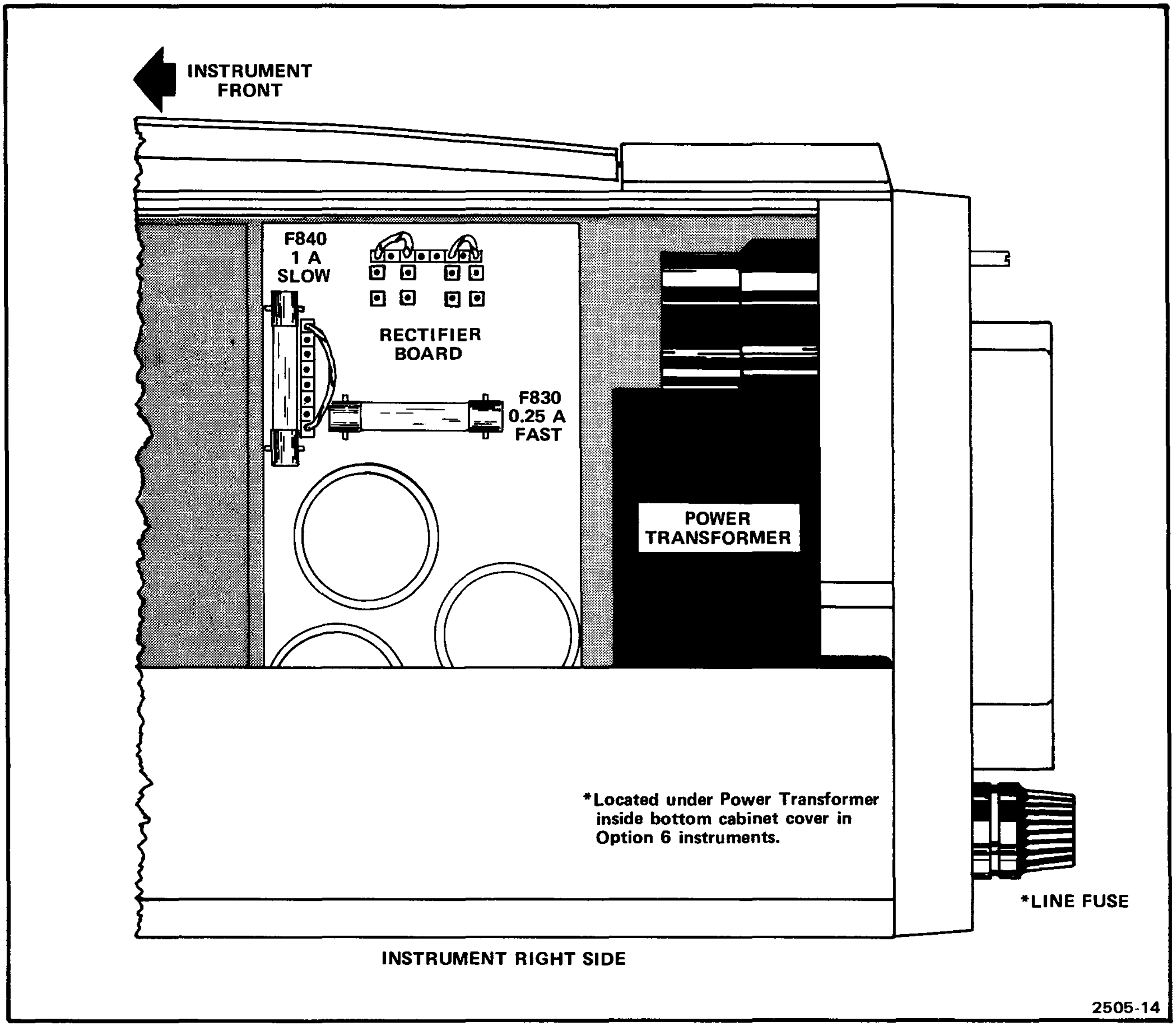

Fig. 7-4. Location and rating of power-supply fuses.

dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

Integrated Circuits. Integrated circuits can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit operation is essential when troubleshooting circuits using integrated circuits. In addition, operating waveforms, logic levels, and other operating information for the integrated circuits are given in Section 6, Theory of Operation, and Section 10, Diagrams and Circuit Board Illustrations. Use care when checking voltages and waveforms around the integrated circuits so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the in-line multi-pin integrated circuits is with an integrated-circuit test clip. This device also doubles as an integrated-circuit extraction tool.

Diodes. A diode can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter scale having a low internal source current, such as the R X 1K scale. The resistance should be very high in one direction, and very low when the meter leads are reversed.

CAUTION

When checking diodes, do not use an ohmmeter scale that has a high internal current, since high currents may damage the diodes under test.

Resistors. Check the resistors with an ohmmeter. Resistor tolerance is given in Section 9, Replaceable Electrical Parts. Normally (with the exception of precision metal-film resistors), resistors do not need to be replaced unless the measured value varies widely from the specified value.

Capacitors. A leaky or shorted capacitor can best be detected by checking resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking if the capacitor passes ac signals (at the frequency for which the circuit is designed to operate).

8. Repair and Readjust the Circuit

If any defective parts are located, follow the replacement procedures given under Component Replacement in this section. Check the performance of any circuit that has been repaired or that has had any electrical components replaced. Adjustment of the circuit may be necessary.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in the 603A Monitor are given here.

OBTAINING REPLACEMENT PARTS

Standard Parts

All electrical and mechanical part replacements can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before ordering or puchasing replacement parts, check the Replaceable Electrical Parts list for value, tolerance, and description.

NOTE

When selecting replacement parts, remember that the physical size and shape of a component may affect its performance in the instrument. All replacement parts should be direct replacements unless you know that a different component will not adversely affect instrument performance.

Special Parts

Some components of the 603A are manufactured or selected by Tektronix, Inc. to meet specific performance requirements. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts

When ordering replacement parts from Tektronix, Inc. include the following information:

1. Instrument type.
2. Instrument serial number.
3. A description of the part (if electrical, include the circuit number; for example, R429).
4. Tektronix part number.

SOLDERING TECHNIQUES

WARNING

To avoid electric shock, disconnect the monitor from the power source before soldering.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques which apply to maintenance of any precision electronic equipment should be used when working on this instrument. Use only 60/40 rosin-core, electric-grade solder.

The choice of soldering iron is determined by the repair to be made. When soldering on circuit boards or small wiring, use only a 15-watt, pencil-type soldering iron. A high-wattage soldering iron can cause the etched circuit wiring to separate from the board base material and melt the insulation from small wiring. Always keep the soldering-iron tip properly tinned to ensure the best heat transfer to the solder joint. Apply only enough heat to remove the component or to make a good solder joint.

To protect heat-sensitive components, hold the component lead with a pair of long-nose pliers between the component body and the solder joint (see Fig. 7-5). Use a solder-removing wick to remove excess solder from connections or to clean circuit-board pads.

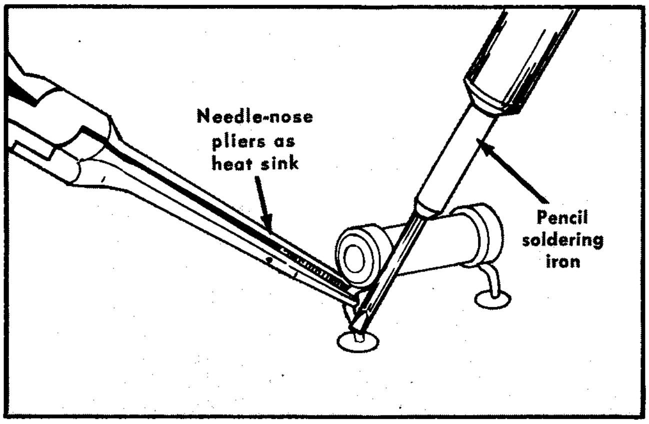

Fig. 7-5. Use of a heat sink to protect components during soldering.

The following technique should be used to replace a component on any of the circuit boards in this instrument. Most components can be replaced without removing the board(s) from the instrument.

1. Touch the soldering-iron tip to the lead at the solder connection. Never place the iron directly on the board, as this may damage the board.

2. Melt a small amount of solder onto the component lead connection. This replaces the flux, which may have been removed during instrument cleaning, and facilitates removal of the component.

3. Grip the component lead with a pair of long-nose pliers. When the solder begins to flow, gently pull the component lead from the board. If unable to separate the lead from the board, try removing the other end of the component.

NOTE

Some components are difficult to remove from the circuit board due to a bend placed in each lead during machine insertion of the component. The purpose of the bent leads is to hold the component in position during a flow-solder manufacturing process which solders all components at once. To make removal of machine-inserted components eaiser, straighten the leads of the component on the back of the circuit board using a small screwdriver or pliers, while heating the soldered connection.

4. Bend the leads of the replacement component to fit the holes in the circuit board. If the component is replaced while the board is mounted in the instrument, cut the leads so they will just protrude through the board. Insert the leads into the holes in the board so that the component is firmly seated against the board, or as originally positioned.

5. Touch the soldering-iron tip to the connection and apply enough heat to make a firm joint.

6. Cut off any excess lead protruding through the board (if not clipped in step 4).

7. Clean the area around the solder connection with a flux-removing solvent. Be careful not to remove the information printed on the circuit board.

COMPONENT REMOVAL AND REPLACEMENT

WARNING

To avoid electric shock, always disconnect the monitor from the power source before replacing components.

The exploded-view drawings associated with the Replaceable Mechanical Parts list (located at the rear of this manual) may be helpful in the removal or disassembly of individual components or sub-assemblies.

Cathode-Ray Tube Removal

Remove the cathode-ray tube (crt) as follows:

WARNING

Use care when handling a crt. Breakage of the crt causes a high-velocity scattering of glass fragments (implosion). Protective clothing and safety glasses should be worn. Avoid striking the crt on any object which might cause it to crack or implode. When storing a crt, place it in a protective carton or set it face down in a protected location on a smooth surface with a soft mat under the faceplate.

1. Remove the bezel assembly and snap-in implosion shield with graticule by removing the two bezel securing screws on the front of the instrument.

2. Remove any protective side-cabinet panels to gain access to the crt leads.

3. Disconnect the storage-element cable connector from the Storage Circuit board.

NOTE

The red and black wires entering the crt shield are connected to the display-rotation coil inside the shield. They will not hamper crt removal and need not be unsoldered.

4. Remove the crt base cover on the rear panel of the instrument. Remove the crt base-pin socket.

5. With one hand on the crt faceplate, push on the crt base. Slide the crt forward, and at the same time feed the storage-element cable through the slot in the main portion of the crt shield. Pull the crt out of the instrument from the front.

Cathode-Ray Tube Replacement

Replace the cathode-ray tube as follows:

1. Press the crt front supports into the front-panel recesses. Then, insert the crt into the main shield while feeding the storage-element cable through the slot in the shield.

2. With the crt fully inserted and loose in the shield, mount the bezel assembly into place and tighten the bezel screws.

3. Place the crt base socket onto the crt base pins. Replace the crt base cover.

4. Connect the storage-element cable to the pin connectors on the Storage Circuit board, and connect the deflection leads to the crt neck pins.

5. Replacing the crt will require readjustment of the potentiometers in the crt circuits, plus resetting X, Y, and Z Gain controls. Refer to Section 4, Performance Check/Adjustment.

Power Transformer Replacement

The procedure for removal and replacement of the power transformer is self-evident. Make note of the lead color-coding of the 19 leads from the transformer to the Power Input and Regulator board, and the two leads from the transformer to the High Voltage and Regulator board.

Replace the power transformer only with a direct replacement Tektronix transformer. After the transformer has been replaced, check the power supply output voltages as outlined in Section 4, Performance Check/Adjustment. Also, check operation of the crt circuits.

Circuit Board Replacement

To remove or replace a circuit board, proceed as follows:

1. Disconnect all leads connected to the board (both soldered lead connections and solderless pin connections). Note placement and color code of any leads removed.

2. Remove all screws holding the board to the chassis or other mounting surface. Push the black plastic mounting clips away from the circuit board edges to free the board. Also, remove any knobs, etc., that would prevent the board from being lifted out of the instrument.

3. Lift the circuit board out of the unit. Do not force or bend the board.

4. To replace the board, reverse the order of removal. Use care when replacing pin connectors; if forced into place while incorrectly positioned, the pin connectors may be damaged.

Semiconductor Replacements

Semiconductors should not be replaced unless actually proved defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement of semiconductors may affect the adjustment of the instrument.

When semiconductors are replaced, check the operation of circuits which may be affected.

WARNING

To avoid electric-shock hazard, always disconnect the monitor from the power source before replacing components.

Replacement semiconductors should be of the original type or a direct replacement. Lead configurations of the semiconductors used in this instrument are shown in Fig. 7-2. Some plastic case transistors have lead configurations that do not agree with those shown.

If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. All transistor sockets in the 603A are wired for the standard basing as used for metal-encased transistors. When removing soldered-in transistors, use a solder-removing wick to remove the solder from the circuit-board pads. Transistors which have heat radiators or are mounted on the chassis use silicone grease to increase heat transfer. Replace silicone grease on both sides of the insulator plate and on the metal tab, if the transistor has one, when replacing these transistors.

WARNING

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

An extracting tool should be used to remove the in-line integrated circuit devices to prevent damaging the pins. This tool is available from Tektronix, Inc. Order Tektronix Part No. 003-0619-00. If an extracting tool is not available, use care to avoid damaging the pins. Pull slowly and evenly on both ends of the integrated circuit. Try to avoid one end disengaging from the socket before the other end.

Circuit-board Pin Replacement

A circuit-board pin replacement kit, including necessary tools, instructions, and replacement pins with attached spare ferrules, is available from Tektronix, Inc. Order Tektronix Part No. 040-0542-00.

To replace a damaged pin, first disconnect any pin connectors. Then, unsolder the damaged pin (see Soldering Techniques) and pull it from the board with a pair of pliers, leaving the ferrule (see Fig. 7-6) in the hole if possible. If the ferrule remains in the circuit board, remove the spare ferrule from the replacement pin and press the new pin into the hole in the circuit board. It may be necessary to ream out the hole in the circuit board with a 0.031-inch drill. If the ferrule is removed with the damaged pin, clean out the hole, using a solder-removing wick and a scribe. Then press the replacement pin, with attached spare ferrule, into the hole. Position the replacement pin in the same manner as the original pin had been. Solder the pin to the circuit board on each side of the circuit board. If the original pin was bent at an angle to mate with a connector, carefully bend the new pin to the same angle. Replace the pin connector.

End-lead Pin Connectors

The pin connectors used to connect the wires to the interconnecting pins are clamped to the ends of the associated leads. To remove or replace damaged end-lead pin connectors, remove the old pin connector from the end of the lead and clamp the replacement connector to the lead.

Some of the pin connectors are grouped and mounted in a plastic holder; the overall result is that these connectors are removed and installed as a multi-pin connector (see Troubleshooting Aids). If the individual end-lead pin connectors are removed from the plastic holder, note the order of the individual wires for correct replacement in the holder.

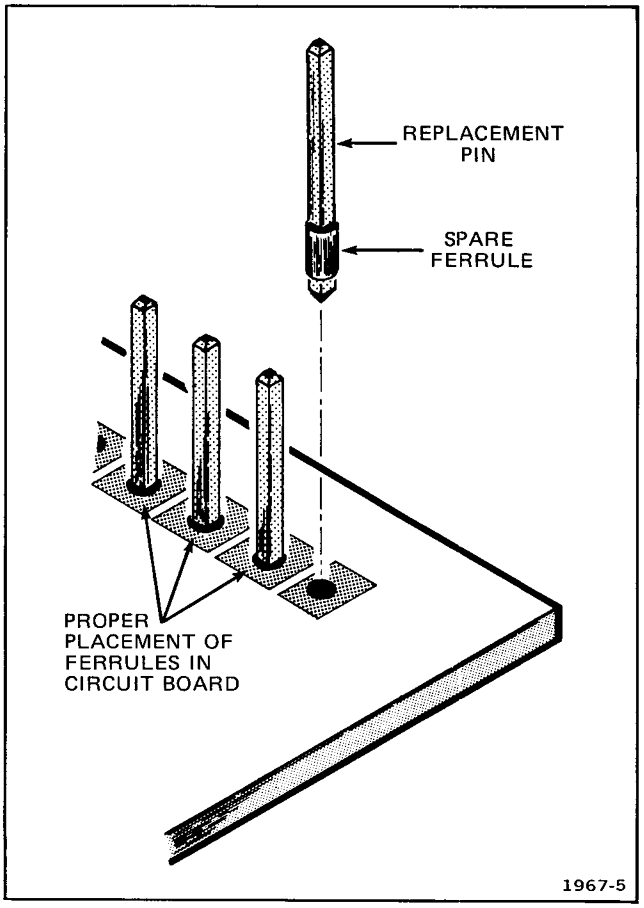

Fig. 7-6. Exploded view of circuit board pin and ferrule.

OPTIONS

INTRODUCTION

Your instrument may be equipped with one or more instrument options. A brief description of each available option is given in the following discussion. Refer to Table 8-1 for location of option information. For further information on instrument options, see your Tektronix catalog or contact your local Tektronix Field Office.

OPTION 1

Includes an internal, unlighted, 8 X 10 division (0.5 inch/div) graticule on the crt faceplate.

OPTION 2

Includes a faster writing-speed crt than the standard instrument (at least 200 div/ms vs 20 div/ms). Stored brightness is lower than the standard instrument.

OPTION 4

Includes an internal X-axis time-base (sweep) with rates from 0.1 second/division to 1 microsecond/division in decade steps plus an uncalibrated VARIABLE control provides sweep rates between the calibrated decade steps and extends the slowest range to at least 1 second/division. X-Y or Y-T mode of operation for the instrument is internally selectable.

OPTION 6

The standard instrument has been modified to meet Underwriter's Laboratory 544 Medical and Dental Equipment requirements. The modifications include warnings required for medical equipment, a hospital-grade power cord and plug cap, and an internal line fuse. The option also includes a carrying handle, protective cabinet panels, and feet.

OPTION 9

The instrument is designated as a recognized component by Underwriter's Laboratory for medical-dental applications.

OPTION 10

Includes a REMOTE PROGRAM connector, mounted on the rear panel of the instrument. The REMOTE PROGRAM connector provides direct connections to the + inputs of the Horizontal (X), Vertical (Y), and Z-Axis amplifiers from a remote location. Also, erase, non-store, and stored brightness enable/disable can be controlled from a remote location. A negative-going pulse, logical 0 (TTL) is present at a connector contact during the erase interval.

OPTION 21

Includes differential INPUT connectors (+ and −) on the rear panel for the Horizontal (X), Vertical (Y), and Z-Axis Amplifiers.

OPTION 22

Includes internal 1:1 or 5:1 switchable input attenuators in the Horizontal (X), and Vertical (Y) Amplifiers to permit extending the gain range of the instrument.

OPTION 23

Includes a carrying handle, protective cabinet panels, and feet. (Not available with Options 6 and 28.)

OPTION 28

Includes protective cabinet panels. (Not available with Options 6 and 23.)

Table 8-1

OPTION INFORMATION LOCATOR

Instrument Option	Manual Section	Location of Information
Option 1 (Crt with internal graticule)	9 Replaceable Electrical Parts	Provides the replacement part number for the crt with an internal graticule.
	8 Instrument Options	Option 1 The introduction includes a description of the Option 1 instrument.
Option 2 (Includes a higher writing-speed crt)	3 Specification	Electrical Table 3-1 includes electrical characteristics for the Option 2 instrument.
	9 Replaceable Electrical Parts	Provides the replacement part number for the crt with the higher writing speed.
Option 4 (Provides an internal horzontal sweep circuit)	2 Operating Instructions	Controls and Connectors Describes the function of the Option 4 front-panel controls. Functional Check Provides a functional check procedure for the Option 4 instrument. Operating Information for Options (Option 4 Internal Time Base) Discusses use of the graticule, controls, and internal sweep generator for making accurate time measurements.
	3 Specification	Electrical Table 3-1, Option 4 Sweep System Includes electrical characteristics for the Option 4 instrument.
	4 Performance Check/Adjustment	Sweep Generator (Option 4) Contains a procedure for checking and adjusting the Option 4 instrument.
	5 Installation	Connecting the Internal Sweep (Option 4) Provides a procedure for changing internal connections to connect the internal sweep generator.
	6 Theory of Operation	Option 4—Time Base Sweep Discusses the operation of the internal sweep circuit.

Table 8-1 (cont)

Instrument Option	Manual Section	Location of Information
Option 4 (cont)	8 Instrument Options	Option 4 The introduction includes a description of the Option 4 instrument.
	9 Replaceable Electrical Parts	Provides an electrical parts list for the Option 4 instrument.
	10 Diagrams and Circuit Board Illustrations	Provides a block diagram, component adjustment, test point, internal control and selector locations, and a schematic diagram for the Option 4 circuit.
	11 Replaceable Mechanical Parts	Provides a mechanical parts list and an exploded-view drawing for the Option 4 instrument.
Option 6 (Listed by Underwriter's Laboratories, Inc., 544 Medical-Dental Equipment Requirements)	5 Installation	Table 5-2 Location of Power-Cord Configuration Information—Lists Hospital-Grade plug. Line-Voltage and Regulating Range Selection—Describes location of the line fuse for the Option 6 instrument. Installation in Patient-Care Facilities Lists WARNINGS that apply.
	8 Instrument Options	Option 6 The introduction includes a description of the Option 6 instrument.
	9 Replaceable Electrical Parts	Provides an electrical parts list with replacement parts footnoted for the Option 6 instrument.
	11 Replaceable Mechanical Parts	Provides a mechanical parts list with replacement parts footnoted for the Option 6 instrument.
Option 9 (Instrument designated by Underwriter's Laboratories as a recognized component for Medical-Dental Equipment applications)	8 Instrument Options	Option 9 The introduction includes a description of the Option 9 instrument.
	9 Replaceable Electrical Parts	Provides an electrical parts list with replacement parts footnoted for the Option 9 instrument.
Option 10 (Remote program connector)	2 Operating Instructions	Rear-Panel Controls and Connectors Describes the REMOTE PROGRAM connector. Remote Operation (Option 10) Describes the functions of the REMOTE PROGRAM connector pins.

Table 8-1 (cont)

Instrument Option	Manual Section	Location of Information
Option 10 (cont)	5 Installation	Remote Program Inputs (Option 10) Provides connection details and logic levels for remote program operation.
	6 Theory of Operation	Storage Circuit 5 Remote Programming (P/O Option 10) Describes operation of the Storage circuit with remote programming.
	8 Instrument Options	Option 10 The introduction includes a description of the Option 10 instrument.
	10 Diagrams and Circuit Board Illustrations	Provides a block diagram and schematic diagram for the Option 10 instrument.
	11 Replaceable Mechanical Parts	Provides an exploded-view drawing and a mechanical parts list with replacement parts footnoted for the Option 10 instrument.
Option 21 (Provides differential inputs for the X, Y, and Z-Axis Amplifiers)	2 Operating Instructions	Rear-Panel Controls and Connectors Describes the functions of the −X, −Y, and −Z INPUT connectors. Functional Check Provides a functional check procedure for the Option 21 instrument. Operating Information for Options Option 21 Full Differential Inputs Provides application information for Option 21 instruments.
	3 Specification	Electrical Table 3-1 Includes electrical characteristics for the Option 21 instrument.
	4 Performance Check/Adjustment	Provides a procedure for checking and adjusting the Option 21 instrument.
	6 Theory of Operation	Differential Inputs (Option 21 only) Discusses operation with Option 21 (differential operation).
	8 Instrument Options	Option 21 The introduction includes a description of the Option 21 instrument.

Table 8-1 (cont)

Instrument Option	Manual Section	Location of Information
Option 21 (cont)	9 Replaceable Electrical Parts	Provides an electrical parts list with replacement parts footnoted for the Option 21 instrument.
	10 Diagrams and Circuit Board Illustrations	Provides a block diagram, test point locations, and schematic diagrams for the Option 21 instrument.
	11 Replaceable Mechanical Parts	Provides an exploded-view drawing and a mechanical parts list with replacement parts footnoted for the Option 21 instrument.
Option 22 (Internal 1:1 and 5:1 switchable attenuators for the X and Y Amplifiers).	2 Operating Instructions	Operating Information for Options Option 22 Switchable Attenuators for X and Y INPUTS Describes use of 5X input attenuators.
	3 Specification	Electrical Table 3-1 Includes electrical characteristics for the Option 22 instrument.
	4 Performance Check/Adjustment	Provides a procedure for checking and adjusting the Option 22 instrument.
	5 Installation	Input Attenuation Selection X and Y Input Attenuator (Option 22) Provides information on factory-set position of attenuators and refers technician to location of switches.
	6 Theory of Operation	Input Attenuators (Option 22 only) Discusses operation with Option 22 (X and Y input attenuators).
	8 Instrument Options	Option 22 The introduction includes a description of the Option 22 instrument.
	9 Replaceable Electrical Parts	Provides an electrical parts list with replacement parts footnoted for the Option 22 instruments.
	10 Diagrams and Circuit Board Illustrations	Provides a block diagram, component, adjustment, internal control and selector locations, and schematic diagram for the Option 22 instrument.

Table 8-1 (cont)

Instrument Option	Manual Section	Location of Information
Option 23 (With handle, feet, and protective cabinet panels)	7 Maintenance	Preventive Maintenance Cabinet Panel Removal Provides instructions on removal of the cabinet panels.
	8 Instrument Options	Option 23 The introduction includes a description of the Option 23 instrument.
	11 Replaceable Mechanical Parts	Provides an exploded-view drawing and a mechanical parts list with replacement parts footnoted for the Option 23 instrument.
Option 28 (With protective cabinet panels)	Same as Option 23	Same as Option 23.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

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

ITEM NAME

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

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00213	NYTRONICS COMPONENTS GROUP INC SUBSIDIARY OF NYTRONICS INC	ORANGE ST	DARLINGTON SC 29532
00853	SANGAMO WESTON INC SANGAMO CAPACITOR DIV	SANGAMO RD P O BOX 128	PICKENS SC 29671
01121	ALLEN-BRADLEY CO	1201 SOUTH 2ND ST	MILWAUKEE WI 53204
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49	DALLAS TX 75265
01686	RCL ELECTRONICS INC	195 MCGREGOR ST	MANCHESTER NH 03102
01963	CHERRY ELECTRICAL PRODUCTS CORP	3600 SUNSET AVE	WAUKEGAN IL 60085
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
03888	KDI PYROFILM CORP	60 S JEFFERSON RD	WHIPPANY NJ 07981
04713	MOTOROLA INC SEMICONDUCTOR GROUP	5005 E MCDOWELL RD	PHOENIX AZ 85008
04726	WARD LEONARD ELECTRIC CO MILRO PRODUCTS DIV		MOUNT VERNON N Y
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV	464 ELLIS ST	MOUNTAIN VIEW CA 94042
07716	TRW INC TRW ELECTRONICS COMPONENTS TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
09023	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO	2652 DALRYMPLE ST	SANFORD NC 27330
10389	ILLINOIS TOOL WORKS INC	1714 N DAMEN AVE	CHICAGO IL 60647
11237	CTS KEENE INC	3230 RIVERSIDE P O BOX 1977	PASO ROBLES CA 93446
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
12969	UNITRODE CORP	580 PLEASANT ST	WATERTOWN MA 02172
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
14193	CAL-R INC	1601 OLYMPIC BLVD	SANTA MONICA CA 90404
14433	ITT SEMICONDUCTORS DIV		WEST PALM BEACH FL
14552	MICRO/SEMICONDUCTOR CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704
15238	ITT SEMICONDUCTORS A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP	500 BROADWAY P O BOX 168	LAWRENCE MA 01841
19701	MEPCO/ELECTRA INC A NORTH AMERICAN PHILIPS CO	P O BOX 760	MINERAL WELLS TX 76067
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701
26769	MEPCO/ELECTRA INC A NORTH AMERICAN PHILIPS COMPANY	5900 AUSTRALIAN AVE	WEST PALM BEACH FL 33407
31433	UNION CARBIDE CORP ELECTRONICS DIV	PO BOX 5928	GREENVILLE SC 29606
31918	ITT SCHADOW INC	8081 WALLACE RD	EDEN PRAIRIE MN 55343
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507
33095	SPECTRUM CONTROL INC	8061 AVONIA RD	FAIRVIEW PA 16415
51406	MURATA ERIE NORTH AMERICA INC GEORGIA OPERATIONS	1148 FRANKLIN RD SE	MARIETTA GA 30067
51642	CENTRE ENGINEERING INC	2820 E COLLEGE AV_	STATE COLLEGE PA 16801
52763	STETTNER ELECTRONICS INC	6135 AIRWAYS BLVD PO BOX 21947	CHATTANOOGA TN 37421
53944	GLOW LITE CORP	BOX 698	PAULS VALLEY OK 73075
54583	TDK ELECTRONICS CORP	755 EASTGATE BLVD	GARDEN CITY NY 11530
56289	SPRAGUE ELECTRIC CO	87 MARSHALL ST	NORTH ADAMS MA 01247
57668	ROHM CORP	16931 MILLIKEN AVE	IRVINE CA 92713
59660	TUSONIX INC	2155 N FORBES BLVD	TUCSON, ARIZONA 85705
59821	CENTRALAB INC SUB NORTH AMERICAN PHILIPS CORP	7158 MERCHANT AVE	EL PASO TX 79915
71400	BUSSMANN MFG CO MCGRAW EDISION CO	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
71450	CTS OF ELKHART	905 N WEST BLVD	ELKHART IN 46514
71468	ITT CANNON ELECTRIC	10550 TALBERT PO BOX 8040	FOUNTAIN VALLEY CA 92728-8040
73138	BECKMAN INSTRUMENTS INC HELIPOT DIV	2500 HARBOR BLVD	FULLERTON CA 92634
74970	JOHNSON E F CO	299 10TH AVE S W	WASECA MN 56093
75042	INTERNATIONAL RESISTIVE CO INC	401 N BROAD ST	PHILADELPHIA PA 19108
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
81439	THERM-O-DISC INC	1320 S MAIN ST P O BOX 1538	MANSFIELD OH 44907
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO	5555 N ELSTRON AVE	CHICAGO IL 60630
83003	VARO INC	2203 WALNUT ST P O BOX 401426	GARLAND TX 75040
91637	DALE ELECTRONICS INC	P O BOX 609	COLUMBUS NE 68601

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-1811-04			CIRCUIT BD ASSY:DEFLECTION	80009	670-1811-04
A2	670-1812-03	B010100	B010460	CIRCUIT BD ASSY:Z AXIS	80009	670-1812-03
A2	670-1812-04	B010461	B011243	CIRCUIT BD ASSY:Z AXIS	80009	670-1812-04
A2	670-1812-05	B011244	B012766	CIRCUIT BD ASSY:Z AXIS	80009	670-1812-05
A2	670-1812-06	B012767		CIRCUIT BD ASSY:Z AXIS	80009	670-1812-06
A3	670-1813-02	B010100	B012662	CIRCUIT BD ASSY:HIGH VOLTAGE & REGULATOR	80009	670-1813-02
A3	670-1813-04	B012663		CIRCUIT BD ASSY:HIGH VOLTAGE & REGULATOR	80009	670-1813-04
A4	670-1815-01			CIRCUIT BD ASSY:STORAGE & CONTROL	80009	670-1815-01
A5	670-1814-01			CIRCUIT BD ASSY:POWER INPUT & RECTIFIER	80009	670-1814-01
A6	670-2278-00			CIRCUIT BD ASSY:SWEEP GENERATOR (OPTION 4 ONLY)	80009	670-2278-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-1811-04			CIRCUIT BD ASSY:DEFLECTION	80009	670-1811-04
A1C110	281-0081-00			CAP,VAR,AIR DI:1.8-13PF,375VDC (OPTION 22 ONLY)	74970	189-0506-075
A1C112	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V (OPTION 22 ONLY)	00853	D155E220K0
A1C116	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C123	281-0544-00			CAP,FXD,CER DI:5.6PF,+/0.5PF,500V	52763	2RDPLZ007 270PM0
A1C124	281-0519-00			CAP,FXD,CER DI:47PF,+/-4.7PF,500V	52763	2RDPLZ007 47P0KC
A1C130	281-0081-00			CAP,VAR,AIR DI:1.8-13PF,375VDC (OPTION 22 ONLY)	74970	189-0506-075
A1C132	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V (OPTION 22 ONLY)	00853	D155E220K0
A1C136	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C143	281-0544-00			CAP,FXD,CER DI:5.6PF,+/0.5PF,500V	52763	2RDPLZ007 270PM0
A1C156	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C165	281-0661-00			CAP,FXD,CER DI:0.8PF,+/-0.1PF,500V	52763	2RDPLZ007 0P80BC
A1C167	281-0628-00			CAP,FXD,CER DI:15PF,5%,500V	52763	2RDPLZ007 15P0JC
A1C168	281-0166-00			CAP,VAR,AIR DI:1.9-15.7 PF,250V	74970	187-0109-055
A1C185	281-0526-00			CAP,FXD,CER DI:1.5PF,+/-0.5PF,500V	52763	2RDPLZ007 1P50DS
A1C187	281-0542-00			CAP,FXD,CER DI:18PF,10%,500V	52763	2RDPLZ007 18P0KC
A1C190	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C191	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C193	290-0522-00			CAP,FXD,ELCTLT:1UF,20%,50V	05397	T368A105M050AZ
A1C230	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C240	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C310	281-0081-00			CAP,VAR,AIR DI:1.8-13PF,375VDC (OPTION 22 ONLY)	74970	189-0506-075
A1C312	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V (OPTION 22 ONLY)	00853	D155E220K0
A1C316	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C323	281-0544-00			CAP,FXD,CER DI:5.6PF,+/0.5PF,500V	52763	2RDPLZ007 270PM0
A1C324	281-0519-00			CAP,FXD,CER DI:47PF,+/-4.7PF,500V	52763	2RDPLZ007 47P0KC
A1C330	281-0081-00			CAP,VAR,AIR DI:1.8-13PF,375VDC (OPTION 22 ONLY)	74970	189-0506-075
A1C332	283-0601-00			CAP,FXD,MICA DI:22PF,10%,300V (OPTION 22 ONLY)	00853	D155E220K0
A1C336	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C343	281-0544-00			CAP,FXD,CER DI:5.6PF,+/0.5PF,500V	52763	2RDPLZ007 270PM0
A1C356	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C365	281-0661-00			CAP,FXD,CER DI:0.8PF,+/-0.1PF,500V	52763	2RDPLZ007 0P80BC
A1C367	281-0579-00			CAP,FXD,CER DI:21PF,5%,500V	52763	2RDPLZ007 21P0JC
A1C368	281-0166-00			CAP,VAR,AIR DI:1.9-15.7 PF,250V	74970	187-0109-055
A1C385	281-0526-00			CAP,FXD,CER DI:1.5PF,+/-0.5PF,500V	52763	2RDPLZ007 1P50DS
A1C387	281-0542-00			CAP,FXD,CER DI:18PF,10%,500V	52763	2RDPLZ007 18P0KC
A1C391	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1C430	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A1CR118	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
A1CR138	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
A1CR152	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR156	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR166	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR167	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR186	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR187	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR222	152-0061-00			SEMICOND DVC,DI:SW,SI,175V,0.1A,DO-35	07263	FDH2161
A1CR226	152-0061-00			SEMICOND DVC,DI:SW,SI,175V,0.1A,DO-35	07263	FDH2161
A1CR243	152-0061-00			SEMICOND DVC,DI:SW,SI,175V,0.1A,DO-35	07263	FDH2161
A1CR318	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
A1CR338	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1CR352	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR356	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR366	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR367	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR386	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR387	152-0333-00			SEMICOND DVC,DI:SW,SI,55V,200MA,DO-35	07263	FDH-6012
A1CR422	152-0061-00			SEMICOND DVC,DI:SW,SI,175V,0.1A,DO-35	07263	FDH2161
A1CR426	152-0061-00			SEMICOND DVC,DI:SW,SI,175V,0.1A,DO-35	07263	FDH2161
A1J131	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
A1J200	131-0569-00			CONN,RCPT,ELEC:25 CONTACT,FEMALE	71468	DB-25S
A1J330	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
A1Q120	151-1054-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1054-00
A1Q152	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q156	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q162	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q172	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q182	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q192	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q202	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q208	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q222	151-0279-03			TRANSISTOR:SELECTED	80009	151-0279-03
A1Q226	151-0279-03			TRANSISTOR:SELECTED	80009	151-0279-03
A1Q240	151-0358-00	B010100	B011359	TRANSISTOR:SELECTED	03508	X44T211
A1Q240	151-0358-02	B011360		TRANSISTOR:SCREENED	80009	151-0358-02
A1Q320	151-1054-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1054-00
A1Q352	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q356	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q362	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q372	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q382	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q392	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q402	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q408	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q422	151-0279-03			TRANSISTOR:SELECTED	80009	151-0279-03
A1Q426	151-0279-03			TRANSISTOR:SELECTED	80009	151-0279-03
A1R105	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R110	321-0891-00			RES,FXD,FILM:800K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED800K0F
A1R112	321-0423-00			RES,FXD,FILM:249K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED249K0F
A1R114	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
A1R116	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R118	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R120	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
A1R123	321-0207-00			RES,FXD,FILM:1.40K OHM,1%,0.125W,TC=T0	19701	5033ED1K400F
A1R124	321-0118-00			RES,FXD,FILM:165 OHM,1%,0.125W,TC=T0	07716	CEAD165R0F
A1R125	311-1417-00			RES,VAR,NONWW:TRMR,2.5K OHM,0.25W	32997	3386F-T06-252
A1R130	321-0891-00			RES,FXD,FILM:800K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED800K0F
A1R132	321-0423-00			RES,FXD,FILM:249K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED249K0F
A1R134	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
A1R136	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R138	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R140	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
A1R143	321-0207-00			RES,FXD,FILM:1.40K OHM,1%,0.125W,TC=T0	19701	5033ED1K400F
A1R152	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R154	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5

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A1R158	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A1R160	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R162	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
A1R164	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R165	323-0385-00			RES,FXD,FILM:100K OHM,1%,0.5W,TC=T0	75042	CECT0-1003F
A1R167	321-0268-00			RES,FXD,FILM:6.04K OHM,1%,0.125W,TC=T0	19701	5043ED6K040F
A1R168	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A1R169	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J
A1R171	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R174	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R176	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R180	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R182	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
A1R184	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R185	323-0385-00			RES,FXD,FILM:100K OHM,1%,0.5W,TC=T0	75042	CECT0-1003F
A1R187	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A1R191	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R194	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R202	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R204	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R208	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R210	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R221	315-0560-00			RES,FXD,FILM:56 OHM,5%,0.25W	57668	NTR25J-E56E0
A1R222	308-0709-00			RES,FXD,WW:8K OHM,3%,7W	00213	1600S-8000-3
A1R224	315-0180-00			RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18R00J
A1R225	315-0560-00			RES,FXD,FILM:56 OHM,5%,0.25W	57668	NTR25J-E56E0
A1R226	308-0709-00			RES,FXD,WW:8K OHM,3%,7W	00213	1600S-8000-3
A1R228	315-0180-00			RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18R00J
A1R229	308-0253-00			RES,FXD,WW:1.32K OHM,5%,3W	14193	SA31-1321J
A1R230	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R240	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R241	315-0333-00			RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A1R242	308-0291-00			RES,FXD,WW:2K OHM,5%,3W	00213	1240S 2000-5
A1R305	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R310	321-0891-00			RES,FXD,FILM:800K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED800K0F
A1R312	321-0423-00			RES,FXD,FILM:249K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED249K0F
A1R314	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
A1R316	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R318	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R320	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
A1R323	321-0207-00			RES,FXD,FILM:1.40K OHM,1%,0.125W,TC=T0	19701	5033ED1K400F
A1R324	321-0118-00			RES,FXD,FILM:165 OHM,1%,0.125W,TC=T0	07716	CEAD165R0F
A1R325	311-1417-00			RES,VAR,NONWW:TRMR,2.5K OHM,0.25W	32997	3386F-T06-252
A1R330	321-0891-00			RES,FXD,FILM:800K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED800K0F
A1R332	321-0423-00			RES,FXD,FILM:249K OHM,1%,0.125W,TC=T0 (OPTION 22 ONLY)	19701	5043ED249K0F
A1R334	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
A1R336	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R338	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R340	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
A1R343	321-0207-00			RES,FXD,FILM:1.40K OHM,1%,0.125W,TC=T0	19701	5033ED1K400F
A1R352	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R354	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A1R358	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A1R360	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E

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A1R362	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
A1R364	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R365	323-0385-00			RES,FXD,FILM:100K OHM,1%,0.5W,TC=T0	75042	CECT0-1003F
A1R367	321-0259-00			RES,FXD,FILM:4.87K OHM,1%,0.125W,TC=T0	07716	CEAD48700F
A1R368	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A1R369	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J
A1R371	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R376	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R380	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R382	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
A1R384	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R385	323-0385-00			RES,FXD,FILM:100K OHM,1%,0.5W,TC=T0	75042	CECT0-1003F
A1R387	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R391	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R394	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R402	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R404	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R408	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R410	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R421	315-0560-00			RES,FXD,FILM:56 OHM,5%,0.25W	57668	NTR25J-E56E0
A1R422	308-0708-00			RES,FXD,WW:5.5K OHM,3%,7W	00213	1600S-5500-3
A1R424	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A1R425	315-0560-00			RES,FXD,FILM:56 OHM,5%,0.25W	57668	NTR25J-E56E0
A1R426	308-0708-00			RES,FXD,WW:5.5K OHM,3%,7W	00213	1600S-5500-3
A1R428	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A1R429	308-0707-00			RES,FXD,WW:950 OHM,1%,3W	01686	T2A-950RF-10
A1R430	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1S110	260-1811-00			SWITCH,SLIDE:DPDT,0.5A,125VAC-DC (OPTION 22 ONLY)	82389	11P-1137
A1S130	260-1811-00			SWITCH,SLIDE:DPDT,0.5A,125VAC-DC (OPTION 22 ONLY)	82389	11P-1137
A1S310	260-1811-00			SWITCH,SLIDE:DPDT,0.5A,125VAC-DC (OPTION 22 ONLY)	82389	11P-1137
A1S330	260-1811-00			SWITCH,SLIDE:DPDT,0.5A,125VAC-DC (OPTION 22 ONLY)	82389	11P-1137
A1S350	260-1811-00			SWITCH,SLIDE:DPDT,0.5A,125VAC-DC (OPTION 4 ONLY)	82389	11P-1137
A1VR241	152-0241-00			SEMICOND DVC,DI:ZEN,SI,33V,5%,0.4W,DO-7	14552	1N973B
A1VR242	152-0288-00			SEMICOND DVC,DI:ZEN,SI,140V,5%,0.4W,DO-7	04713	SZ11824RL

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A2	670-1812-03	B010100	B010460	CIRCUIT BD ASSY:Z AXIS	80009	670-1812-03
A2	670-1812-04	B010461	B011243	CIRCUIT BD ASSY:Z AXIS	80009	670-1812-04
A2	670-1812-05	B011244	B012766	CIRCUIT BD ASSY:Z AXIS	80009	670-1812-05
A2	670-1812-06	B012767		CIRCUIT BD ASSY:Z AXIS	80009	670-1812-06
A2C501	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A2C506	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A2C512	281-0549-00			CAP,FXD,CER DI:68PF,10%,500V	52763	2RDPLZ007 68POKU
A2C513	281-0621-00			CAP,FXD,CER DI:12PF,1%,500V	52763	2RDPLZ007 12POLC
A2C516	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A2C523	281-0621-00			CAP,FXD,CER DI:12PF,1%,500V	52763	2RDPLZ007 12POLC
A2C525	283-0178-00			CAP,FXD,CER DI:0.1UF,20%,100V	05397	C330C104Z1U1CA
A2C526	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A2C531	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A2C539	281-0534-00			CAP,FXD,CER DI:3.3PF,+/-0.25PF,500V	52763	2RDPLZ007 3P3OCC
A2C547	281-0629-00			CAP,FXD,CER DI:33PF,5%,600V	52763	2RDPLZ007 33POJC
A2C548	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A2C553	283-0178-00			CAP,FXD,CER DI:0.1UF,20%,100V	05397	C330C104Z1U1CA
A2C556	281-0526-00	B010100	B010460	CAP,FXD,CER DI:1.5PF,+/-0.5PF,500V	52763	2RDPLZ007 1P50DS
A2C556	281-0627-00	B010461	B011243	CAP,FXD,CER DI:1PF,+/-0.25PF,500V	52763	2RDPLZ007 1POOCC
A2C556	283-0348-00	B011244		CAP,FXD,CER DI:0.5PF,+/-0.1PF,100V	51642	W150100NP0508B
A2C560	281-0160-00			CAP,VAR,CER DI:7-25PF,350V,MINTR CER DISC,T OP ADJ	33095	53-717-001 B7-25
A2CR508	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
A2CR518	152-0246-00			SEMICOND DVC,DI:SW,SI,40V,200MA,DO-7	14433	WG1537TK
A2CR526	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2CR528	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2CR531	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2CR541	152-0233-00			SEMICOND DVC,DI:SW,SI,80V,75MA,DO-7	03508	DA2737
A2CR542	152-0153-00			SEMICOND DVC,DI:SW,SI,10V,50MA,.DO-7	07263	FD7003
A2Q520	151-1054-00			TRANSISTOR:FET,N-CHAN,SI,TO-71	80009	151-1054-00
A2Q526	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A2Q528	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A2Q532	151-0301-00			TRANSISTOR:PNP,SI,TO-18	04713	ST898
A2Q534	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A2Q536	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A2Q542	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A2Q544	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A2Q554	151-0270-00			TRANSISTOR:PNP,SI,TO-5	04713	ST919
A2Q556	151-0279-03	B010100	B011243	TRANSISTOR:SELECTED	80009	151-0279-03
A2Q556	151-0124-00	B011244		TRANSISTOR:NPN,SI,TO-39	04713	SM8138
A2R501	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A2R503	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J
A2R505	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
A2R506	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A2R508	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A2R510	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A2R511	321-0142-00			RES,FXD,FILM:294 OHM,1%,0.125W,TC=T0	07716	CEAD294R0F
A2R512	311-1226-00			RES,VAR,NONWW:TRMR,2.5K OHM,0.5W	32997	3386F-T04-252
A2R513	321-0210-00			RES,FXD,FILM:1.50K OHM,1%,0.125W,TC=T0	19701	5033ED1K50F
A2R515	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W,TC=T0	75042	CEBT0-1004F
A2R516	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A2R518	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A2R520	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A2R523	321-0210-00			RES,FXD,FILM:1.50K OHM,1%,0.125W,TC=T0	19701	5033ED1K50F
A2R525	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A2R526	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J
A2R527	321-0158-00			RES,FXD,FILM:432 OHM,1%,0.125W,TC=T0	07716	CEAD432R0F
A2R528	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2R530	321-0321-00			RES,FXD,FILM:21.5K OHM,1%,0.125W,TC=T0	07716	CEAD21501F
A2R531	321-0208-00			RES,FXD,FILM:1.43K OHM,1%,0.125W,TC=T0	19701	5033ED1K43F
A2R532	321-0127-00			RES,FXD,FILM:205 OHM,1%,0.125W,TC=T0	07716	CEAD205R0F
A2R534	321-0198-00			RES,FXD,FILM:1.13K OHM,1%,0.125W,TC=T0	07716	CEAD11300F
A2R535	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
A2R536	321-0198-00			RES,FXD,FILM:1.13K OHM,1%,0.125W,TC=T0	07716	CEAD11300F
A2R537	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
A2R539	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A2R541	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A2R544	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A2R545	315-0472-00	B010100	B011243	RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A2R545	301-0272-00	B011244		RES,FXD,FILM:2.7K OHM,5%,0.5W	19701	5053CX2K700J
A2R547	316-0181-00			RES,FXD,CMPSN:180 OHM,10%,0.25W	01121	CB1811
A2R549	303-0563-00			RES,FXD,CMPSN:56K OHM,5%,1W	01121	GB5635
A2R551	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A2R553	308-0206-00			RES,FXD,WW:7.5K OHM,5%,5W	04726	5X 7.5K 5PERCENT
A2R556	322-0613-00			RES,FXD,FILM:20.4K OHM,1%,0.25W,TC=T0	24546	NA60D2042F
A2R557	316-0100-00			RES,FXD,CMPSN:10 OHM,10%,0.25W	01121	CB1001
A2R558	321-0254-00			RES,FXD,FILM:4.32K OHM,1%,0.125W,TC=T0	07716	CEAD43200F
A2R559	321-0253-00			RES,FXD,FILM:4.22K OHM,1%,0.125W,TC=T0	19701	5033ED 4K 220F
A2R560	315-0202-00	B010100	B011243	RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A2R560	315-0102-00	B011244		RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2VR526	152-0149-00			SEMICOND DVC,DI:ZEN,SI,10V,5%,0.4W,DO-7	15238	Z5406
A2VR541	152-0166-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-7	04713	SZ11738RL
A2VR551	152-0101-00			SEMICOND DVC,DI:ZEN,SI,75V,5%,1W,A31A	04713	SZM25000K1

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3	670-1813-02	B010100	B012662	CIRCUIT BD ASSY:HIGH VOLTAGE & REGULATOR	80009	670-1813-02
A3	670-1813-04	B012663		CIRCUIT BD ASSY:HIGH VOLTAGE & REGULATOR	80009	670-1813-04
A3C565	283-0162-00	B010100	B012662	CAP,FXD,CER DI:0.01UF,+80-20%,5000V	51406	DHA42Y5S103Z5KV
A3C565	283-0162-01	B012663		CAP,FXD,CER DI:0.01UF,-20+80%,5000V	51406	DHA42Y5S103Z5KV
A3C566	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	51406	DHR17Y55102M5KV
A3C571	283-0178-00			CAP,FXD,CER DI:0.1UF,20%,100V	05397	C330C104Z1U1CA
A3C578	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	31433	C330C332JIG5CA
A3C580	283-0162-00	B010100	B012662	CAP,FXD,CER DI:0.01UF,+80-20%,5000V	51406	DHA42Y5S103Z5KV
A3C580	283-0162-01	B012663		CAP,FXD,CER DI:0.01UF,-20+80%,5000V	51406	DHA42Y5S103Z5KV
A3C581	283-0162-00	B010100	B012662	CAP,FXD,CER DI:0.01UF,+80-20%,5000V	51406	DHA42Y5S103Z5KV
A3C581	283-0162-01	B012663		CAP,FXD,CER DI:0.01UF,-20+80%,5000V	51406	DHA42Y5S103Z5KV
A3C582	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T368B226M015AS
A3C583	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	51406	DHR17Y55102M5KV
A3C584	283-0067-00			CAP,FXD,CER DI:0.001UF,10%,200V	59660	835-515-YSE0102K
A3C585	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	31433	C330C332JIG5CA
A3C586	281-0512-00			CAP,FXD,CER DI:27PF,+/-2.7PF,500V	52763	2RDPLZ007 27P0KC
A3C587	290-0305-01			CAP,FXD,ELCTLT:3UF,10%,150V	26769	40LW305A150K1C
A3C836	283-0178-00			CAP,FXD,CER DI:0.1UF,20%,100V	05397	C330C104Z1U1CA
A3C841	283-0081-00			CAP,FXD,CER DI:0.1UF,+80-20%,25V	59821	2DDU69E104Z
A3C842	290-0536-00			CAP,FXD,ELCTLT:10UF,20%,25V TANTALUM	05397	T368B106M025AS
A3C852	281-0550-00			CAP,FXD,CER DI:120PF,10%,500V	52763	2RDPLZ007 120PMO
A3C857	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A3C862	283-0111-00			CAP,FXD,CER DI:0.1UF,20%,50V	05397	C330C104M5U1CA
A3C864	290-0175-00			CAP,FXD,ELCTLT:10UF,20%,35V	05397	T110C106M035AS
A3C865	281-0543-00			CAP,FXD,CER DI:270PF,10%,500V	52763	2RDPLZ007 27POMO
A3C870	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T368B226M015AS
A3C872	281-0504-00			CAP,FXD,CER DI:10PF,+/-1PF,500V	54583	TCC20CH2H100FYA
A3C876	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A3CR565	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A3CR566	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A3CR567	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A3CR569	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR570	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR578	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR580	152-0409-00			SEMICOND DVC,DI:RECT,SI,12K,5MA,A298J	83003	VG12X-1
A3CR586	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A3CR835	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR836	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A3CR841	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A3CR842	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A3CR850	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR851	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR864	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A3CR865	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR870	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR875	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3DS565	150-0111-00			LAMP,GLOW:125V MAX,1.5MA,2AC-AT,WIRE	53944	A1B-9
A3DS5566	150-0111-00			LAMP,GLOW:125V MAX,1.5MA,2AC-AT,WIRE	53944	A1B-9
A3DS5567	150-0111-00			LAMP,GLOW:125V MAX,1.5MA,2AC-AT,WIRE	53944	A1B-9
A3Q570	151-0254-00			TRANSISTOR:DARLINGTON,NPN,SI	03508	X38L3118
A3Q576	151-0134-00			TRANSISTOR:PNP,SI,TO-39	04713	SM3195
A3Q830	151-0228-00			TRANSISTOR:PNP,SI,TO-105	07263	S21862
A3Q846	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A3Q852	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A3Q865	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A3Q870	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A3Q875	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A3R564	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3R565	315-0106-00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
A3R566	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A3R567	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A3R569	316-0153-00			RES,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
A3R570	316-0154-00			RES,FXD,CMPSN:150K OHM,10%,0.25W	01121	CB1541
A3R571	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A3R572	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A3R573	307-0333-00			RES,FXD,FILM:HV DIVIDER	80009	307-0333-00
A3R575	311-1232-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	32997	3386F-T04-503
A3R576	316-0100-00			RES,FXD,CMPSN:10 OHM,10%,0.25W	01121	CB1001
A3R577	316-0153-00			RES,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
A3R578	301-0181-00			RES,FXD,FILM:180 OHM,5%,0.5W	19701	5053CX180R0J
A3R579	316-0150-00			RES,FXD,CMPSN:15 OHM,10%,0.25W	01121	CB1501
A3R581	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A3R582	308-0459-00			RES,FXD,WW:1.1 OHM,5%,3W	01686	T2B-791.1-5
A3R585	315-0125-00			RES,FXD,FILM:1.2M OHM,5%,0.25W	19701	5043CX1M200J
A3R586	316-0564-00			RES,FXD,CMPSN:560K OHM,10%,0.25	01121	CB5641
A3R587	321-0410-00			RES,FXD,FILM:182K OHM,1%,0.125W,TC=T0	19701	5033ED182K0F
A3R588	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A3R589	321-0371-00			RES,FXD,FILM:71.5K OHM,1%,0.125W,TC=T0	07716	CEAD71501F
A3R590	316-0104-00			RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
A3R591	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A3R592	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A3R593	301-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.5W	19701	5053CX6K800J
A3R594	311-1136-00			RES,VAR,NONWW:TRMR,100K OHM,0.25W	71450	YA5536
A3R596	311-1136-00			RES,VAR,NONWW:TRMR,100K OHM,0.25W	71450	YA5536
A3R832	322-0414-00			RES,FXD,FILM:200K OHM,1%,0.25W,TC=T0	91637	MFF1412G20002F
A3R834	321-0351-00			RES,FXD,FILM:44.2K OHM,1%,0.125W,TC=T0	07716	CEAD44201F
A3R836	301-0102-00			RES,FXD,FILM:1K OHM,5%,0.50W	19701	5053CX1K000J
A3R837	308-0230-00			RES,FXD,WW:2.7K OHM,5%,3W	14193	SA31-2701J
A3R838	301-0300-00			RES,FXD,FILM:30 OHM,5%,0.5W	19701	5053CX30R00J
A3R842	307-0007-00			RES,FXD,CMPSN:2.7 OHM,10%,1W	80009	307-0007-00
A3R846	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A3R847	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A3R850	316-0823-00			RES,FXD,CMPSN:82K OHM,10%,0.25W	01121	CB8231
A3R851	301-0683-00			RES,FXD,FILM:68K OHM,5%,0.5W	19701	5053CX68K00J
A3R852	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A3R853	316-0103-00			RES,FXD,CMPSN:10K OHM,10%,0.25W	01121	CB1031
A3R857	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=T0	19701	5033ED4K990F
A3R858	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=T0	19701	5033ED10K0F
A3R859	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A3R860	307-0015-00			RES,FXD,CMPSN:3.3 OHM,5%,1W	01121	GB33G5
A3R861	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A3R862	307-0335-00			RES,FXD,FILM:150 OHM,5%,0.4W	24546	FP-4G150R0J
A3R863	316-0273-00			RES,FXD,CMPSN:27K OHM,10%,0.25W	01121	CB2731
A3R865	316-0331-00			RES,FXD,CMPSN:330 OHM,10%,0.25W	01121	CB3311
A3R867	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	57668	NTR25J-E620E
A3R868	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A3R870	315-0562-00			RES,FXD,FILM:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A3R872	316-0221-00			RES,FXD,CMPSN:220 OHM,10%,0.25W	01121	CB2211
A3R873	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A3R875	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A3R876	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A3R877	321-0256-00			RES,FXD,FILM:4.53K OHM,1%,0.125W,TC=T9	19701	5033ED4K530F
A3R878	311-1124-00			RES,VAR,NONWW:TRMR,250 OHM,0.25W	71450	YA5533
A3R879	321-0202-00			RES,FXD,FILM:1.24K OHM,1%,0.125W,TC=T0	24546	NA55D1241F
A3T580	120-0750-00			XFMR,PWR,STU:HV	80009	120-0750-00
A3VR591	152-0255-00			SEMICOND DVC,DI:ZEN,SI,51V,5%,0.4W,DO-7	04713	SZG35009K7

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Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3VR836	152-0291-00			SEMICOND DVC,DI:ZEN,SI,20V,5%,1W,A31A	04713	1N3027B
A3VR850	152-0357-00			SEMICOND DVC,DI:ZEN,SI,82V,5%,0.4W,DO-7	04713	SZ12461KRL
A3VR870	152-0227-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-7	04713	SZ13903

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4	670-1815-01			CIRCUIT BD ASSY:STORAGE & CONTROL	80009	670-1815-01
A4C595	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	51406	DHR17Y55102M5KV
A4C608	283-0067-00			CAP,FXD,CER DI:0.001UF,10%,200V	59660	835-515-YSE0102K
A4C614	281-0501-00			CAP,FXD,CER DI:4.7PF,+/-1PF,500V	59660	301-000S2H0479F
A4C621	283-0604-00			CAP,FXD,MICA DI:304PF,2%,500V	00853	D155F3040G0
A4C625	283-0026-00			CAP,FXD,CER DI:0.2UF,+80-20%,25V	31433	C330C332JIG5CA
A4C629	281-0604-00			CAP,FXD,CER DI:2.2PF,+/-0.25PF,500V	52763	2RDPLZ007 2P20CC
A4C631	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A4C636	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A4C642	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A4C644	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T368B226M015AS
A4C652	290-0529-00			CAP,FXD,ELCTLT:47UF,20%,20V	05397	T362C476M020AS
A4C715	290-0512-00			CAP,FXD,ELCTLT:22UF,20%,15V	05397	T368B226M015AS
A4C721	290-0002-00			CAP,FXD,ELCTLT:8UF,+50-10%,450V	09023	BR8-450
A4C722	290-0025-00			CAP,FXD,ELCTLT:6.25UF,+99-10%,300V	00853	066EE6R2U300B
A4C763	283-0008-00			CAP,FXD,CER DI:0.1UF,20%,500V	51642	500-500-X7R-104M
A4C764	281-0543-00			CAP,FXD,CER DI:270PF,10%,500V	52763	2RDPLZ007 27POMO
A4C770	290-0530-00			CAP,FXD,ELCTLT:68UF,20%,6V	56289	196D686X0006KA1
A4C771	283-0002-00			CAP,FXD,CER DI:0.01UF,+80-20%,500V	59821	D103Z40Z5ULADEG
A4CR603	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR606	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR608	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR615	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR636	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR641	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR652	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR664	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR680	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR682	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR724	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A4CR725	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A4CR760	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR762	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A4CR763	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A4CR764	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR775	152-0488-00			SEMICOND DVC,DI:RECT,SI,200V,0.5A	04713	SDA317
A4Q606	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A4Q610	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q615	151-0279-03			TRANSISTOR:SELECTED	80009	151-0279-03
A4Q620	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q628	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q640	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A4Q644	151-0302-00			TRANSISTOR:NPN,SI,TO-18	04713	ST899
A4Q648	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q675	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A4Q690	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q700	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q715	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q760	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q764	151-0347-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7951
A4R175	311-1311-00			RES,VAR,NONWW:PNL,1K OHM,0.5W	01121	73U4G048L102M
A4R375	311-1311-00			RES,VAR,NONWW:PNL,1K OHM,0.5W	01121	73U4G048L102M
A4R562	311-1313-00			RES,VAR,NONWW:PNL,2K OHM,0.5W	01121	73M4G0481202M
A4R595	311-1312-00			RES,VAR,NONWW:PNL,5M OHM,1W	32997	81C1D-E24-BA0328
A4R602	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A4R603	316-0274-00			RES,FXD,CMPSN:270K OHM,10%,0.25W	01121	CB2741
A4R608	316-0472-00			RES,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
A4R609	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4R610	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A4R611	316-0393-00			RES,FXD,CMPSN:39K OHM,10%,0.25W	01121	CB3931
A4R613	316-0223-00			RES,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
A4R614	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A4R620	316-0223-00			RES,FXD,CMPSN:22K OHM,10%,0.25W	01121	CB2231
A4R621	315-0125-00			RES,FXD,FILM:1.2M OHM,5%,0.25W	19701	5043CX1M200J
A4R622	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A4R623	316-0104-00			RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
A4R626	315-0123-00			RES,FXD,FILM:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A4R628	316-0104-00			RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
A4R629	315-0125-00			RES,FXD,FILM:1.2M OHM,5%,0.25W	19701	5043CX1M200J
A4R631	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A4R633	316-0393-00			RES,FXD,CMPSN:39K OHM,10%,0.25W	01121	CB3931
A4R634	316-0393-00			RES,FXD,CMPSN:39K OHM,10%,0.25W	01121	CB3931
A4R636	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A4R637	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A4R638	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A4R639	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A4R641	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A4R642	316-0153-00			RES,FXD,CMPSN:15K OHM,10%,0.25W	01121	CB1531
A4R644	316-0121-00			RES,FXD,CMPSN:120 OHM,10%,0.25W	01121	CB1211
A4R647	301-0122-00			RES,FXD,FILM:1.2K OHM,5%,0.5W	57668	TR50J-E 1K2
A4R648	316-0331-00			RES,FXD,CMPSN:330 OHM,10%,0.25W	01121	CB3311
A4R650	316-0393-00			RES,FXD,CMPSN:39K OHM,10%,0.25W	01121	CB3931
A4R651	315-0183-00			RES,FXD,FILM:18K OHM,5%,0.25W	19701	5043CX18K00J
A4R652	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A4R661	321-0365-00			RES,FXD,FILM:61.9K OHM,1%,0.125W,TC=T0	07716	CEAD61901F
A4R663	315-0124-00			RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A4R664	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A4R666	321-0304-00			RES,FXD,FILM:14.3K OHM,1%,0.125W,TC=T0	19701	5033ED14K30F
A4R667	321-0350-00			RES,FXD,FILM:43.2K OHM,1%,0.125W,TC=T0	19701	5043ED43K20F
A4R670	311-1314-00			RES,VAR,NONWW:TRMR,5K OHM,0.25W	71450	201-YA5551
A4R671	316-0331-00			RES,FXD,CMPSN:330 OHM,10%,0.25W	01121	CB3311
A4R672	323-0452-00			RES,FXD,FILM:499K OHM,1%,0.5W,TC=T0	75042	CECT0-4993F
A4R675	321-0410-00			RES,FXD,FILM:182K OHM,1%,0.125W,TC=T0	19701	5033ED182K0F
A4R676	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A4R678	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A4R680	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A4R681	303-0823-00			RES,FXD,CMPSN:82K OHM,5%,1W	01121	GB8235
A4R682	303-0823-00			RES,FXD,CMPSN:82K OHM,5%,1W	01121	GB8235
A4R691	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A4R692	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A4R693	315-0683-00			RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A4R694	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A4R695	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A4R696	315-0163-00			RES,FXD,FILM:16K OHM,5%,0.25W	57668	NTR25J-E 16K
A4R700	311-1315-00			RES,VAR,NONWW:TRMR,25K OHM,0.25W	71450	201-YA555A
A4R701	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A4R703	316-0334-00			RES,FXD,CMPSN:330K OHM,10%,0.25W	01121	CB3341
A4R704	316-0334-00			RES,FXD,CMPSN:330K OHM,10%,0.25W	01121	CB3341
A4R715	311-1314-00			RES,VAR,NONWW:TRMR,5K OHM,0.25W	71450	201-YA5551
A4R716	315-0154-00			RES,FXD,FILM:150K OHM,5%,0.25W	57668	NTR25J-E150K
A4R718	315-0123-00			RES,FXD,FILM:12K OHM,5%,0.25W	57668	NTR25J-E12K0
A4R723	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A4R724	301-0823-00			RES,FXD,FILM:82K OHM,5%,0.5W	19701	5053CX82K00J
A4R725	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A4R728	301-0134-00			RES,FXD,FILM:130K OHM,5%,0.5W	19701	5053CX130K0J
A4R729	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4R730	311-1136-00			RES,VAR,NONWW:TRMR,100K OHM,0.25W	71450	YA5536
A4R734	315-0623-00			RES,FXD,FILM:62K OHM,5%,0.25W	19701	5043CX62K00J
A4R735	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A4R760	301-0224-00			RES,FXD,FILM:220K OHM,5%,0.5W	01121	EB2245
A4R761	316-0474-00			RES,FXD,CMPSN:470K OHM,10%,0.25W	01121	CB4741
A4R762	305-0183-00			RES,FXD,CMPSN:18K OHM,5%,2W	01121	HB1835
A4R763	315-0161-00			RES,FXD,FILM:160 OHM,5%,0.25W	57668	NTR25J-E 160E
A4R764	315-0753-00			RES,FXD,FILM:75K OHM,5%,0.25W	57668	NTR25J-E75K0
A4R765	316-0472-00			RES,FXD,CMPSN:4.7K OHM,10%,0.25W	01121	CB4721
A4R766	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A4R767	323-0437-00			RES,FXD,FILM:348K OHM,1%,0.5W,TC=T0	75042	CECT0-3483F
A4R768	321-0352-00			RES,FXD,FILM:45.3K OHM,1%,0.125W,TC=T0	07716	CEAD45301F
A4R770	303-0271-00			RES,FXD,CMPSN:270 OHM,5%,1W	01121	GB2715
A4R775	316-0104-00			RES,FXD,CMPSN:100K OHM,10%,0.25W	01121	CB1041
A4S630	260-1308-00			SWITCH,PUSH:DPDT,MOMENTARY	80009	260-1308-00
A4S695	260-1211-00			SWITCH,PUSH:1A,28VDC	31918	601348
A4U630	156-0149-00			MICROCKT,DGTL:DUAL 4-INP NAND SCHMITT	01295	SN7413N
A4VR611	152-0168-00			SEMICOND DVC,DI:ZEN,SI,12V,5%,0.4W,DO-763B	14552	TD331689
A4VR734	152-0288-00			SEMICOND DVC,DI:ZEN,SI,140V,5%,0.4W,DO-7	04713	SZ11824RL
A4VR763	152-0166-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-7	04713	SZ11738RL
A4VR770	152-0279-00			SEMICOND DVC,DI:ZEN,SI,5.1V,5%,0.4W,DO-7	14552	TD3810989

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A5	670-1814-01			CIRCUIT BD ASSY:POWER INPUT & RECTIFIER	80009	670-1814-01
A5C820	290-0569-00			CAP,FXD,ELCTLT:50UF,+50-10%,250V	56289	68D10476
A5C830	290-~~0571-00~~ 0587-00			~~CAP,FXD,ELCTLT:5000UF,+100-10%,25V~~	56289	68D10478
A5C840	290-0571-00			CAP,FXD,ELCTLT:5000UF,+100-10%,25V	56289	68D10478
A5C860	290-0570-00			CAP,FXD,ELCTLT:500UF,+75-10%,50V	56289	68D10477
A5CR820	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR821	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR822	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR823	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR830	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR831	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR832	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR833	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR840	152-0488-00			SEMICOND DVC,DI:RECT,SI,200V,0.5A	04713	SDA317
A5CR860	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR861	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR862	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5CR863	152-0107-00			SEMICOND DVC,DI:RECT,SI,400 V,400MA,A1	12969	"G727"
A5F830	159-0028-00			FUSE,CARTRIDGE:0.25A,250V,FAST BLOW	71400	AGC-1/4
A5F840	159-0019-00			FUSE,CARTRIDGE:3AG,1A,250V,SLOW BLOW	71400	MDL 1
A5R820	304-0683-00			RES,FXD,CMPSN:68K OHM,10%,1W	01121	GB6831
A5R830	302-0150-00			RES,FXD,CMPSN:15 OHM,10%,0.5W	01121	EB1501
A5R831	304-0823-00			RES,FXD,CMPSN:82K OHM,10%,1W	01121	GB8231

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A6	670-2278-00			CIRCUIT BD ASSY:SWEEP GENERATOR (OPTION 4 ONLY)	80009	670-2278-00
A6C905	281-0503-00			CAP,FXD,CER DI:8PF,+/-0.5PF,500V	52763	2RDPLZ007 8P00DC
A6C910	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A6C912	281-0629-00			CAP,FXD,CER DI:33PF,5%,600V	52763	2RDPLZ007 33P0JC
A6C914	283-0004-00			CAP,FXD,CER DI:0.02UF,+80-20%,150V	59660	855-558Z5V0203Z
A6C924	283-0041-00			CAP,FXD,CER DI:0.0033UF,5%,500V	59660	841-542B332J
A6C925	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A6C930	285-0754-02			CAP,FXD,PLASTIC:0.001UF,3%,400V (AVAILABLE AS A MATCHED SET, PART NUMBER 295-0159-00. THE LETTER SUFFIX AND THE TOLERANCE SHOULD BE THE SAME FOR ALL THE TIMING CAPACITORS IN THE ASSEMBLY)	80009	285-0754-02
A6C934	285-0753-00			CAP,FXD,PLASTIC:0.01UF,3.5%,100V (SEE DESCRIPTION ON C930)	80009	285-0753-00
A6C938	285-0895-00			CAP,FXD,PLASTIC:1.0UF,3%,25V (SEE DESCRIPTION ON C930)	80009	285-0895-00
A6C960	281-0604-00			CAP,FXD,CER DI:2.2PF,+/-0.25PF,500V	52763	2RDPLZ007 2P20CC
A6C962	290-0572-00			CAP,FXD,ELCTLT:0.1UF,20%,50V	05397	T368A104050AZ
A6C976	281-0549-00			CAP,FXD,CER DI:68PF,10%,500V	52763	2RDPLZ007 68P0KU
A6C990	290-0534-00			CAP,FXD,ELCTLT:1UF,20%,35V	05397	T368A105M035AZ
A6C995	290-0572-00			CAP,FXD,ELCTLT:0.1UF,20%,50V	05397	T368A104050AZ
A6CR930	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A6CR975	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A6Q960	151-0342-00			TRANSISTOR:PNP,SI,TO-92	07263	S035928
A6Q964	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
A6Q975	151-0342-00			TRANSISTOR:PNP,SI,TO-92	07263	S035928
A6Q978	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A6R905	315-0363-00			RES,FXD,FILM:36K OHM,5%,0.25W	57668	NTR25J-E36K0
A6R906	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A6R910	316-0332-00			RES,FXD,CMPSN:3.3K OHM,10%,025W	01121	CB3321
A6R915	311-0607-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	73138	82-25-2
A6R918	311-0949-00			RES,VAR,NONWW:TRMR,2K OHM,0.5W	01121	W-7789
A6R920	316-0333-00			RES,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
A6R922	316-0122-00			RES,FXD,CMPSN:1.2K OHM,10%.0.25W	01121	CB1221
A6R924	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A6R930	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W,TC=T0	19701	5033ED49K90F
A6R934	321-0452-00			RES,FXD,FILM:499K OHM,1%,0.125W,TC=T0	19701	5043ED499K0F
A6R938	307-0381-00			RES,FXD,FILM:4.99 MEG OHM,1%,0.5W	03888	FL1/2 4.99M +-1%
A6R945	311-0443-00			RES,VAR,NONWW:PNL,2.5K OHM,0.75W	11237	300SF-41330
A6R946	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A6R950	321-0327-00			RES,FXD,FILM:24.9K OHM,1%,0.125W,TC=T0	07716	CEAD24901F
A6R952	321-0311-00			RES,FXD,FILM:16.9K OHM,1%,0.125W,TC=T0	07716	CEAC16901F
A6R955	321-0369-00			RES,FXD,FILM:68.1K OHM,1%,0.125W,TC=T0	19701	5043ED68K10F
A6R956	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
A6R958	316-0222-00			RES,FXD,CMPSN:2.2K OHM,10%,0.25W	01121	CB2221
A6R960	316-0333-00			RES,FXD,CMPSN:33K OHM,10%,0.25W	01121	CB3331
A6R962	316-0101-00			RES,FXD,CMPSN:100 OHM,10%,0.25W	01121	CB1011
A6R965	311-0635-00			RES,VAR,NONWW:TRMR,1K OHM,0.5W	32997	3329H-G48-102
A6R967	321-0230-00			RES,FXD,FILM:2.43K OHM,1%,0.125W,TC=T0	19701	504[illegible]D2K430F
A6R971	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A6R973	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A6R975	316-0102-00			RES,FXD,CMPSN:1K OHM,10%,0.25W	01121	CB1021
A6R976	316-0471-00			RES,FXD,CMPSN:470 OHM,10%,0.25W	01121	CB4711
A6R978	315-0133-00			RES,FXD,FILM:13K OHM,5%,0.25W	19701	5043CX13K00J
A6R990	301-0241-00			RES,FXD,FILM:240 OHM,5%,0.5W	01121	EB2415
A6R994	303-0821-00			RES,FXD,CMPSN:820 OHM,5%,1W	01121	GB8215
A6S909	260-0960-01			SWITCH,SLIDE:FORM Z,0.5A,120VDC,BLACK BTTN	10389	23-021-043
A6S930	105-0389-00			ACTR ASSY,CAM S:TIMING	80009	105-0389-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A6U930	155-0055-00			MICROCKT,LINEAR:TRIGGER & SWP AMPL	80009	155-0055-00
A6VR962	152-0166-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-7	04713	SZ11738RL
A6VR990	152-0217-00			SEMICOND DVC,DI:ZEN,SI,8.2V,5%,0.4W,DO-7	04713	SZG20
A6VR994	152-0217-00			SEMICOND DVC,DI:ZEN,SI,8.2V,5%,0.4W,DO-7	04713	SZG20

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
F800	159-0041-00			FUSE,CARTRIDGE:3AG,1.25A,250V,20SEC	71400	MSL 1 1/4
J110	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
J200	131-0569-00			CONN,RCPT,ELEC:25 CONTACT,FEMALE (OPTION 10 ONLY)	71468	DB-25S
J310	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
J505	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
J515	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE (OPTION 21 ONLY)	13511	31-279
L598	108-0644-00			COIL,TUBE DEFL:TRACE ROTATION	80009	108-0644-00
Q580	151-0349-00	B010100	B011359	TRANSISTOR:NPN,SI,SELECTED,TO-127	04713	SJE924
Q580	151-0349-05	B011360		TRANSISTOR:SCREENED	80009	151-0349-05
Q678	151-0358-00	B010100	B011359	TRANSISTOR:SELECTED	03508	X44T211
Q678	151-0358-02	B011360		TRANSISTOR:SCREENED	80009	151-0358-02
Q680	151-0358-00	B010100	B011359	TRANSISTOR:SELECTED	03508	X44T211
Q680	151-0358-02	B011360		TRANSISTOR:SCREENED	80009	151-0358-02
Q725	151-0358-00	B010100	B011359	TRANSISTOR:SELECTED	03508	X44T211
Q725	151-0358-02	B011360		TRANSISTOR:SCREENED	80009	151-0358-02
Q735	151-0358-00	B010100	B011359	TRANSISTOR:SELECTED	03508	X44T211
Q735	151-0358-02	B011360		TRANSISTOR:SCREENED	80009	151-0358-02
Q762	151-0358-00	B010100	B011359	TRANSISTOR:SELECTED	03508	X44T211
Q762	151-0358-02	B011360		TRANSISTOR:SCREENED	80009	151-0358-02
Q836	151-0476-00			TRANSISTOR:NPN,SI,TO-220AB	02735	68430
Q840	151-0496-00			TRANSISTOR:NPN,SI	80009	151-0496-00
Q860	151-0496-00			TRANSISTOR:NPN,SI	80009	151-0496-00
R598	311-1332-00			RES,VAR,NONWW:PNL,5K OHM,2W	12697	CM40936
S800	260-1222-00			SWITCH,PP:DPDT,40A,250AC,PUSH-PULL	01963	E79-96A
S801	260-0551-00			SWITCH,THRMSTC:NC,OPEN 86.1,CL 74,10A,240V	81439	36 T 21 3780
T800	120-1046-00			XFMR,PWR,SDN&SU:	80009	120-1046-00
V735	154-0634-01			ELECTRON TUBE:CRT,P401	80009	154-0634-01
V735	154-0634-03			ELECTRON TUBE:CRT,P403 (OPTION 2 ONLY)	80009	154-0634-03
V735	154-0634-10			ELECTRON TUBE:CRT,P400,INT SCALE (OPTION 1 ONLY)	80009	154-0634-10
V735	154-0634-12			ELECTRON TUBE:CRT,P402,INT SCALE (OPTION 12 ONLY)	80009	154-0634-12

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DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

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

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

Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The overline on a signal name indicates that the signal performs its intended function when it goes to the low state.

Abbreviations are based on ANSI Y1.1-1972.

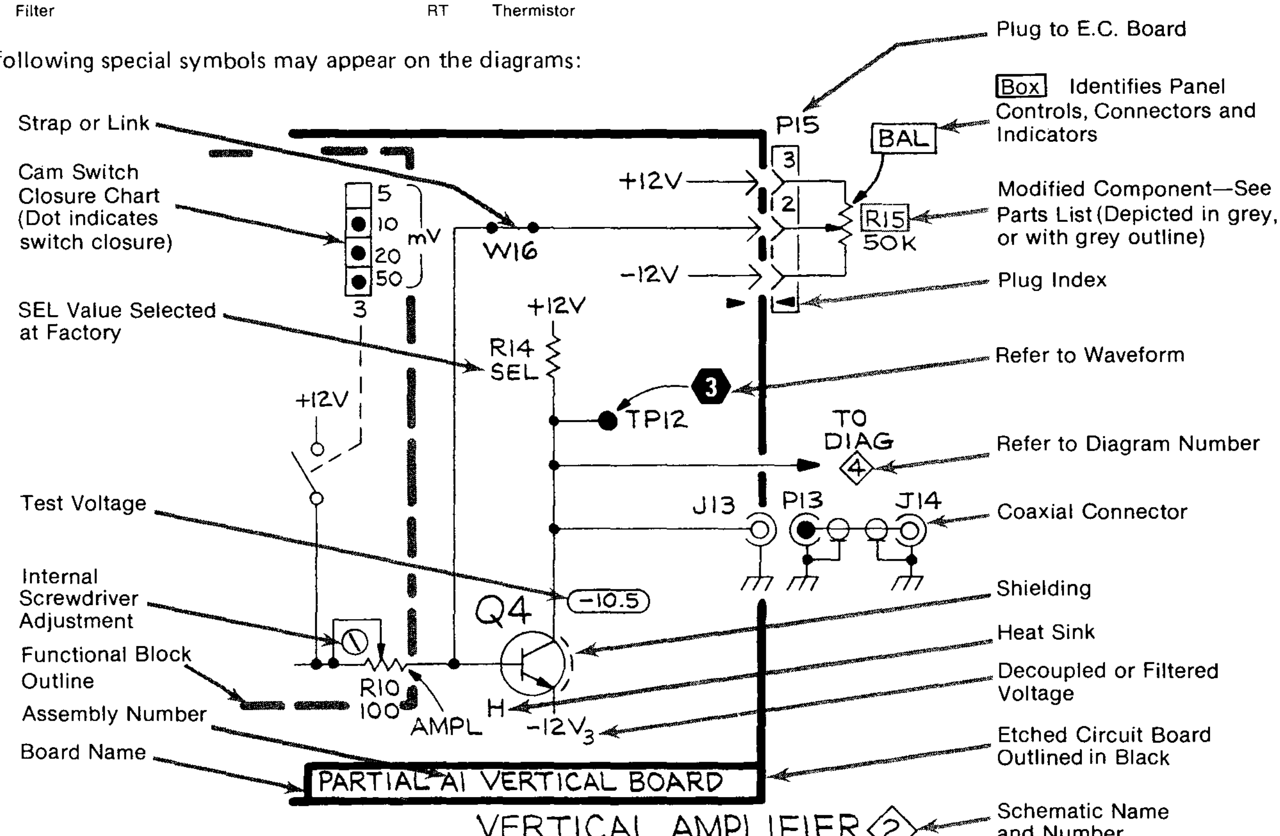
Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc. are:

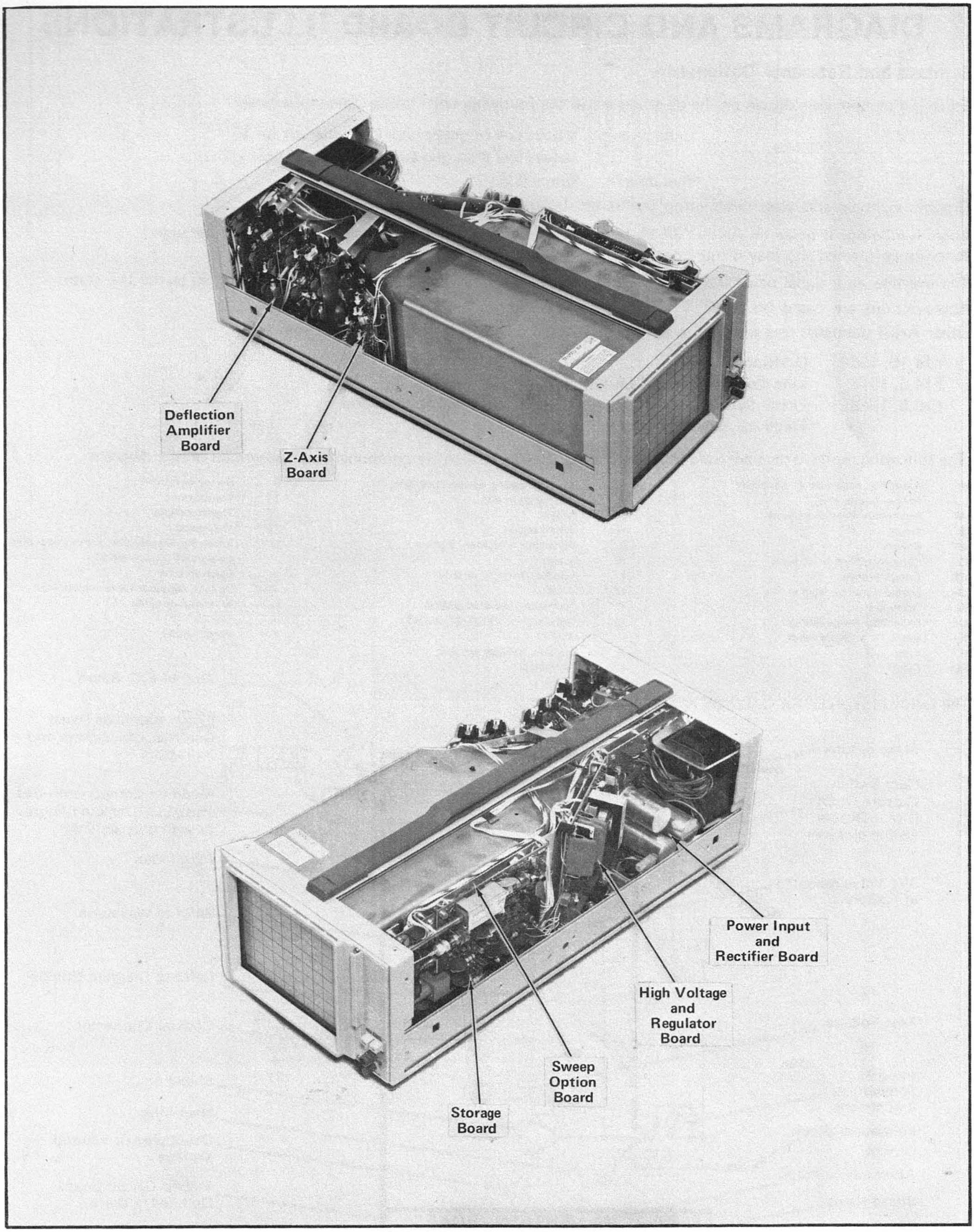
Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

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

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

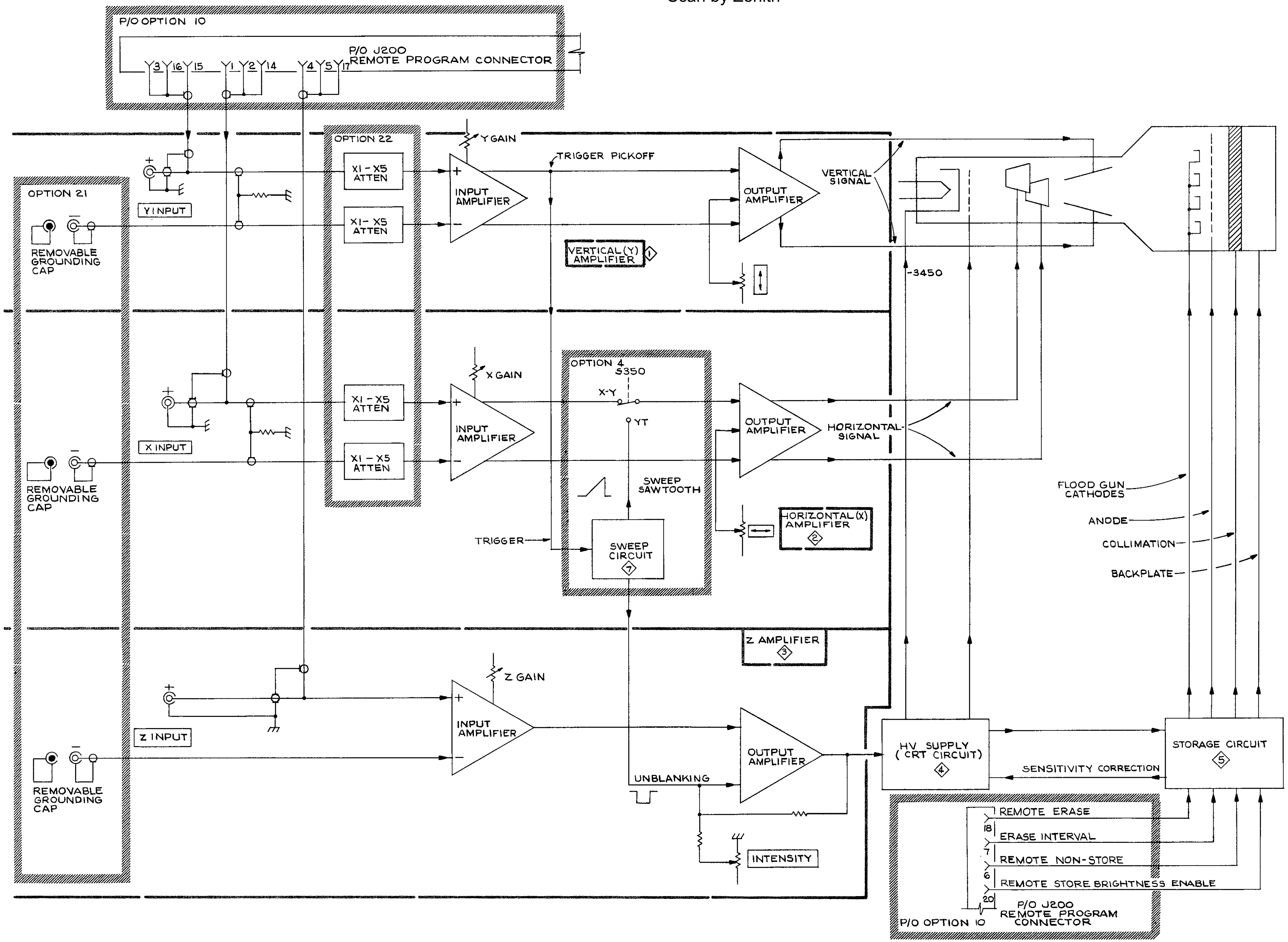
The following special symbols may appear on the diagrams:





1259-05

Fig. 10-1. Circuit board locations.



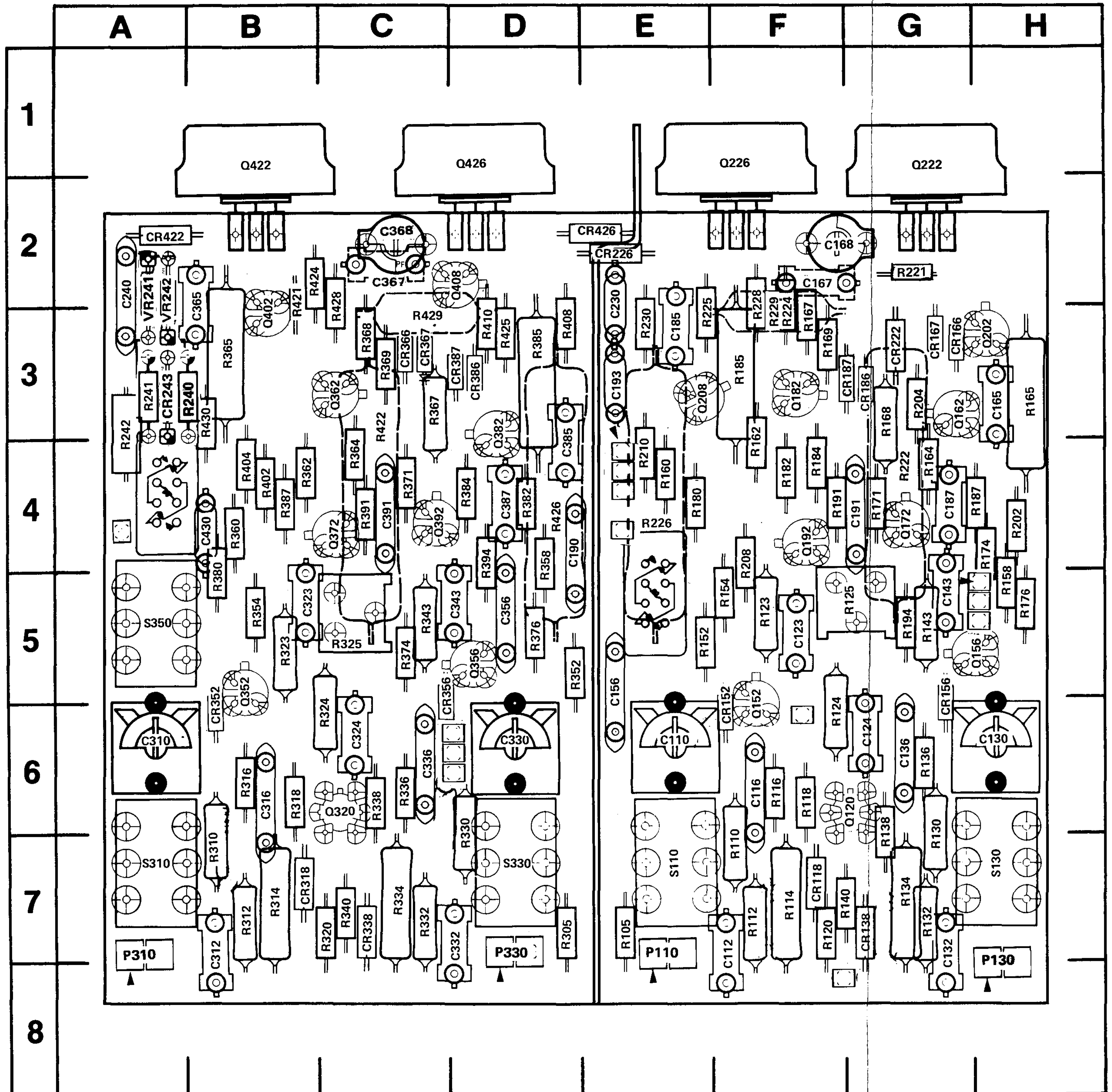
BLOCK DIAGRAM

603A

2505-23

BLOCK DIAGRAM (WITH OPTIONS)

A1 DEFLECTION AMPLIFIER BOARD



(1259)2505-15

Fig. 10-2. A1-Deflection Amplifier components and waveform test points locator.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C110	6E	P110	7E	R182	4F	R404	4B
C112	7F	P130***	8H	R184	4F	R408	3D
C116	6F	P310	7A	R185	3F	R410	3D
C123	5F	P330***	7D	R187	4H	R421	2B
C124	6G			R191	4F	R422†	3C
C130**	6G	Q120	6G	R194	5G	R424	2B
C132**	7G	Q152	6F	R202	4H	R425	3D
C136	6G	Q156	5G	R204	3G	R426†	4D
C143	5G	Q162	3G	R208	4F	R428	2C
C156	5E	Q172	4G	R210	4E	R429†	3C
C165	3H	Q182	3F	R221	1G	R430	3B
C167†	2F	Q192	4F	R222†	4G		
C168	2F	Q202	3H	R224	3F	S110	7E
C185	3E	Q208	3E	R225	3E	S130**	7H
C187	4G	Q222	1G	R226†	4E	S310	7A
C190	4D	Q226	1F	R228	2F	S330**	7D
C191	4G	Q320	6C	R229†	3F	S350*	5A
C193	3E	Q352	5B	R230	3E		
C230	2E	Q356	5D	R240	3B	VR241	2A
C240	2A	Q362	3C	R241	3A	VR242	2A
C310	6A	Q372	4C	R242	3A		
C312	7B	Q382	3D	R305	7D		
C316	6B	Q392	4C	R310	7B		
C323	5B	Q402	3B	R312	7B		
C324	6C	Q408	2D	R314	7B		
C330**	6D	Q422	1B	R316	6B		
C332**	7D	Q426	1D	R318	6B		
C336	6C			R320	7C		
C343	5D	R105	7E	R323	5B		
C356	5D	R110	7F	R324	6C		
C365	2B	R112	7F	R325	5C		
C367†	2C	R114	7F	R330**	6D		
C368	2C	R116	6F	R332**	7C		
C385	3D	R118	6F	R334	7C		
C387	4D	R120	7F	R336	6C		
C391	4C	R123	5F	R338	6C		
C430	4B	R124	6F	R340	7C		
		R125	5G	R343	5C		
CR118	7F	R130**	6G	R352	5D		
CR138	7G	R132**	7G	R354	5B		
CR152	6F	R134	7G	R358	4D		
CR156	6G	R136	6G	R360	4B		
CR166	3G	R138	6G	R362	4B		
CR167	3G	R140	7F	R364	4C		
CR186	3G	R143	5G	R365	3B		
CR187	3G	R152	5D	R367	3C		
CR222	3G	R154	5F	R368	3C		
CR226	2E	R158	5H	R369	3C		
CR243	3A	R160	4E	R371	4C		
CR318	7B	R162	4F	R374	5C		
CR338	7C	R164	4G	R376	5D		
CR352	5B	R165	3H	R380	5B		
CR356	5C	R167	3F	R382	4D		
CR366	3C	R168	3G	R384	4D		
CR367	3C	R169	3F	R385	3D		
CR386	3D	R171	4G	R387	4B		
CR387	3D	R174	4H	R391	4C		
CR422	2A	R176	5H	R394	4D		
CR426	2E	R180	4E	R402	4B		

*Option 4 only
**Option 22 only
***Option 21 only
† = Reverse side of board

@

VOLTAGE AND WAVEFORM CONDITIONS

Note

The test equipment used to obtain the voltages and waveforms is listed in Table 4-1, Test Equipment.

VOLTAGE CONDITIONS

The dc voltages indicated on the schematic diagram were obtained with no test signal input, using a digital voltmeter. The INTENSITY and Position controls were set for a barely visible dot at near center screen with the internal sweep generator disconnected (Option 4 version only).

WAVEFORM CONDITIONS

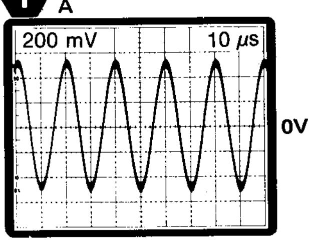
The following waveforms were monitored with a test oscilloscope and a 10X probe. The waveforms designated 'A' were taken with a 1-volt p-p, 50-kHz sine wave applied to the +Y INPUT and a grounding cap on the −Y INPUT. Waveforms designated 'B' were taken with the same signal applied to both +Y and −Y INPUTs.

Note that the dc level of each waveform is given at the test oscilloscope graticule horizontal centerline.

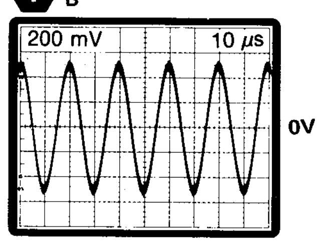
The Y Gain was adjusted for 8 divisions of deflection on the 603A, with a 1-volt (p-p) input signal.

The test oscilloscope was externally triggered from the signal generator to preserve phasing information.

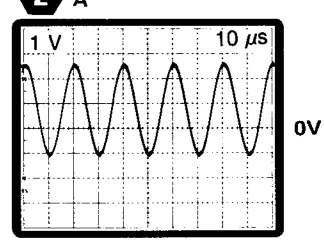
1 A



1 B



2 A



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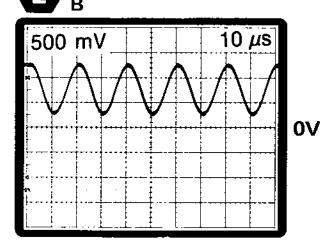
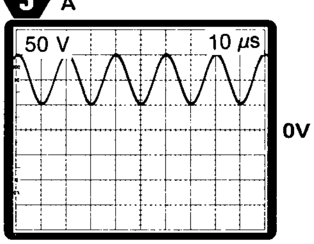
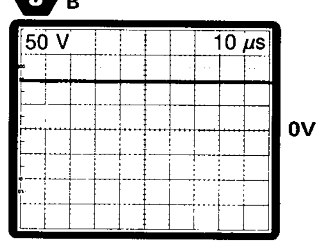


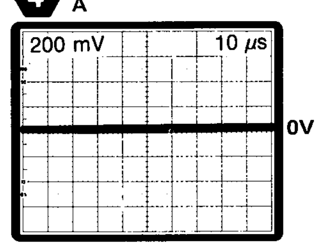
3 A



3 B



4 A



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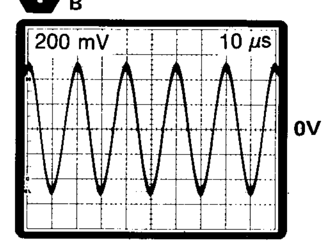
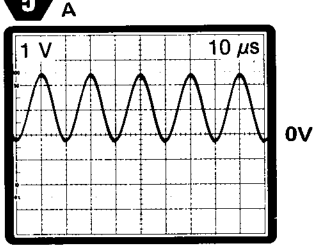


5 A



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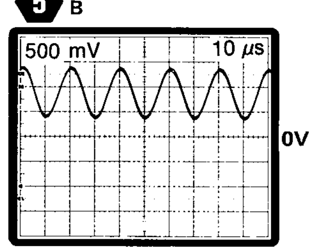
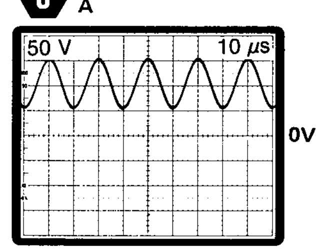


6 A



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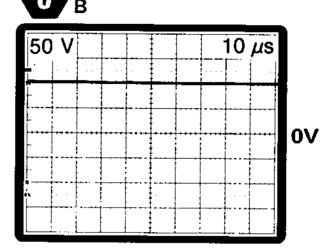

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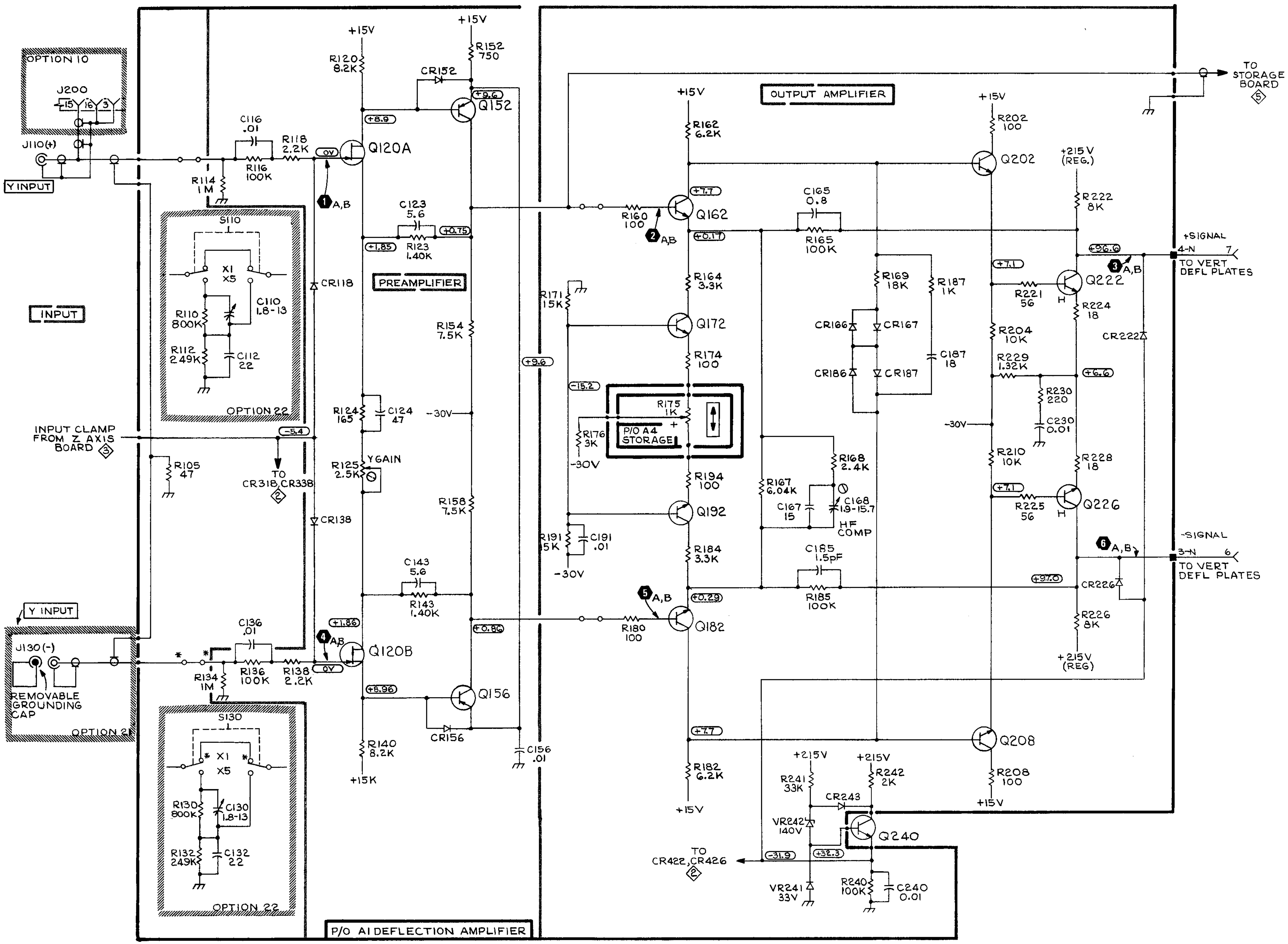


603A

2505-24
REV, FEB 1982

VERTICAL (Y) DEFLECTION AMPLIFIER

VERTICAL (Y) DEFLECTION AMP

VOLTAGE AND WAVEFORM CONDITIONS

Note

The test equipment used to obtain the voltages and waveforms is listed in Table 4-1, Test Equipment.

VOLTAGE CONDITIONS

The dc voltages indicated on the schematic diagram were obtained with no test signal input, using a digital voltmeter. The INTENSITY and Position controls were set for a barely visible dot at near center screen with the internal sweep generator disconnected (Option 4 version only).

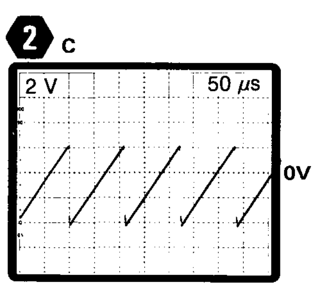
WAVEFORM CONDITIONS

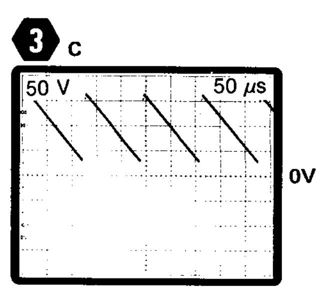
Waveforms 1A through 6A and 1B through 6B are located alongside the Vertical (Y) Deflection Amplifier 1 schematic diagram. The waveforms were monitored with a test oscilloscope and a 10X probe. The waveforms designated 'A' were taken with a 1-volt p-p, 50-kHz sine wave applied to the +X INPUT and a grounding cap on the −Y INPUT. The internal sweep generator was disconnected, and the XY-YT switch (S350) was set to XY (Option 4 only). Waveforms designated 'B' were taken with the same signal applied to both +X and −X INPUTs.

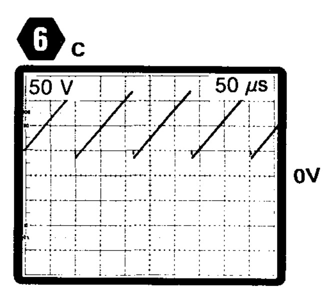
Note that the dc level of each waveform is given at the test oscilloscope graticule horizontal centerline.

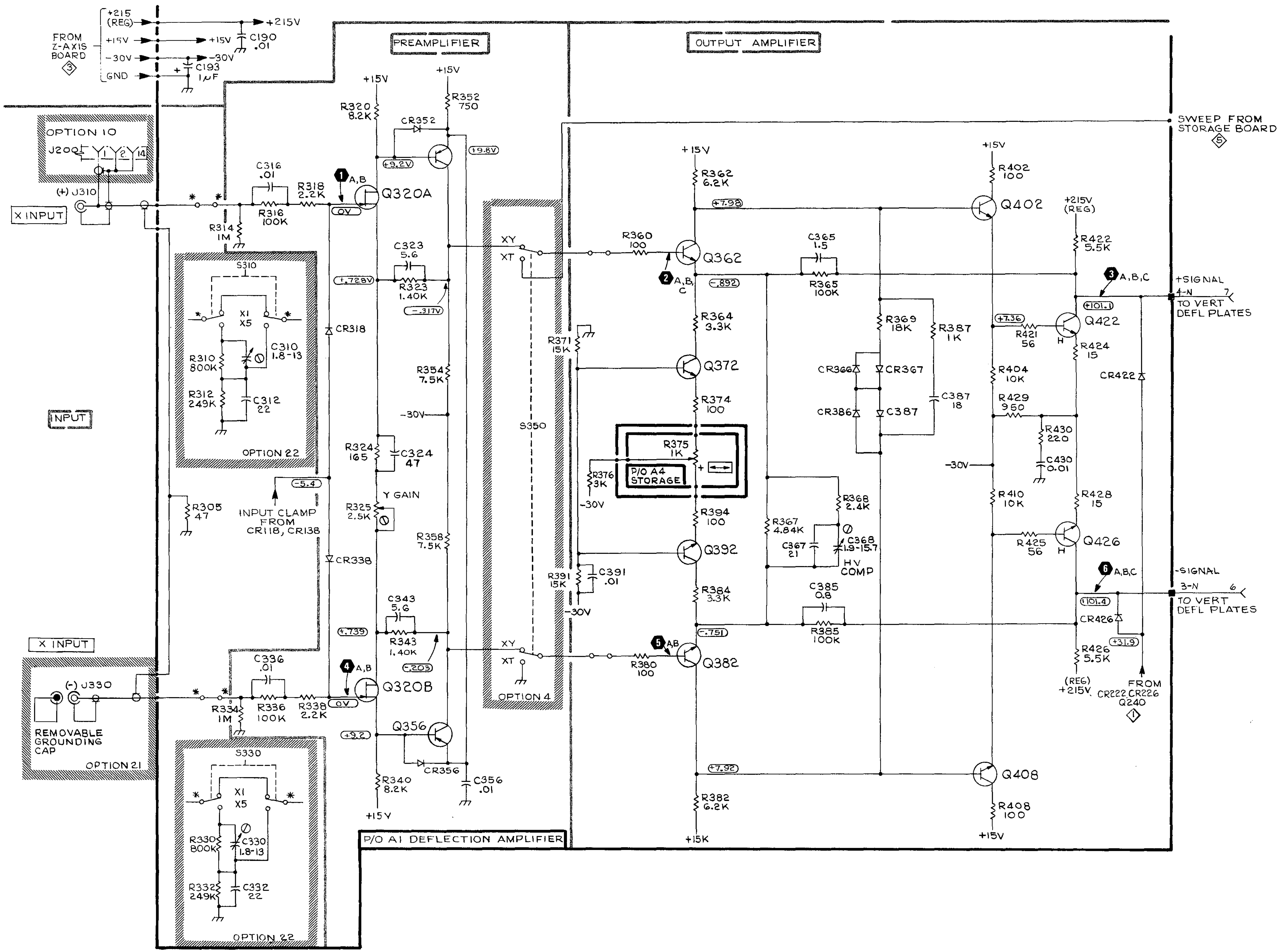
The X Gain was adjusted for 8 divisions of deflection on the 603A, with a 1-volt (p-p) input signal. The test oscilloscope was externally triggered from the signal generator to preserve phasing information.

Waveforms 2C, 3C, and 6C (below) were taken at points 2, 3, and 6 with the internal sweep generator connected and the XY-YT switch set to YT. The front-panel SEC/DIV switch was set to 10μ, Norm/Auto triggering was set to Auto, Sweep Length was set to approximately 10.5 divisions. These three waveforms apply to Option 4 versions only.









603A

2505-25
REV, AUG 1981

HORIZONTAL (X) DEFLECTION AMPLIFIER 2

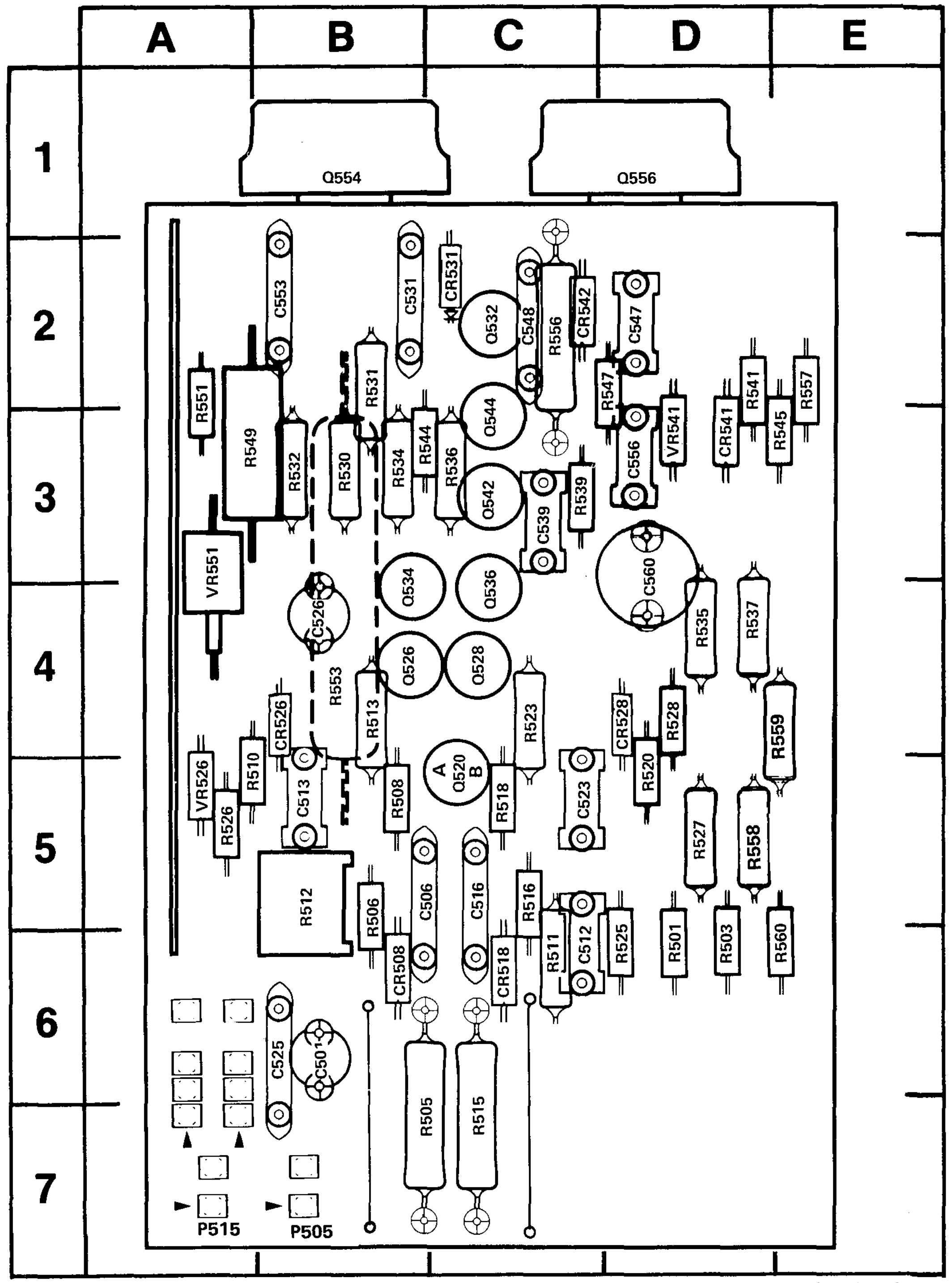


Fig. 10-3. A2 - Z-Axis components and waveform test points locator.

CKT NO	GRID LOC	CKT NO	GRID LOC
C501	6B	R505	6C
C506	5B	R506	5B
C512	6C	R508	5B
C513	5B	R510	5B
C516	5B	R511	6C
C523	5C	R512	5B
C525	6B	R513	4B
C526	4B	R515	6C
C531	2B	R516	5C
C539	3C	R518	5C
C547	2D	R520	4D
C548	2C	R523	4C
C553	2B	R525	5D
C556	3D	R526	5A
C560	3D	R527	5D
		R528	4D
CR508	6B	R530	3B
CR518	6C	R531	2B
CR526	4B	R532	3B
CR528	4D	R534	3B
CR531	2C	R535	4D
CR541	3D	R536	3C
CR542	2C	R537	4D
		R539	3C
P505	7B	R541	3D
P515*	7A	R544	3B
		R545	3E
Q520	5B	R547	3D
Q526	4B	R549	3B
Q528	4C	R551	2A
Q532	2C	R553†	4B
Q534	4B	R556	2C
Q536	4C	R557	2E
Q542	3C	R558	5D
Q544	3C	R559	4E
Q554	1B	R560	5D
Q556	1D		
		VR526	5A
R501	5D	VR541	3D
R503	5D	VR551	3A

† = Reverse side of board

*Option 21 only

VOLTAGE AND WAVEFORM CONDITIONS

Note

The test equipment used to obtain the voltages and waveforms is listed in Table 4-1, Test Equipment.

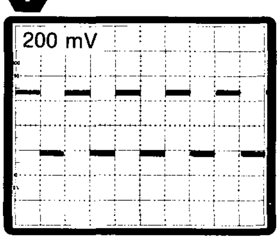
VOLTAGE CONDITIONS

The dc voltages indicated on the schematic diagram were obtained with no test signal input, using a digital voltmeter. The INTENSITY control was set for a reading of +10 V at the collectors of Q554 and Q556, the Position controls were set for a display near center screen, and the internal sweep generator was disconnected (Option 4 version only).

WAVEFORM CONDITIONS

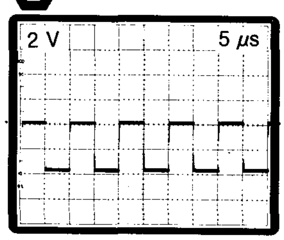
The following waveforms were monitored with a test oscilloscope and a 10X probe. A negative-going, 100 kHz, 0.5 V (p-p) square wave signal was applied to the +Z INPUT connector (to the −Z INPUT connector for waveform 1 at the gate of Q520B). The Position controls were set fully clockwise, the internal sweep generator disconnected (Option 4 version only), and the unused input connector grounded (grounding cap installed). The INTENSITY control was set for +40 V dc at the collectors of Q554 and Q556 with the test signal applied to the +Z INPUT, and the +10 V dc at the same point with the test signal applied to the −Z INPUT.

1



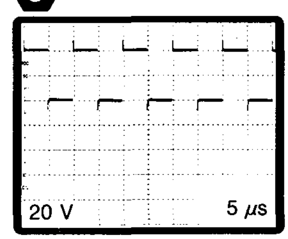
0V

2

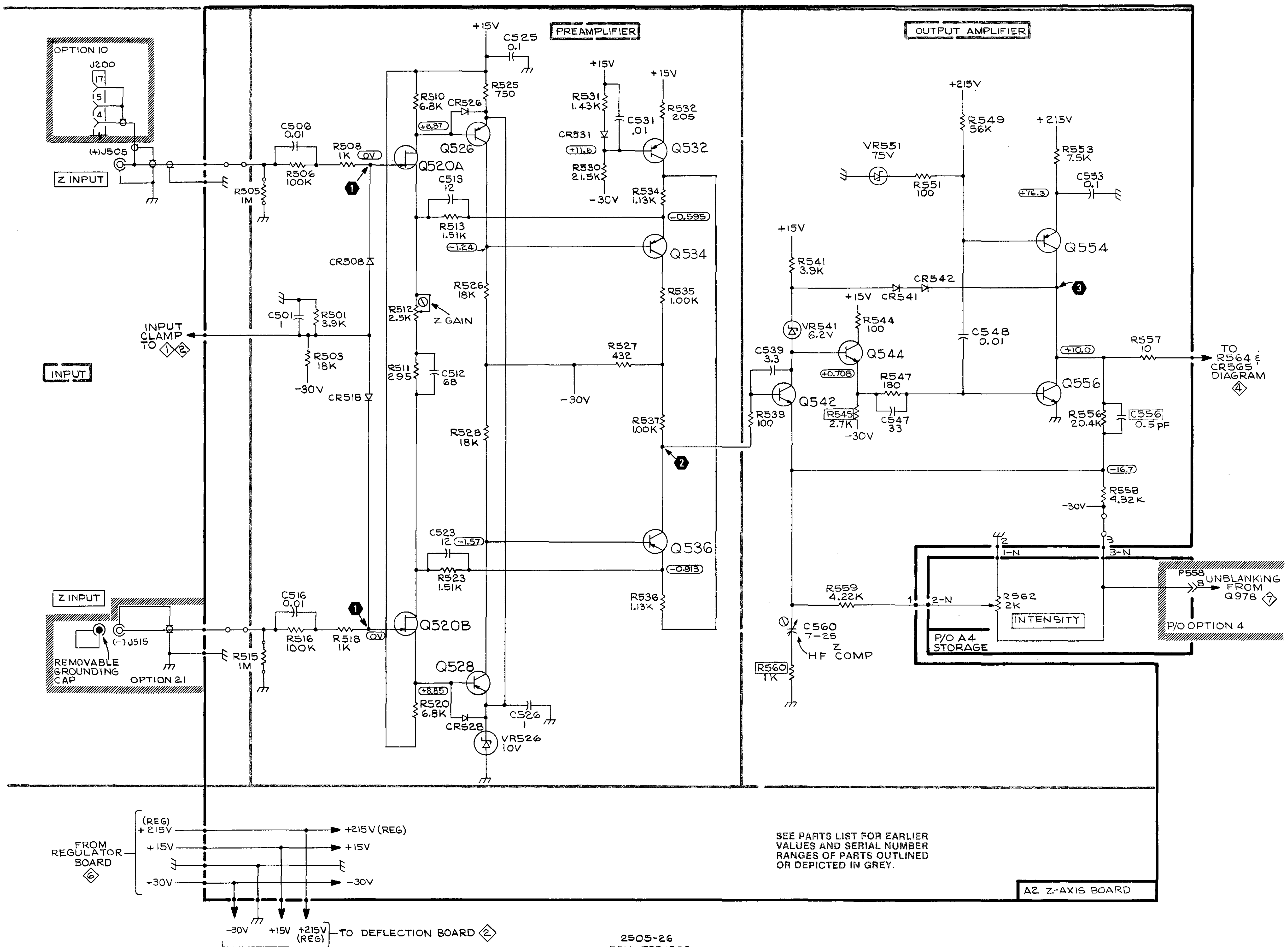


-12V

3



0V



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Scan by Zenith

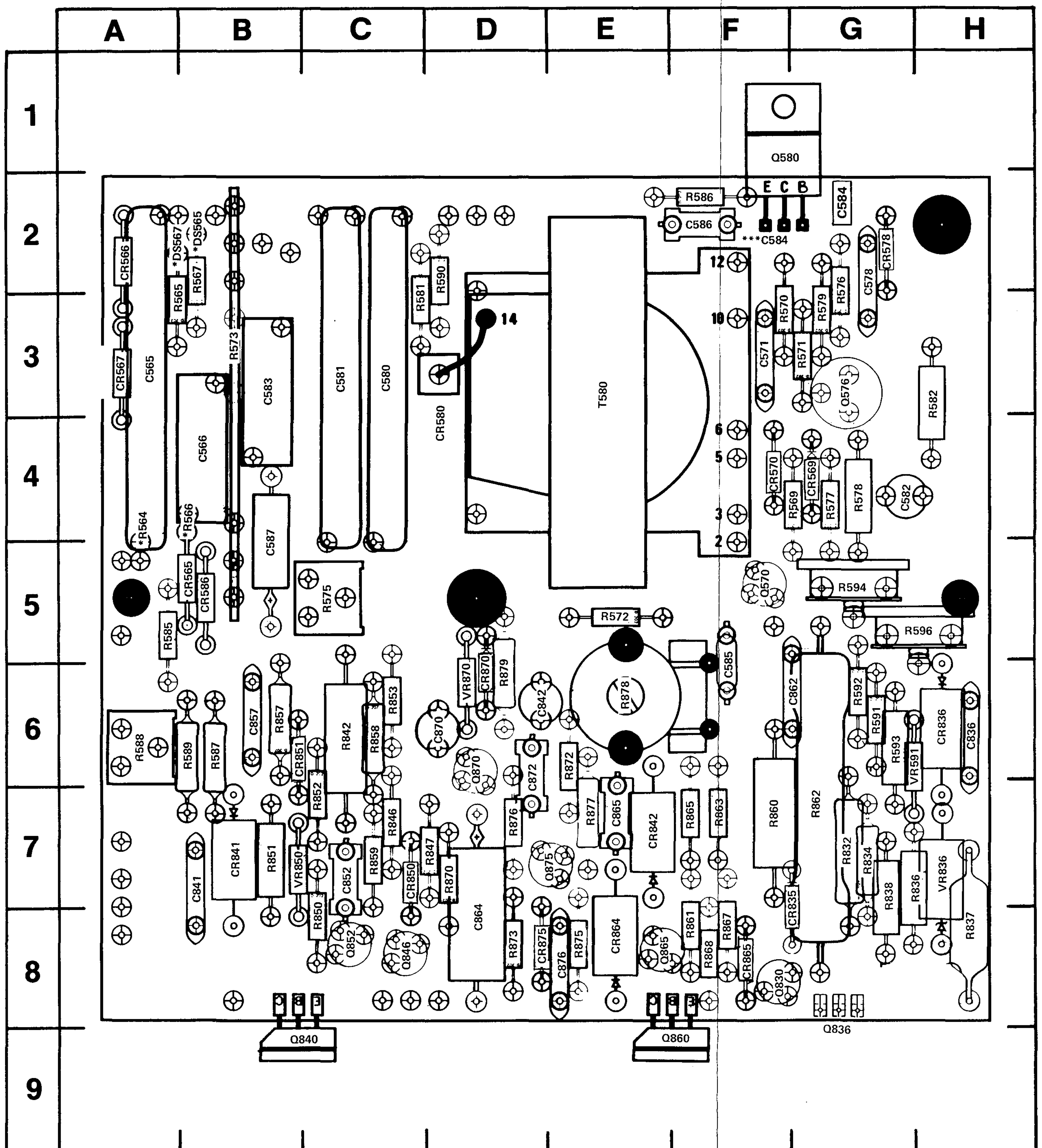


Fig. 10-4. A3 - High Voltage and regulator components and waveform test points locator. (1259)2505-17A

REV, FEB 1982

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C565	3A	DS565	2B	R596	5H
C566	4B	DS566	3A	R832	7G
C571	3F	DS567	2B	R834	7G
C578	3G			R836	7G
C580	3C	Q570	5F	R837	8H
C581	3C	Q576	3G	R838	7G
C582	4G	Q580	1F	R842	6C
C583	3B	Q830	8F	R846	7C
C584	2F	Q836	8G	R847	7D
C585	5F	Q840	9C	R850	8C
C586	2F	Q846	8C	R851	7B
C587	4B	Q852	8C	R852	7C
C836	6H	Q860	9F	R853	6C
C841	7B	Q865	8E	R857	6B
C842	6E	Q870	6D	R858	6C
C852	7C	Q875	7D	R859	7C
C857	6B	R564	4A	R860	7F
C862	6F	R565	3A	R861	8F
C864	8D	R566	4B	R862	7G
C865	7E	R567	3B	R863	7F
C870	6D	R569	4F	R865	7F
C872	6D	R570	3F	R867	8F
C876	8E	R571	3G	R868	8F
		R572	5E	R870	7D
CR565	5B	R573	3B	R872	7E
CR566	2A	R575	5C	R873	8D
CR567	3A	R576	3G	R875	8E
CR569	4G	R577	4G	R876	7D
CR570	4F	R578	4G	R877	7E
CR578	2G	R579	3G	R878	6E
CR580	4D	R581	3D	R879	6D
CR586	5B	R582	3H		
CR835	7G	R585	5B	T580	4E
CR836	6H	R586	2F		
CR841	7B	R587	6B	VR591	6G
CR842	7E	R588	6A	VR836	7H
CR850	7C	R589	6B	VR850	7C
CR851	6C	R590	2D	VR870	6D
CR864	8E	R591	6G		
CR865	8F	R592	6G		
CR870	5D	R593	6G		
CR875	8D	R594	5G		

VOLTAGE AND WAVEFORM CONDITIONS

Note

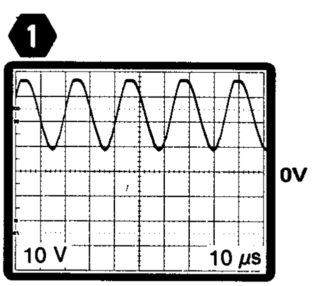
The test equipment used to obtain the voltages and waveforms is listed in Table 4-1, Test Equipment.

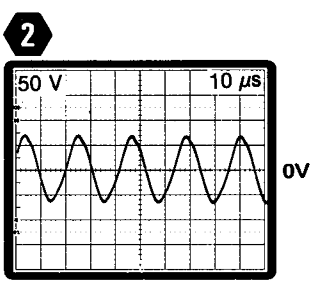
VOLTAGE CONDITIONS

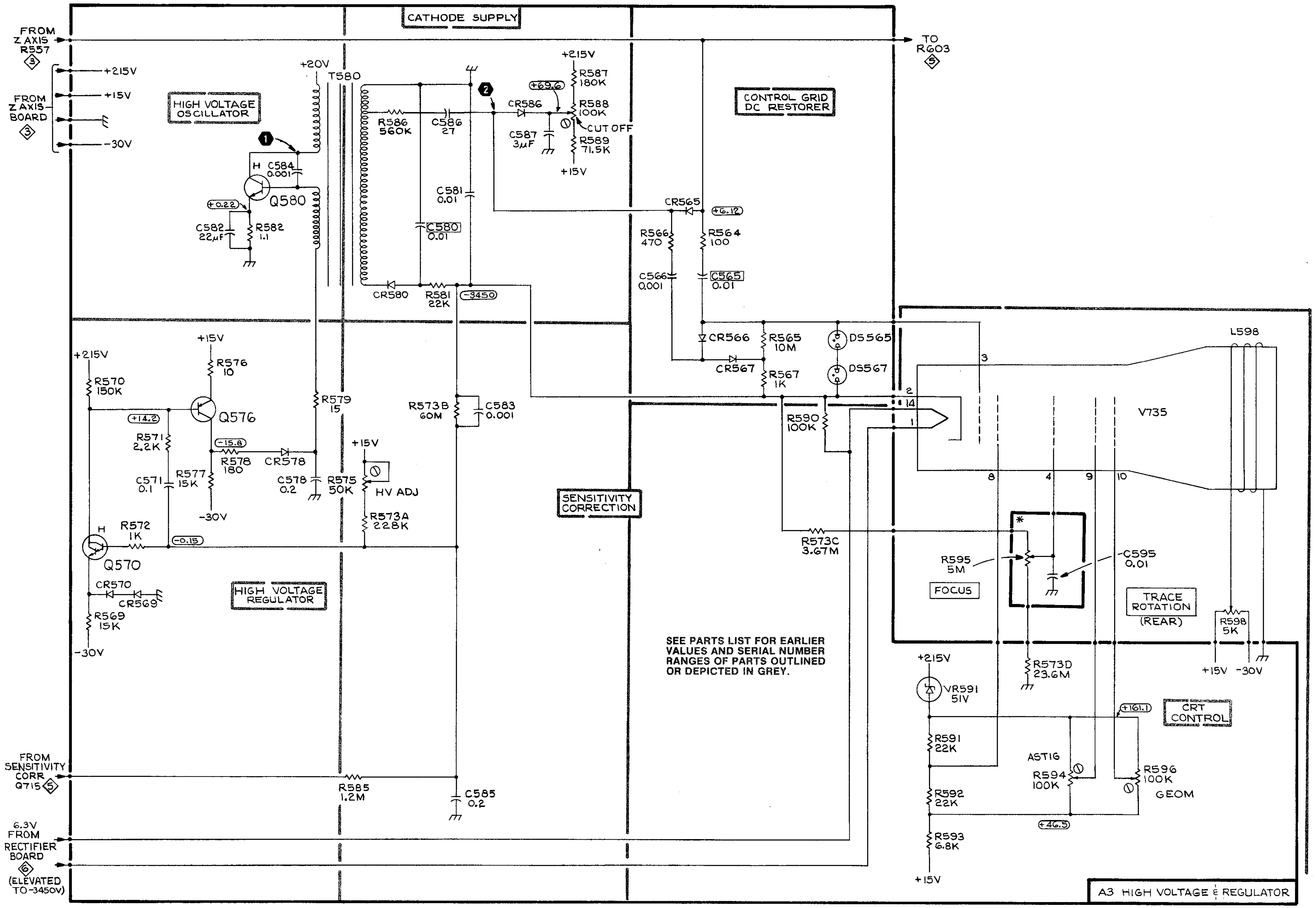
The dc voltages indicated on the schematic diagram were obtained with no test signal input, using a digital multimeter. The INTENSITY and Position controls were set for a barely visible dot at near center screen with the internal sweep generator disconnected (Option 4 version only). The STORE pushbutton is pressed in, and STORED BRIGHTNESS is fully clockwise.

WAVEFORM CONDITIONS

The following waveforms were monitored by a test oscilloscope and a 10X probe with no test signal applied and the internal sweep generator disconnected (Option 4 version only). The INTENSITY control is set fully counterclockwise, the STORE pushbutton is pressed in, and STORED BRIGHTNESS is fully clockwise.







* P/O A4 STORAGE BOARD

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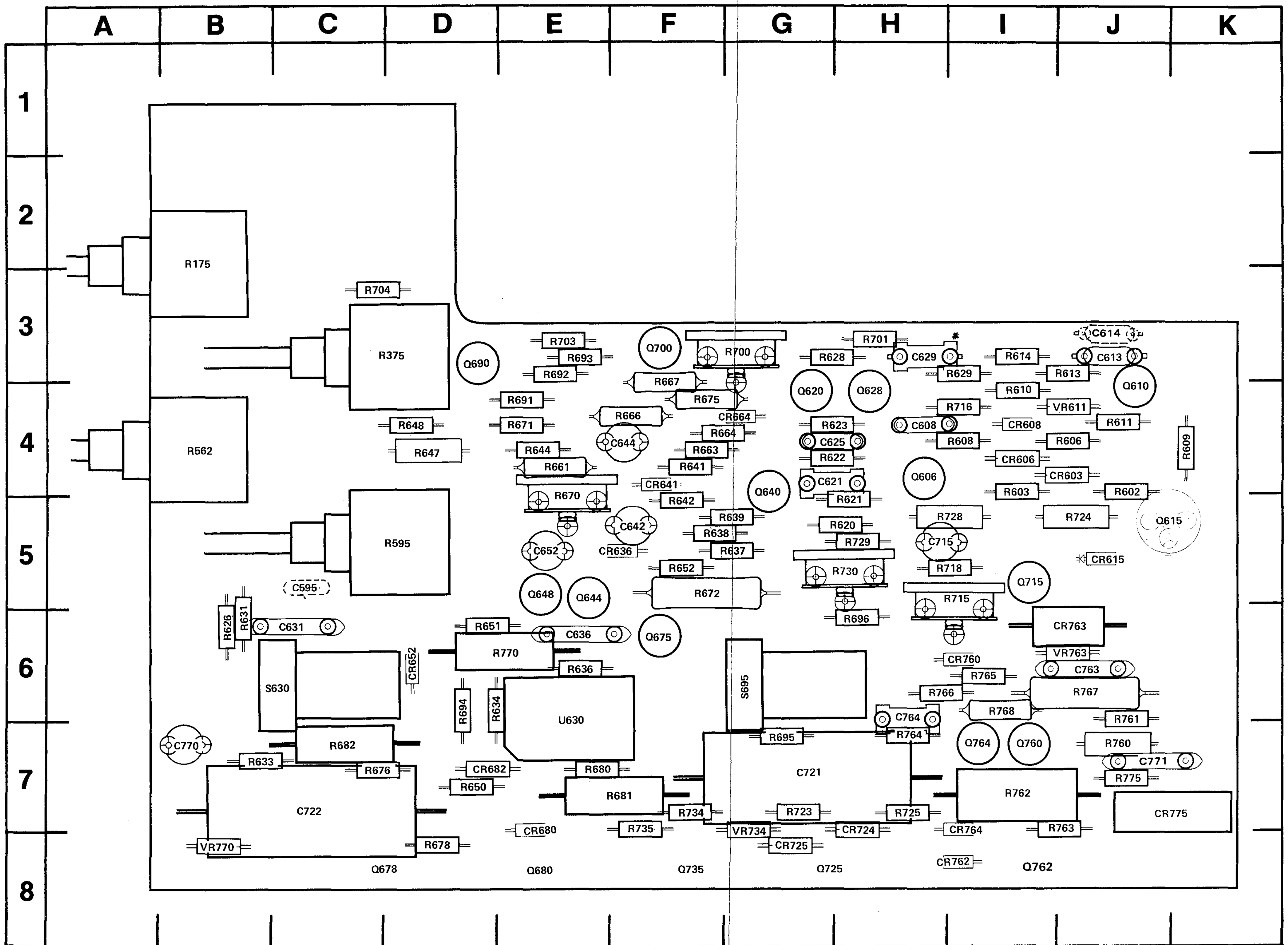
CRT CIRCUIT ④



(1259)2505-18A

Fig. 10-5. A4 - Storage components and waveform test points locator.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRI LOC
C595†	5C	R175	2B	R701	3H
C608	4H	R375	3D	R703	3E
C613†	3J	R562	4B	R704	3C
C614†	3J	R595	5D	R715	5H
C621	5H	R602	4J	R716	4H
C625	4H	R603	4I	R718	5H
C629	3H	R606	4J	R723	7G
C631	6C	R608	4H	R724	5J
C636	6E	R609	4J	R725	7H
C642	5F	R610	4I	R728	5H
C644	6F	R611	4J	R729	5H
C652	5E	R613	3J	R730	5H
C715	5H	R614	3I	R734	7F
C721	7G	R620	5H	R735	7F
C722	7C	R621	4H	R760	7J
C763	6J	R622	4G	R761	6J
C764	6H	R623	4G	R762	7I
C770	7B	R626	6B	R763	7J
C771	7K	R628	3H	R764	7H
		R629	3I	R765	6I
CR603	4J	R631	5B	R766	6I
CR606	4I	R633	7B	R767	6J
CR608	4I	R634	6E	R768	6I
CR615	5J	R636	6E	R770	6E
CR636	5F	R637	5G	R775	7J
CR641	4F	R638	5G		
CR652	6D	R639	5G	S630	6C
CR664	4G	R641	4F	S695	6G
CR680	7E	R642	4F		
CR682	7D	R644	4E	U630	6E
CR724	7H	R647	4D		
CR725	8G	R648	4D	VR611	4I
CR760	6I	R650	7E	VR734	7G
CR762	8I	R651	6D	VR763	6J
CR763	6J	R652	5F	VR770	8B
CR764	7I	R661	4E		
CR775	7K	R663	4F		
Q606	4H	R664	4F		
Q610	4J	R666	4F		
Q615	5K	R667	4F		
Q620	4G	R670	5E		
Q628	3H	R671	4E		
Q640	4G	R672	5F		
Q644	5F	R675	4F		
Q648	5E	R676	7D		
Q675	6F	R678	7D		
Q678	8C	R680	7F		
Q680	8E	R681	7F		
Q690	3D	R682	7C		
Q700	3F	R691	4E		
Q715	5I	R692	3E		
Q725	8G	R693	3E		
Q735	8F	R694	6D		
Q760	7I	R695	6G		
Q762	8I	R696	6H		
Q764	6I	R700	3G		

† = Reverse side of board

VOLTAGE AND WAVEFORM CONDITIONS

Note

The test equipment used to obtain the voltages and waveforms is listed in Table 4-1, Test Equipment.

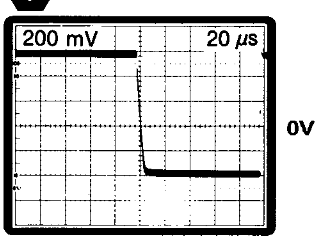
VOLTAGE CONDITIONS

The dc voltages indicated on the schematic diagram were obtained with a 1-V amplitude, 100 μs duration sawtooth applied to the +X INPUT. The INTENSITY and Position controls were set for a centered trace of normal brightness. The internal sweep generator was disconnected (Option 4 only). The STORE pushbutton was pressed in (except for those voltages marked with an asterisk, *). STORED BRIGHTNESS was set fully clockwise.

WAVEFORM CONDITIONS

The following waveforms were monitored with a test oscilloscope and a 10X probe. A 1-V amplitude, 100 μs duration, positive-going sawtooth was applied to the +X INPUT. A 2-V positive square wave with a duration of 100 μs was applied to the +Z INPUT. The internal sweep generator was disconnected (Option 4 only). Unused input connectors were grounded (grounding caps installed). The INTENSITY control was set for normal brightness. The STORE pushbutton was pressed in, and STORED BRIGHTNESS was set fully clockwise.

1



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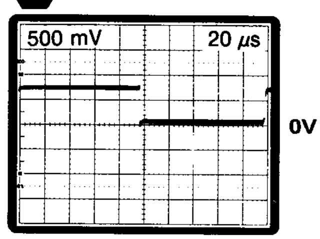

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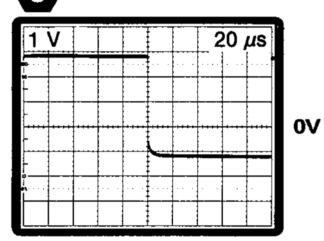

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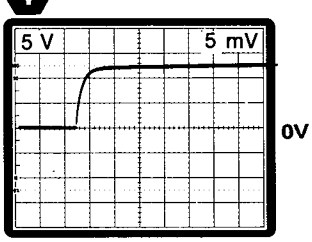

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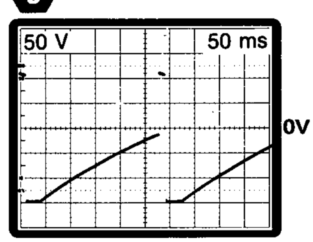
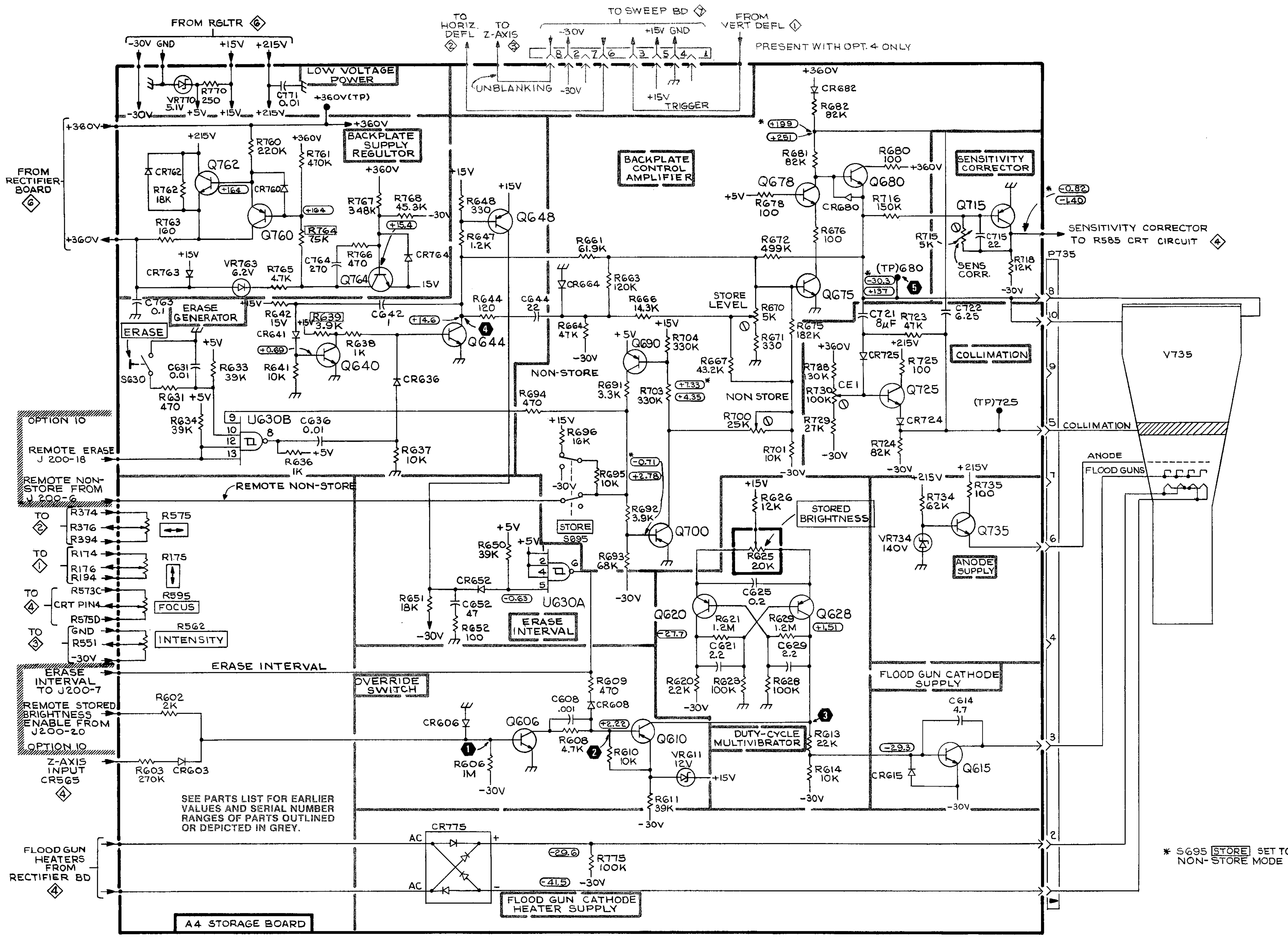




STORAGE CIRCUIT 5

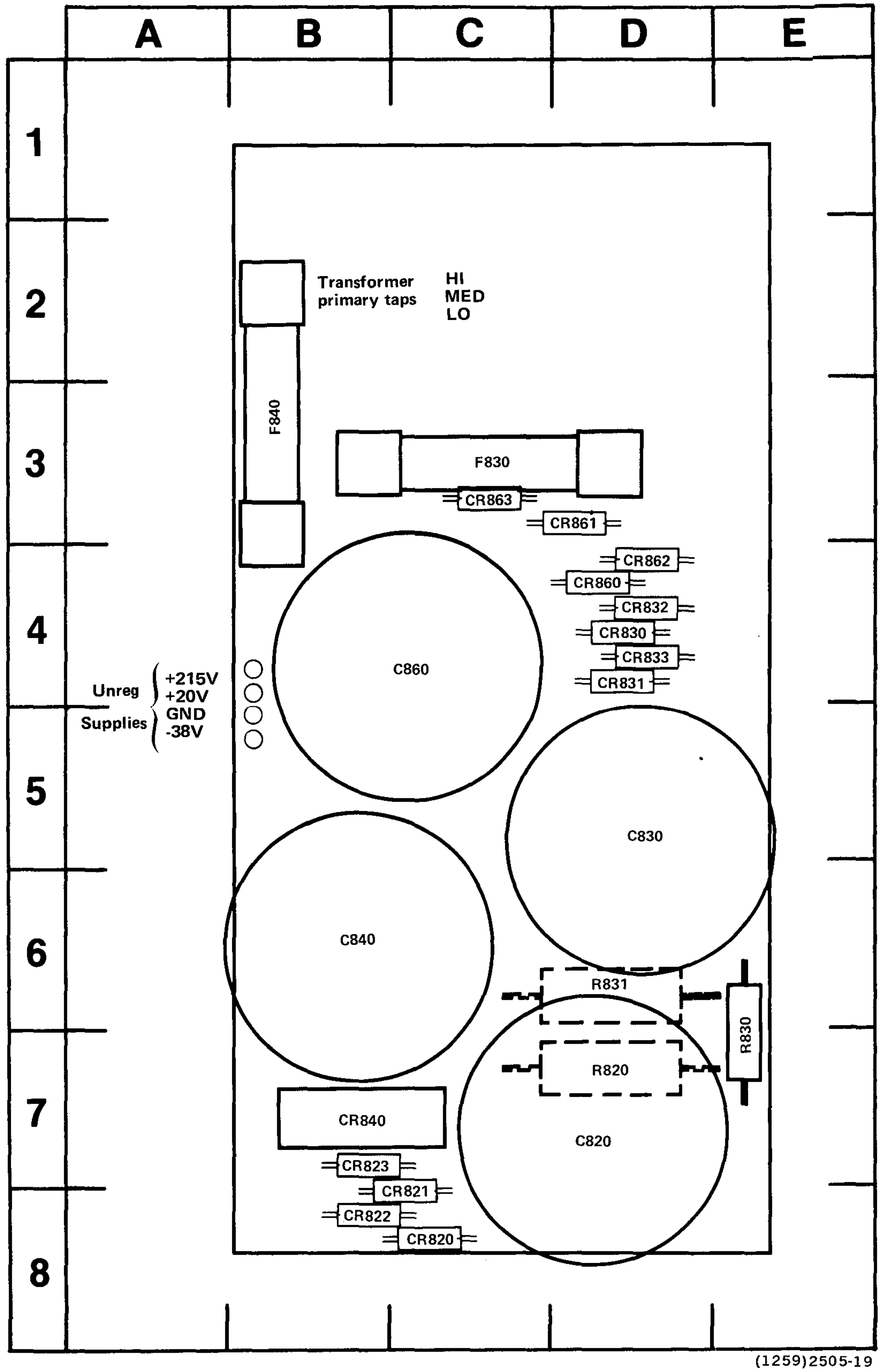


Fig. 10-6. A5 - Power Input and Rectifiers components, transformer primary taps, and test points locator.

CKT NO	GRID LOC
C820	7D
C830	4E
C840	6B
CR820	8C
CR821	7C
CR822	8B
CR823	7B
CR830	4D
CR831	4D
CR832	4D
CR833	4D
CR840	7C
CR860	4D
CR861	3D
CR862	4D
CR863	3C
F830	3C
F840	3B
R820	6D
R830	7E
R831	6D

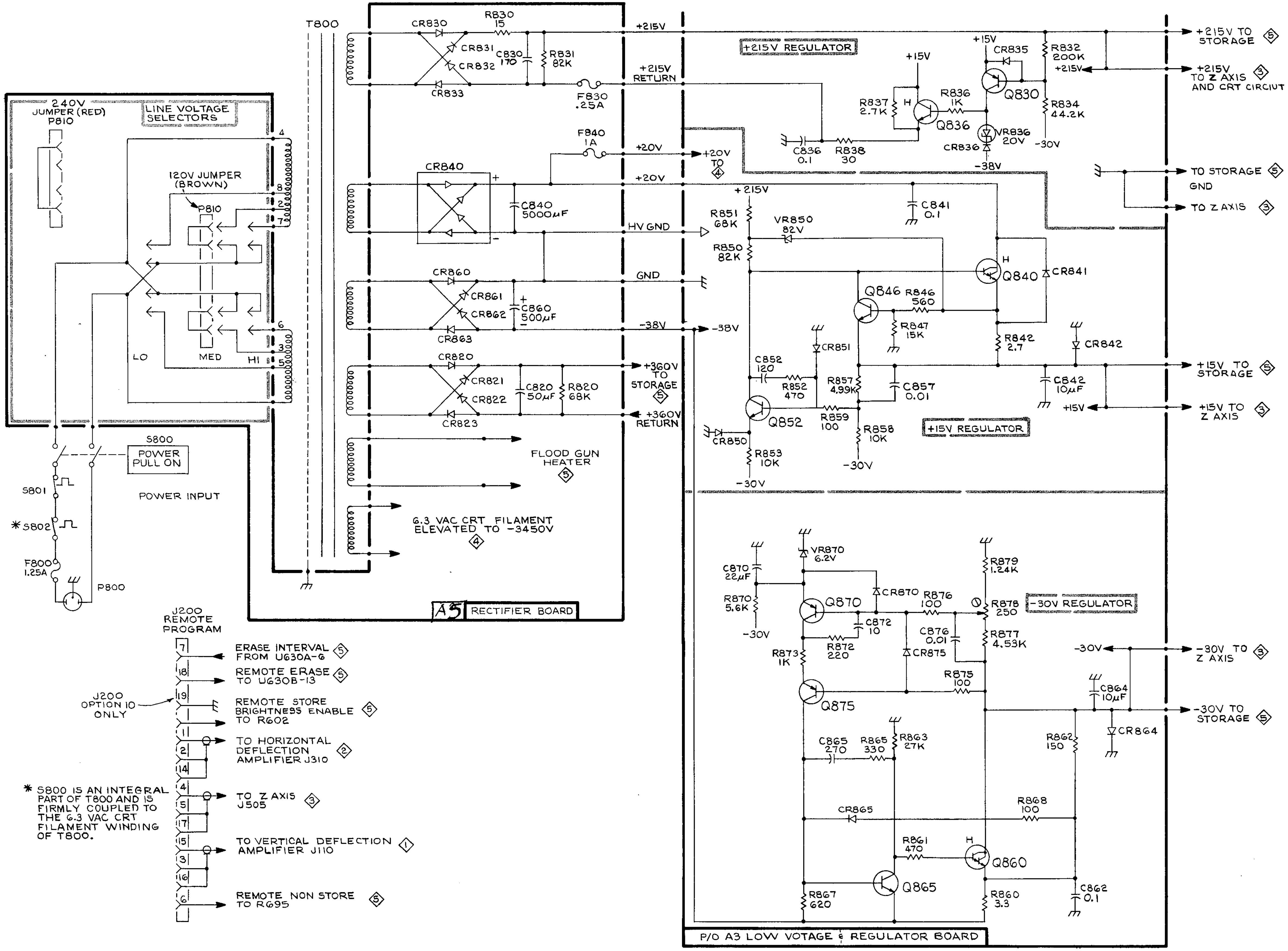
VOLTAGE AND WAVEFORM CONDITIONS

Note

The test equipment used to obtain the voltages and waveforms is listed in Table 4-1, Test Equipment.

VOLTAGE CONDITIONS

The dc voltages indicated on the schematic diagram were obtained with no test signal input, using a digital voltmeter. The INTENSITY and Position controls were set for a barely visible dot at near center screen with the internal sweep generator disconnected (Option 4 version only).



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LOW VOLTAGE POWER SUPPLY & REGULATORS 6

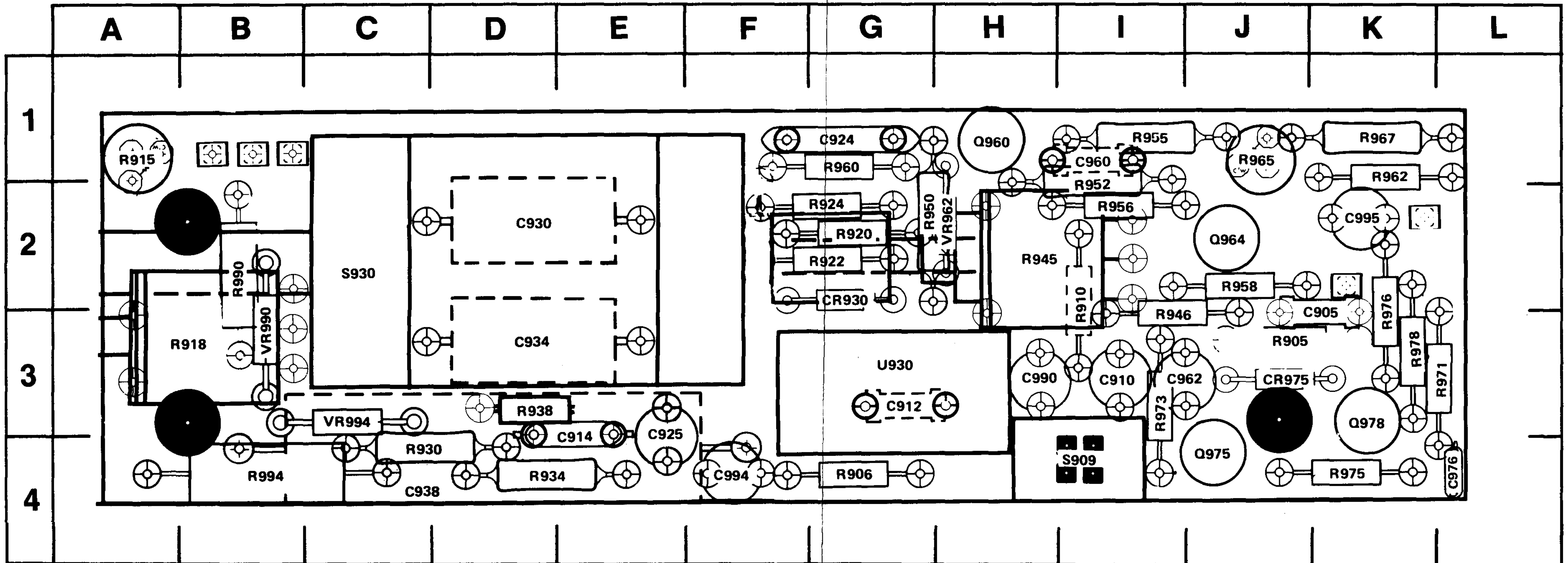

Fig. 10-7. A6 - Option 4 Sweep components and waveform test points locator.

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C905	2J	R915	1A	S909	4I
C910	3I	R918	3B	S930	2C
C912†	3G	R920	2G		
C914	3E	R922	2G	U930	3G
C924	1G	R924	2G		
C925	4E	R930	4D	VR962†	2H
C930†	2D	R934	4D	VR990	3B
C934†	3D	R938	4D	VR994	3C
C938†	4C	R938	4D		
C960	1I	R945	2H		
C962	3J	R946	3I		
C976	4L	R950†	2G		
C990	3H	R952	2I		
C994	4F	R955	1I		
C995	2K	R956	2I		
		R958	2J		
CR930	3G	R960	1G		
CR975	3J	R962	1K		
		R965	1J		
Q960	1H	R967	1K		
Q964	2J	R971	3L		
Q975	4J	R973	3I		
Q978	4K	R975	4K		
		R976	3K		
R905	3J	R978	3K		
R906	4G	R990	2B		
R910†	2I	R994	4B		

† = Reverse side of board.

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A6 OPTION 4
SWEEP BOARD

VOLTAGE AND WAVEFORM CONDITIONS

Note

The test equipment used to obtain the voltages and waveforms is listed in Table 4-1, Test Equipment.

VOLTAGE CONDITIONS

The dc voltages indicated on the schematic diagram were obtained with no test signal input, using a digital multimeter. The INTENSITY and Position controls were set for a barely visible trace at near center screen with the internal sweep generator connected. The internal Trig Mode switch (S909) was set to Auto.

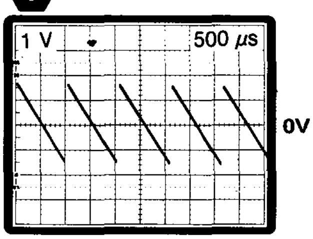
WAVEFORM CONDITIONS

The following waveforms were monitored by a test oscilloscope and a 10X probe with no test signal applied and the internal sweep generator connected. The internal Trig Mode switch (S909) was set to the Auto position, SEC/DIV switch to .1m, and VARIABLE control fully clockwise (calibrated).

Note

If no waveform is obtained at the test points, adjust the SLOPE/LEVEL control.

1



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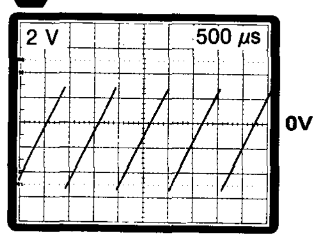
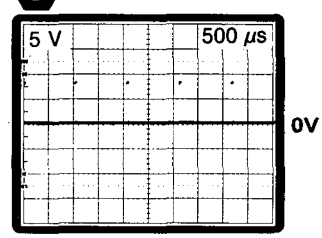


3



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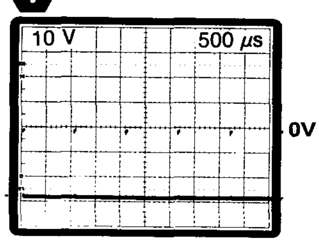
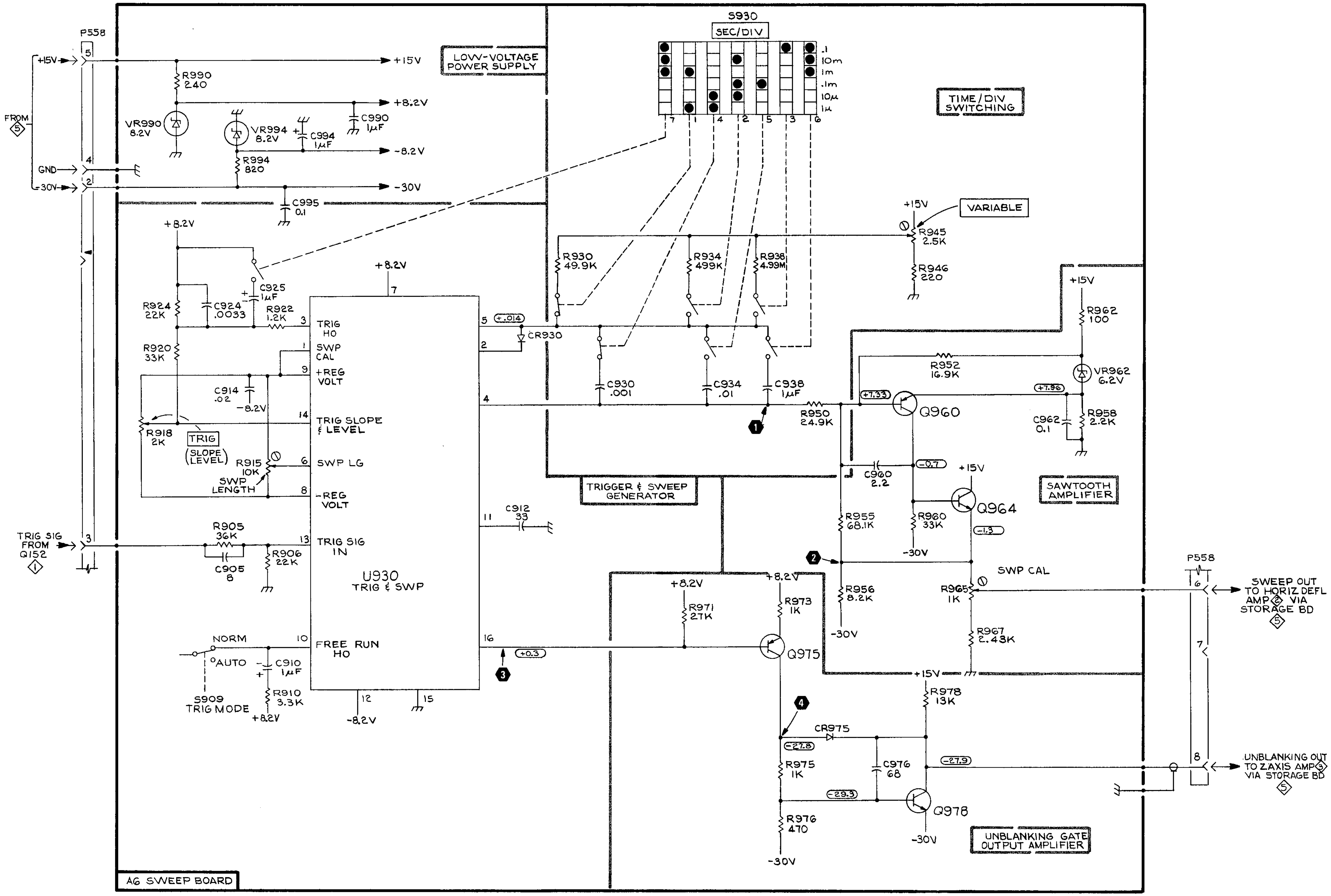



P558
+15V
FROM 5
GND
-30V
R990 240
VR990 8.2V
VR994 8.2V
C994 1μF
C990 1μF
R994 820
C995 0.1
+15V
+8.2V
-8.2V
-30V
LOW-VOLTAGE POWER SUPPLY
S930
SEC/DIV
.1
10m
1m
.1m
10μ
1μ
TIME/DIV SWITCHING
VARIABLE
R945 2.5K
R946 220
R930 49.9K
R934 499K
R938 4.99M
C930 .001
C934 .01
C938 1μF
CR930
R950 24.9K
Q960
R952 16.9K
VR962 6.2V
R962 100
R958 2.2K
C962 0.1
C960 2.2
Q964
R955 68.1K
R960 33K
R956 8.2K
R965 1K
R967 2.43K
SWP CAL
SAWTOOTH AMPLIFIER
TRIGGER & SWEEP GENERATOR
R924 22K
C924 .0033
C925 1μF
R922 1.2K
R920 33K
C914 .02
R918 2K
TRIG (SLOPE) (LEVEL)
R915 10K SWP LENGTH
TRIG HO
SWP CAL
+REG VOLT
TRIG SLOPE & LEVEL
SWP LG
-REG VOLT
TRIG SIG IN
FREE RUN HO
U930 TRIG & SWP
C912 33
TRIG SIG FROM Q152 1
R905 36K
C905 8
R906 22K
NORM
AUTO
S909 TRIG MODE
C910 1μF
R910 3.3K
R971 27K
R973 1K
Q975
R978 13K
CR975
C976 68
R975 1K
R976 470
Q978
UNBLANKING GATE OUTPUT AMPLIFIER
SWEEP OUT TO HORIZ DEFL AMP 2 VIA STORAGE BD 5
UNBLANKING OUT TO Z AXIS AMP 3 VIA STORAGE BD 5
A6 SWEEP BOARD

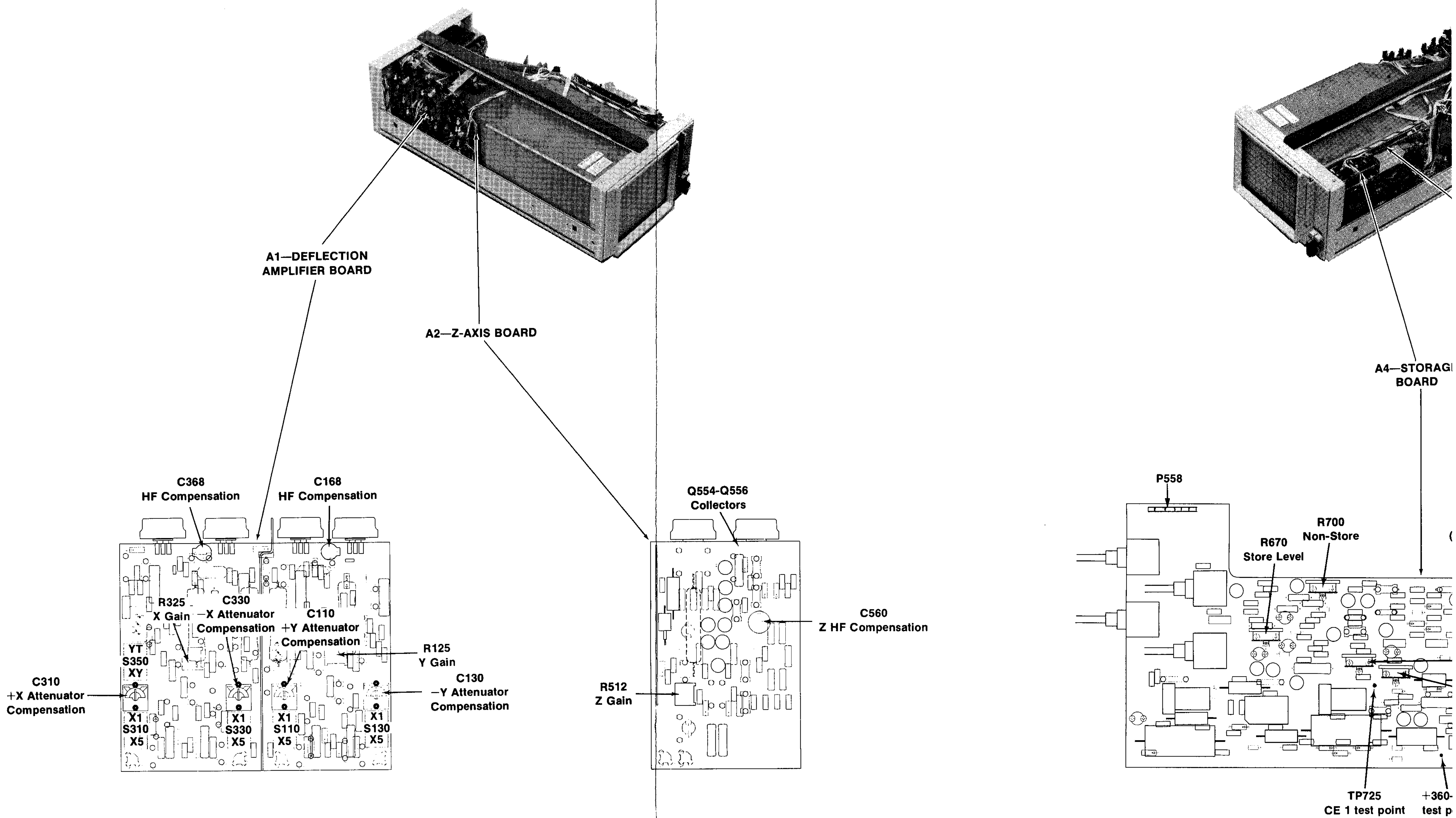


Fig. 10-8. Internal control, test point, and adjustment locations.

REV A JUL 1980

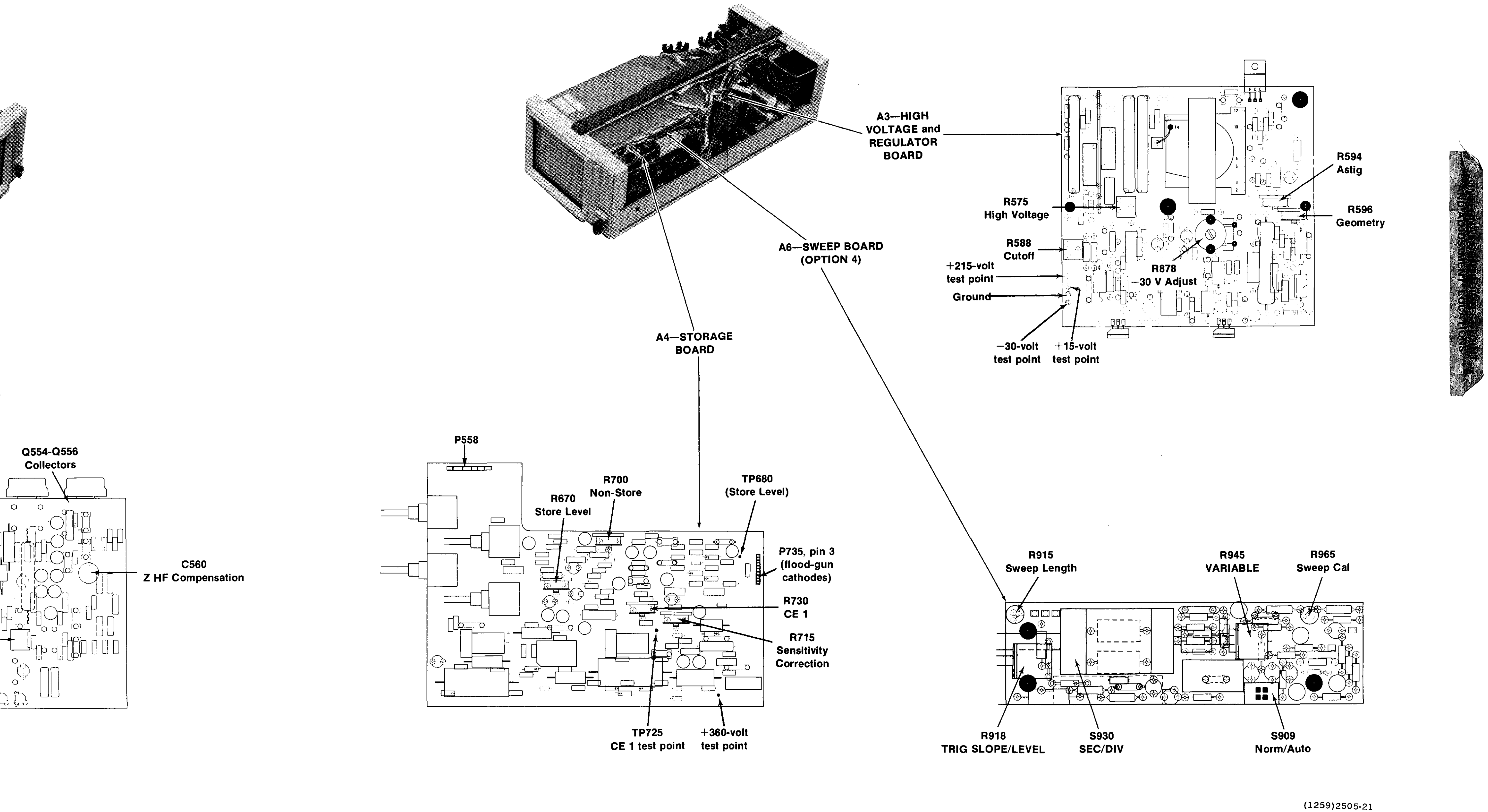
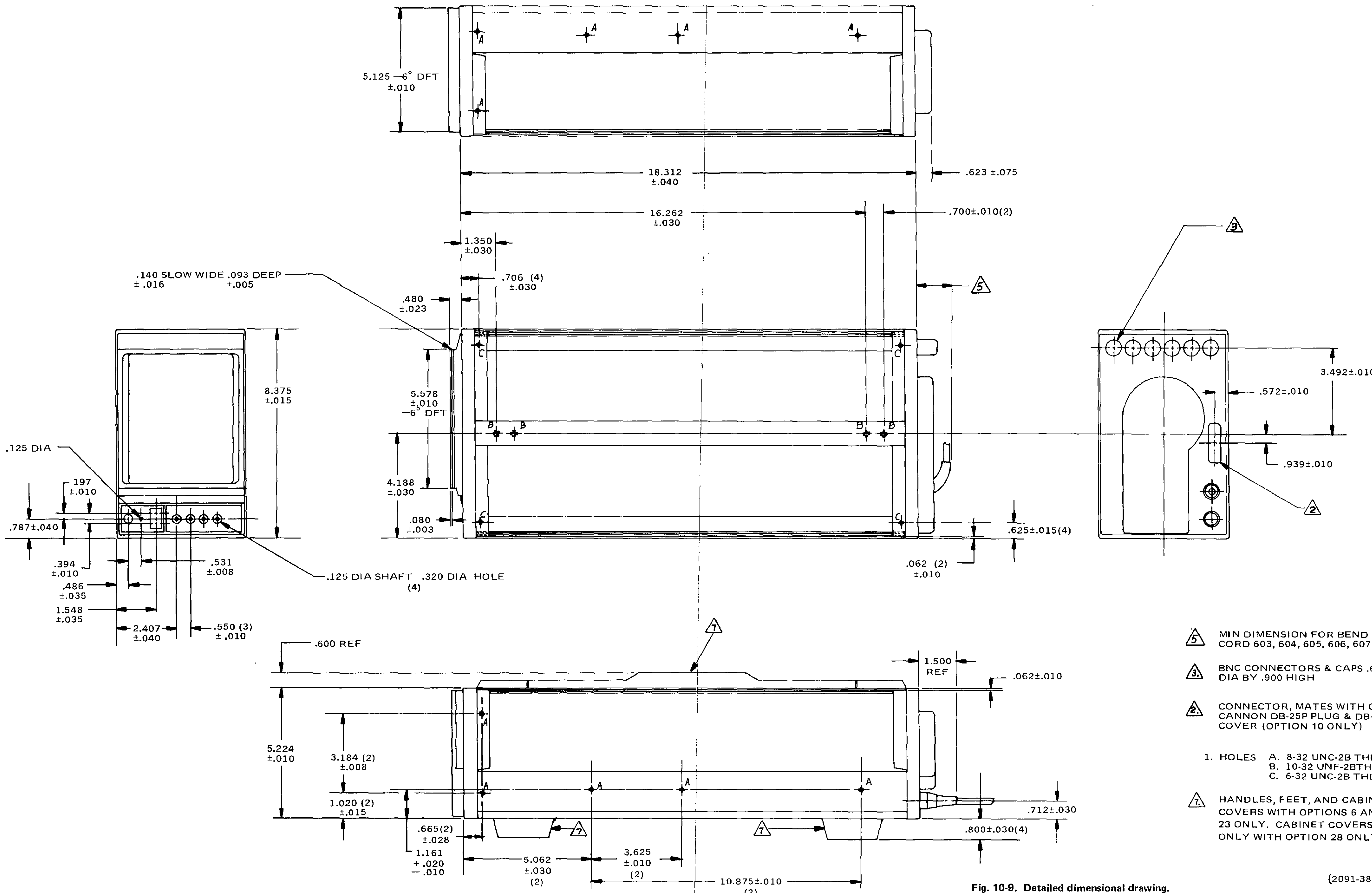


Fig. 10-8. Internal control, test point, and adjustment locations.

DETAILED DIMENSIONAL DRAWING



5. MIN DIMENSION FOR BEND IN POWER CORD 603, 604, 605, 606, 607 0.900 1.250

3. BNC CONNECTORS & CAPS .625 MAX DIA BY .900 HIGH

2. CONNECTOR, MATES WITH CINCH OR CANNON DB-25P PLUG & DB-51226-1A COVER (OPTION 10 ONLY)

1. HOLES A. 8-32 UNC-2B THD
B. 10-32 UNF-2BTHD
C. 6-32 UNC-2B THD

7. HANDLES, FEET, AND CABINET COVERS WITH OPTIONS 6 AND 23 ONLY. CABINET COVERS ONLY WITH OPTION 28 ONLY.

(2091-38) 2505-22

Fig. 10-9. Detailed dimensional drawing.

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English To Metric Conversion

Inches	Centimeters	Inches	Centimeters
0.003	0.008	0.600	1.524
0.005	0.013	0.623	1.582
0.008	0.020	0.625	1.588
0.010	0.025		
0.015	0.038	0.665	1.689
		0.700	1.778
0.016	0.041	0.706	1.793
0.020	0.051	0.712	1.809
0.023	0.058	0.787	1.999
0.028	0.071	0.800	2.032
0.030	0.076	.900	2.286
		1.020	2.591
0.035	0.089	1.161	2.949
0.040	0.102	1.350	3.429
0.062	0.158	1.500	3.810
0.075	0.191		
0.080	0.203	1.548	3.932
		2.407	6.116
0.093	0.236	3.187	8.087
0.125	0.318	3.492	8.870
0.140	0.356	3.625	9.208
0.197	0.500		
0.320	0.813	4.188	10.638
		5.062	12.858
0.339	0.861	5.125	13.018
0.394	1.001	5.224	13.269
0.480	1.219	5.578	14.168
0.486	1.234		
0.531	1.349	8.325	21.273
		10.875	27.623
0.550	1.397	16.262	41.306
0.572	1.453	18.312	46.513

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

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

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

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

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

SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number

00X Part removed after this serial number

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5 Name & Description

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

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

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

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

ABBREVIATIONS

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	P O BOX 3608	HARRISBURG PA 17105
05820	EG AND G WAKEFIELD ENGINEERING	60 AUDUBON RD	WAKEFIELD MA 01880
06229	ELECTROVERT INC	86 HARTFORD AVE	MOUNT VERNON NY 10553
06915	RICHCO PLASTIC CO	5825 N TRIPP AVE	CHICAGO IL 60646
08261	SPECTRA-STRIP AN ELTRA CO	7100 LAMPSON AVE	GARDEN GROVE CA 92642
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
12136	P H C INDUSTRIES INC	1643 HADDON AVE	CAMDEN NJ 08103
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS	30 HUNTER LANE	CAMP HILL PA 17011
22670	G M NAMEPLATE INC	2040 15TH AVE WEST	SEATTLE WA 98119
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701
28520	HEYCO MOLDED PRODUCTS	147 MICHIGAN AVE P O BOX 160	KENILWORTH NJ 07033
71468	ITT CANNON ELECTRIC	10550 TALBERT PO BOX 8040	FOUNTAIN VALLEY CA 92728-8040
71785	TRW INC TRW CINCH CONNECTORS	1501 MORSE AVE	ELK GROVE VILLAGE IL 60007
73743	FISCHER SPECIAL MFG CO	446 MORGAN ST	CINCINNATI OH 45206
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES IL 60016
77900	SHAKEPROOF DIV OF ILLINOIS TOOL WORKS	SAINT CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIVISION	ST CHARLES ROAD	ELGIN IL 60120
79136	WALDES KOHINOOR INC	47-16 AUSTEL PLACE	LONG ISLAND CITY NY 11101
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
83385	MICRODOT MANUFACTURING INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
83553	ASSOCIATED SPRING BARNES GROUP INC	15001 S BROADWAY P O BOX 231	GARDENA CA 90248
85471	BOYD INDUSTRIAL RUBBER DIV OF A B BOYD CO	2527 GRANT AVE	SAN LEANDRO CA 94579
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
TK0308	NATIONAL ELECTRIC CABLE	16566 SW 72 AVENUE	PORTLAND OR 97223
TK0392	NORTHWEST FASTENER SALES INC	7923 SW CIRRUS DRIVE	BEAVERTON OR 97005
TK0433	PORTLAND SCREW CO	6520 N BASIN	PORTLAND OR 97217
TK0435	LEWIS SCREW CO	4114 S PEORIA	CHICAGO IL 60609
TK1665	PORTLAND DIE AND STAMPING INC	4805 SE 26TH	PORTLAND OR 97202

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	390-0270-00			1	CAB.SIDE,MON:LEFT 0.032 AL (OPTION 23 AND 28 ONLY)	80009	390-0270-00
	390-0522-00			1	CAB.SIDE,MON:LEFT (OPTION 6 ONLY)	80009	390-0522-00
	390-0244-00			1	CAB.SIDE,MON:RIGHT,0.032 AL (OPTION 23 AND 28 ONLY)	80009	390-0244-00
	390-0521-00			1	CAB.SIDE,MON:RIGHT (OPTION 6 ONLY)	80009	390-0521-00
	214-0816-00			2	.FASTENER,PAWL:	80009	214-0816-00
-2	386-1151-00			1	..CLAMP,RIM CLENC:SPG STL CD PL	83553	ORDER BY DESCR
-3	386-0227-00			1	..STOP,CLP,RIM CL:	80009	386-0227-00
-4	214-0604-00			1	..WASHER,SPR TNSN:0.26 ID X 0.47 OD,SST	80009	214-0604-00
-5	214-0603-01			1	..PIN,SECURING:0.45 DIA X 0.27,ZAMAK CD PL	80009	214-0603-01
	342-0127-00			1	INSULATOR,PLATE:POWER SUPPLY,POLYESTER (OPTION 23 ONLY)	80009	342-0127-00
-6	390-0280-00			1	COVER,MONITOR:BOTTOM (OPTION 23 ONLY)	80009	390-0280-00
	214-0816-00			4	.FASTENER,PAWL:	80009	214-0816-00
-7	386-1151-00			1	..CLAMP,RIM CLENC:SPG STL CD PL	83553	ORDER BY DESCR
-8	386-0227-00			1	..STOP,CLP,RIM CL:	80009	386-0227-00
-9	214-0604-00			1	..WASHER,SPR TNSN:0.26 ID X 0.47 OD,SST	80009	214-0604-00
-10	214-0603-01			1	..PIN,SECURING:0.45 DIA X 0.27,ZAMAK CD PL	80009	214-0603-01
	342-0127-00			1	INSULATOR,PLATE:POWER SUPPLY,POLYESTER (OPTION 28 ONLY)	80009	342-0127-00
	390-0281-00			1	COVER,MONITOR:BOTTOM (OPTION 28 ONLY)	80009	390-0281-00
	214-0603-02			4	.PIN ASSY,SECRG:W/SPRING WASHER	80009	214-0603-02
	386-1151-00			4	.CLAMP,RIM CLENC:SPG STL CD PL	83553	ORDER BY DESCR
	386-0227-00			4	.STOP,CLP,RIM CL:	80009	386-0227-00
	390-0523-00			1	CAB.BOTTOM,MON: (OPTION 6 ONLY)	80009	390-0523-00
-11	348-0074-00			2	.HINGE BLOCK,STA:R FR,L REAR,BLACK ACETAL .(OPTION 6 ONLY) .(ATTACHING PARTS)	80009	348-0074-00
-12	211-0532-00			2	.SCREW,MACHINE:6-32 X .750,FILH,STL .(OPTION 6 ONLY)	TK0435	ORDER BY DESCR
-13	210-0457-00			2	.NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL .(OPTION 6 ONLY) .(END ATTACHING PARTS)	78189	511-061800-00
-14	348-0207-00			2	.FOOT,CABINET:R FRONT,BLACK,PU .(OPTION 6 ONLY)	80009	348-0207-00
-15	348-0073-00			2	.HINGE BLOCK,STA:L FR,R REAR,BLACK ACETAL .(OPTION 6 ONLY) .(ATTACHING PARTS)	80009	348-0073-00
	211-0532-00			2	.SCREW,MACHINE:6-32 X .750,FILH,STL .(OPTION 6 ONLY)	TK0435	ORDER BY DESCR
-16	210-0457-00			2	.NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL .(OPTION 6 ONLY) .(END ATTACHING PARTS)	78189	511-061800-00
-17	348-0208-00			2	.FOOT,CABINET:L FRONT,BLACK PU .(OPTION 6 ONLY)	80009	348-0208-00
	214-0603-02			4	.PIN ASSY,SECRG:W/SPRING WASHER .(OPTION 6 ONLY)	80009	214-0603-02
	386-1151-00			4	.CLAMP,RIM CLENC:SPG STL CD PL .(OPTION 6 ONLY)	83553	ORDER BY DESCR
	386-0227-00			4	.STOP,CLP,RIM CL: .(OPTION 6 ONLY)	80009	386-0227-00
-18	200-0728-00			2	COVER,HDL END:1.91 X 0.91 X 0.36 BLUE (OPTION 23 AND 28 ONLY)	80009	200-0728-00
-19	367-0116-00			1	HANDLE,CARRYING:16.54 L,BLUE VINYL (OPTION 23 AND 28 ONLY) (ATTACHING PARTS)	12136	ORDER BY DESCR
-20	212-0597-00			4	SCREW,SHOULDER:10-32 X 0.55,0.5 RDH,STL (OPTION 23 AND 28 ONLY)	83486	ORDER BY DESCR
-21	386-1624-00			2	PLATE,HDL RTNG:STAINLESS STEEL (OPTION 23 AND 28 ONLY)	80009	386-1624-00
-22	386-1283-00			2	PLATE,HDL MTG:FRONT (OPTION 23 AND 28 ONLY)	80009	386-1283-00

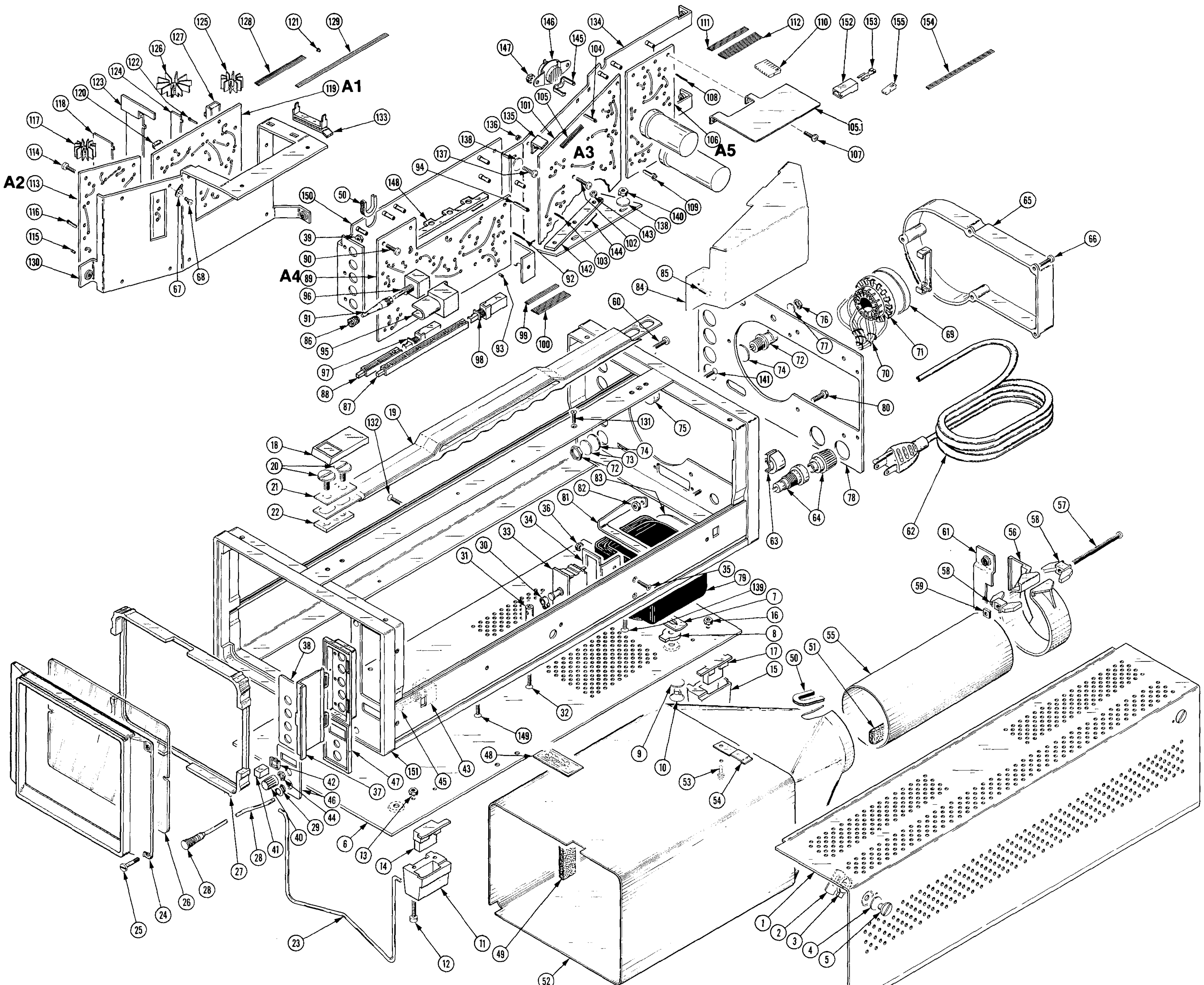
Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					(END ATTACHING PARTS)		
-23	348-0275-00			1	FLIP-STAND,CAB.:3.75 H,SST	80009	348-0275-00
					(OPTION 6 AND 23 ONLY)		
-24	200-1218-00			1	RTNR,CRT SCALE:6.814 X 5.125,NYLON	80009	200-1218-00
	200-1218-06			1	RTNR,CRT SCALE:6.814 X 5.125,NYLON,BLACK	80009	200-1218-06
					(OPTION 6 ONLY)		
					(ATTACHING PARTS)		
-25	211-0188-00			2	SCREW,MACHINE:4-40 X 0.6,PNH,SST	80009	211-0188-00
					(END ATTACHING PARTS)		
-26	337-1440-01			1	SHLD,IMPLOSION:GREEN	80009	337-1440-01
	337-1440-02			1	SHLD,IMPLOSION:AMBER	80009	337-1440-02
					(OPTION 76 ONLY)		
-27	386-1946-00			1	SUPPORT,CRT:FRONT	80009	386-1946-00
-28	384-1128-00			1	KNOB:POWER SWITCH	80009	384-1128-00
-29	358-0216-00			1	GROMMET,PLASTIC:GRAY,ROUND,0.257 ID	80009	358-0216-00
-30	376-0127-00			1	CPLG,SHAFT,FLEX:0.055 & 0.326 ID,DELRIN	80009	376-0127-00
-31	385-0033-00			1	SPACER,POST:0.625 L W/6-32 THD THRU,NYL	80009	385-0033-00
					(ATTACHING PARTS)		
-32	211-0538-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-33	----- -----			1	SWITCH,PUSH:(SEE S800 REPL)		
-34	407-0895-01			1	BRACKET,ELEC SW:ALUMINUM	80009	407-0895-01
					(ATTACHING PARTS)		
-35	211-0101-00			2	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-36	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-37	200-1282-00			1	DOOR,ACCESS:	80009	200-1282-00
-38	333-1514-00			1	PANEL,FRONT:	80009	333-1514-00
					(ATTACHING PARTS)		
-39	210-0406-00			3	NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
	210-0004-00			3	WASHER,LOCK:#4 INTL,0.015 THK,STL	77900	1204-00-00-0541C
					(END ATTACHING PARTS)		
-40	366-1023-01			1	KNOB:GY,0.127 ID X 0.392 OD X 0.531 H	80009	366-1023-01
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL	TK0392	ORDER BY DESCR
-41	366-1257-84			1	PUSH BUTTON:SIL GY,ERASE	80009	366-1257-84
	366-1257-85			1	PUSH BUTTON:SIL GY,STORE	80009	366-1257-85
-42	426-0681-00			2	FRAME,PUSH BTN:	80009	426-0681-00
-43	----- -----			1	RES.,VAR,NONWIR:(SEE R625 REPL)		
					(ATTACHING PARTS)		
-44	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-45	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
					(END ATTACHING PARTS)		
-46	333-1511-01			1	PANEL,FRONT:	80009	333-1511-01
-47	386-2067-03			1	SUBPANEL,FRONT:	80009	386-2067-03
-48	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	22670	ORDER BY DESCR
-49	348-0279-00			2	PAD,CUSHIONING:3.5 X 0.67 X 0.188,RUBBER	80009	348-0279-00
-50	348-0145-00			2	GROMMET,PLASTIC:GRAY,U SHAPE,0.48 ID	80009	348-0145-00
-51	348-0070-01			3	PAD,CUSHIONING:2.03 X 0.69 X 0.18 SI RBR	85471	ORDER BY DESCR
-52	337-1419-05			1	SHIELD SECT,CRT:	80009	337-1419-05
					(ATTACHING PARTS)		
-53	211-0587-00			1	SCREW,MACHINE:6-32 X 0.188,HEX HD,BRS	80009	211-0587-00
					(END ATTACHING PARTS)		
-54	344-0226-00			1	CLIP,CABLE:8 CONDUCTOR RIBBON,PH BRZ	80009	344-0226-00
-55	337-1420-00			1	SHIELD SECT,CRT:	80009	337-1420-00
-56	354-0409-00			1	R,CLP,CRT SHLD:U/O 2.375 OD SHIELD	80009	354-0409-00
					(ATTACHING PARTS)		
-57	211-0632-00			1	SCREW,MACHINE:6-32 X 2.25,FILH,STL	TK0433	ORDER BY DESCR
-58	343-0123-01			2	CLP,ELCTRN TUBE:AL,CD PL	80009	343-0123-01
-59	210-0407-00			1	NUT,PLAIN,HEX:6-32 X 0.25,BRS CD PL	73743	3038-402
-60	211-0507-00			1	SCREW,MACHINE:6-32 X 0.312,PNH,STL	83385	ORDER BY DESCR
-61	407-0922-00			1	BRACKET,CRT CLP:ALUMINUM	80009	407-0922-00
					(END ATTACHING PARTS)		
-62	161-0017-04			1	CABLE ASSY,PWR,:3,18 AWG,96.0 L	80009	161-0017-04
	161-0106-00			1	CABLE ASSY,PWR,:3,18 AWG,115V,70.0 L	TK0308	ORDER BY DESCR
					(OPTION 6 ONLY)		
-63	358-0529-00			1	BSHG,STRAIN RLF:U/W 0.36 DIA CABLE,STRAIGHT SAFETY CONTROLLED	28520	207 (UL 6P3-4)

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-64	352-0076-00	B010100	B011149	1	FUHLR,EXTR POST:3AG,20A,250V,PNL MT	75915	3420212-L
	204-0837-00	B011150		1	BODY,FUSEHOLDER:3AG,6.3A,250V,PNL MT,UL	S3629	031.1681
	200-2264-00	B011150		1	CAP,FUSEHOLDER:3AG FUSES	S3629	FEK 031 1666
	200-1388-03	B010200	B011149	1	COVER,FUSE LEAD:POLYURETHANE	80009	200-1388-03
	200-0237-04	B011150		1	COVER,FUHLR:PLASTIC	80009	200-0237-04
-65	200-1308-01			1	COVER,CRT:REAR	80009	200-1308-01
					(ATTACHING PARTS)		
-66	211-0097-00			5	SCREW,MACHINE:4-40 X 0.312,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-67	210-0201-00			2	TERMINAL,LUG:0.12 ID,LOCKING,BRZ TIN PL	86928	A373-157-2
					(ATTACHING PARTS)		
-68	211-0007-00			2	SCREW,MACHINE:4-40 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-69	200-0616-02			1	COVER,CRT SKT:1.78 DIA X 0.2 D,WHITE	80009	200-0616-02
-70	136-0659-00			1	SKT,PL-IN ELEK:ELCTRN TUBE,14 CONT W/LEADS	80009	136-0659-00
-71	136-0202-04			1	.SKT,PL-IN ELEK:ELECTRON TUBE,14 CONTACT	80009	136-0202-04
-72	131-0955-00			3	CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
					(ATTACHING PARTS)		
-73	210-0255-00			3	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	12327	ORDER BY DESCR
-74	342-0117-00			6	INSULATOR,BSHG:0.375 ID X 0.625 OD	80009	342-0117-00
					(END ATTACHING PARTS)		
-75	----- -----			1	RES.,VAR,NONWIR:(SEE R575 REPL)		
					(ATTACHING PARTS)		
-76	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-77	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL	77900	1214-05-00-0541C
					(END ATTACHING PARTS)		
	334-2551-00			1	MARKER,IDENT:MKD WARNING POWER PLUG	80009	334-2551-00
	334-2555-00			1	MARKER,IDENT:MKD WARNING,LINE FUSE	80009	334-2555-00
-78	333-1515-07			1	PANEL,REAR:	80009	333-1515-07
	333-1515-05			1	PANEL,REAR:	80009	333-1515-05
					(OPTION 6 ONLY)		
-79	----- -----			1	TRANSFORMER:(SEE T800 REPL)		
					(ATTACHING PARTS)		
-80	212-0100-00			4	SCREW,MACHINE:8-32 X 0.625,HEX HD,STL	83385	ORDER BY DESCR
-81	343-0267-00			2	BRACKET,HLDN:TRANSFORMER,AL	80009	343-0267-00
-82	210-0458-00			4	NUT,PL,ASSEM WA:8-32 X 0.344,STL CD PL	78189	511-081800-00
					(END ATTACHING PARTS)		
					TRANSFORMER INCLUDES:		
	214-2439-00			1	.HEAT EXCHANGER:1.0 X 0.5 X 0.0108,COPPER	80009	214-2439-00
-83	342-0028-00			2	INSULATOR,PLATE:TRANSFORMER,ANODIZED AL	80009	342-0028-00
	252-0562-00			AR	PLASTIC EXTR:0.1 X 0.12,POLYETHYLENE	06229	GS2
-84	337-2304-00			1	SHIELD,ELEC:CIRCUIT BOARD,HV	80009	337-2304-00
					(ATTACHING PARTS)		
-85	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-86	366-1432-00			4	KNOB:GY,0.125 ID X 0.312 OD X 0.5 H	80009	366-1432-00
-87	384-1061-00			1	EXTENSION SHAFT:4.357 L	80009	384-1061-00
-88	384-1099-00			1	EXTENSION SHAFT:1.58 L X 0.187 SQ,PLSTC	80009	384-1099-00
-89	----- -----			1	CKT BD ASSY:STORAGE & CONTROL(SEE A4 REPL)		
					(ATTACHING PARTS)		
-90	211-0008-00			5	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					CRT BOARD ASSY INCLUDES:		
-91	384-1121-00			2	.EXTENSION SHAFT:1.41 L X 0.125 OD TPR,NYLON	80009	384-1121-00
-92	131-0608-00			7	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-93	136-0220-00			2	.SKT,PL-IN ELEK:TRANSISTOR 3 CONTACT	71785	133-23-11-034
	136-0269-02			1	.SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP,LOW CLEA	09922	DILB14P-108T
					.RANCE,PCB MT		
-94	214-0579-00			3	.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-95	200-1327-00			1	.SHIELD,RESISTOR:	80009	200-1327-00
-96	----- -----			4	.RES.,VAR:(SEE R175,R375,R562,R595 REPL)		
-97	----- -----			1	.SWITCH,PUSH:(SEE S630 REPL)		
-98	----- -----			1	.SWITCH,PUSH:(SEE S1211 REPL)		
	198-2806-00			1	.WIRE SET,ELEC:	80009	198-2806-00
-99	175-0826-00			AR	..CABLE,SP,ELEC:3,26 AWG,STRD,PVC JKT,RBN	80009	175-0826-00
-100	175-0829-00			AR	..CABLE,SP,ELEC:6,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-973
-101	----- -----			1	CKT BD ASSY:HIGH VOLT & REG(SEE A3 REPL)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					(ATTACHING PARTS)		
-102	211-0008-00			1	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
	136-0252-07			3	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-103	131-0608-00			62	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-104	214-0579-00			4	.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	198-2803-00			1	.WIRE SET,ELEC:	80009	198-2803-00
-105	175-0827-00			AR	..CABLE,SP,ELEC:4,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-954
-105.1	337-2296-00	B010100	B010375	1	.SHIELD,ELEC:CIRCUIT BOARD	80009	337-2296-00
	337-2296-01	B010376		1	.SHIELD,ELEC:CIRCUIT BOARD	80009	337-2296-01
-106	----- -----			1	CKT BD ASSY:PWR INPUT & RECTIF(SEE A5 REPL)		
					(ATTACHING PARTS)		
-107	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
-108	131-0608-00			14	.TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL	22526	48283-036
-109	344-0154-00			4	.CLIP,ELECTRICAL:FUSE,CKT BD MT	80009	344-0154-00
-110	131-1896-00			1	.BUS,CONDUCTOR:8.22 AWG,1.5 L	80009	131-1896-00
	131-1895-00			1	.BUS,CONDUCTOR:8,22 AWG,1.5L	80009	131-1895-00
	198-2804-00			1	.WIRE SET,ELEC:	80009	198-2804-00
-111	175-0827-00			AR	..CABLE,SP,ELEC:4,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-954
-112	175-0830-00			AR	..CABLE,SP,ELEC:7,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-972
-113	----- -----			1	CKT BOARD ASSY:Z AXIS(SEE A2 REPL)		
					(ATTACHING PARTS)		
-114	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
-115	136-0252-07			6	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
	131-0589-00			4	.TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ	22526	48283-029
	131-1334-00			1	.BUS,CONDUCTOR:	80009	131-1334-00
-116	214-0579-00			1	.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-117	214-1291-00	B010100	B012766	2	.HEAT SINK,XSTR:TO-5,SIL BRZ PTD BLACK	05820	207SB
	214-1291-00	B012767		1	.HEAT SINK,XSTR:TO-5,SIL BRZ PTD BLACK	05820	207SB
	214-1254-00	B012767		1	.HEAT SINK,XSTR:TO-5,CU BE	05820	209SB
					.(Q554)		
-118	337-1179-00			1	.SHIELD,ELEC:DEFLECTION AMP	80009	337-1179-00
-119	----- -----			1	CKT BOARD ASSY:DEFLECTION(SEE A1 REPL)		
					(ATTACHING PARTS)		
	211-0008-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
-120	131-0566-00			10	.BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
	131-0589-00			4	.TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ	22526	48283-029
	131-1334-00			1	.BUS,CONDUCTOR:	80009	131-1334-00
-121	136-0252-07			12	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-122	214-0579-00			4	.TERM,TEST POINT:BRS CD PL	80009	214-0579-00
-123	337-1626-00			1	.SHIELD,ELEC:DEFLECTION,FRONT	80009	337-1626-00
-124	337-1627-00			1	.SHIELD,MIRROR:DEFLECTION,REAR	80009	337-1627-00
-125	214-1291-00			2	.HEAT SINK,XSTR:TO-5,SIL BRZ PTD BLACK	05820	207SB
-126	214-1254-00			1	.HEAT SINK,XSTR:TO-5,CU BE	05820	209SB
	214-1254-01			1	.HEAT SINK,XSTR:TO-5,W/HEAT SHRINK	80009	214-1254-01
-127	----- -----			4	.SWITCH,PUSH:(SEE S110 REPL)		
	198-2802-00			1	.WIRE SET,ELEC:	80009	198-2802-00
-128	175-0827-00			AR	..CABLE,SP,ELEC:4,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-954
-129	175-0826-00			AR	..CABLE,SP,ELEC:3,26 AWG,STRD,PVC JKT,RBN	80009	175-0826-00
-130	441-1041-00			1	CHAS,DSPL UNIT:DEFLECTION	80009	441-1041-00
					(ATTACHING PARTS FOR CHASSIS)		
-131	211-0025-00			2	SCREW,MACHINE:4-40 X 0.375,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-132	211-0101-00			3	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
	343-0298-00			1	STRAP,RETAINING:0.25 DIA CABLE	06915	HUC-4
-133	344-0225-00			1	CLIP,CABLE:4 CONDUCTOR RIBBON,DELRIN	80009	344-0225-00
-134	441-1042-01			1	CHASSIS,MONITOR:	80009	441-1042-01
-135	344-0133-00			4	.CLIP,SPR TNSN:CKT BOARD MT,ACETAL BLACK	80009	344-0133-00
-136	210-0659-01			4	.EYELET,METALLIC:0.121 OD X 0.156 L,BRS CD P	80009	210-0659-01
					.L		
					(ATTACHING PARTS FOR CHASSIS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-137	211-0541-00			2	SCREW,MACHINE:6-32 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
-138	210-0949-00			2	WASHER,FLAT:0.141 ID X 0.5 OD X 0.062,BRS	12327	ORDER BY DESCR
-139	211-0538-00			2	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	93907	ORDER BY DESCR
-140	210-0457-00			2	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
-141	211-0101-00			3	SCREW,MACHINE:4-40 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-142	343-0315-00			1	CLAMP,XSTR:PHENOLIC	80009	343-0315-00
					(ATTACHING PARTS)		
-143	210-0407-00			3	NUT,PLAIN,HEX:6-32 X 0.25,BRS CD PL	73743	3038-402
					(END ATTACHING PARTS)		
-144	342-0082-00			11	INSULATOR,PLATE:TRANSISTOR,ALUMINA	80009	342-0082-00
-145	344-0236-00			3	CLIP,SPR TNSN:XSTR MTG,CU BE BRIGHT DIP	80009	344-0236-00
-146	----- -----			1	SW,THRMSTC:(SEE S801 REPL)		
					(ATTACHING PARTS)		
-147	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-148	343-0337-00			1	RETAINER,XSTR:PHENOLIC	80009	343-0337-00
					(ATTACHING PARTS)		
-149	211-0538-00			4	SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-150	441-1043-00			1	CHAS,DSPL UNIT:STORAGE	80009	441-1043-00
-151	426-1302-01			1	FRAME,MONITOR:REAR	80009	426-1302-01
-152	200-1075-00			1	COVER,TERMINAL:QUICK DISCONNECT	00779	1-480435-0
	198-3990-00			1	WIRE SET,ELEC:	80009	198-3990-00
-153	131-0622-00			3	.CONTACT,ELEC:28-32 AWG,BRS & CU BE GLD PL	22526	46241-000
	131-0792-00			3	.CONNECTOR,TERM:18-20 AWG,CU BE GOLD PL	22526	46221
	131-2065-00			3	.TERM,QIK DISC.:18-22 AWG,BRASS TIN PLATED	00779	2-520181-2
-154	175-0826-00			AR	.CABLE,SP,ELEC:3,26 AWG,STRD,PVC JKT,RBN	80009	175-0826-00
-155	352-0198-00			3	.HLDR,TERM CONN:2 WIRE,BLACK	80009	352-0198-00

FIG. 1 EXPLODED



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OPTION 4

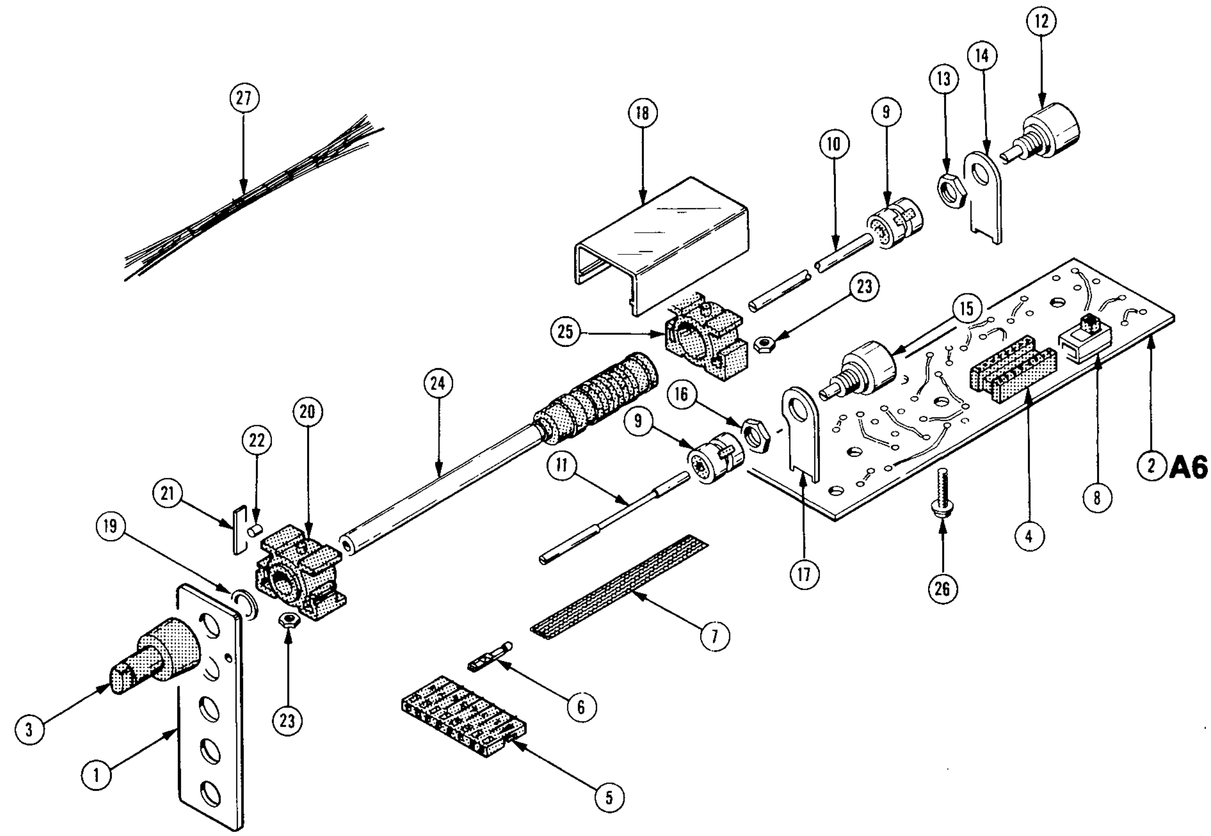
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Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	333-1513-00			1	PANEL,FRONT:	80009	333-1513-00
-2	----- -----			1	CKT BOARD ASSY:SWEEP GENERATOR(SEE A6 REPL)		
					(ATTACHING PARTS)		
	211-0007-00			4	SCREW,MACHINE:4-40 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
					CKT BOARD ASSY INCLUDES:		
-3	366-1369-00			1	.KNOB:GY,0.157 ID X 0.531 OD X 1.025 H	80009	366-1369-00
	131-0604-00			7	.CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
-4	136-0260-02			1	.SKT,PL-IN ELEK:MICROCKT,16 DIP,PCB MT	09922	DILB16P-108T
	198-2861-00			1	.WIRE SET,ELEC:	80009	198-2861-00
-5	352-0166-05			2	..HLDR,TERM CONN:8 WIRE,GREEN	80009	352-0166-05
-6	131-0707-00			8	..CONTACT,ELEC:22-26 AWG,BRS,CU BE GLD PL	22526	47439-000
-7	175-0828-00			AR	..CABLE,SP,ELEC:5,26 AWG,STRD,PVC JKT,RBN	08261	111-2699-955
-8	----- -----			1	.SWITCH,SLIDE:(SEE S909 REPL)		
-9	376-0051-01			2	.CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD,DELRIN	80009	376-0051-01
	354-0251-00			2	..RING,CPLG:0.251 ID X 0.375 OD X 0.187,AL	80009	354-0251-00
-10	384-0284-00			1	.EXTENSION SHAFT:5.688 L X 0.125 OD,AL	80009	384-0284-00
-11	384-1156-00			1	.EXTENSION SHAFT:2.2 L X 0.125 OD,STL CD PL	80009	384-1156-00
-12	----- -----			1	.RES.,VAR:(SEE R945 REPL)		
					.(ATTACHING PARTS)		
-13	210-0583-00			1	.NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
	210-0940-00			1	.WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-14	387-0794-00			1	.PLATE,CMPNT MTG:VAR RESISTOR,BRASS	TK1665	ORDER BY DESCR
					.(END ATTACHING PARTS)		
-15	----- -----			1	.RES.,VAR:(SEE R918 REPL)		
					.(ATTACHING PARTS)		
-16	210-0583-00			1	.NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
	210-0940-00			1	.WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-17	386-2351-00			1	.PL,VAR RES MTG:HORIZ CKT BD	80009	386-2351-00
					.(END ATTACHING PARTS)		
	105-0389-00			1	.ACTR ASSY,CAM S:TIMING	80009	105-0389-00
-18	200-1441-00			1	..COVER,CAM SW:7 ELEMENTS	80009	200-1441-00
-19	354-0219-00			1	..RING,RETAINING:EXT,CRESCENT,U/O 0.25 DIA	79136	5103-25-S-ZD-R
-20	401-0155-00			1	..BEARING,CAM SW:FRONT,0.454 DIA CAM	80009	401-0155-00
-21	214-1704-01			1	..SPRING,FLAT:0.52 X 0.125 X 0.008,CU BE	80009	214-1704-01
-22	214-1127-00			1	..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
-23	210-0406-00			4	..NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-24	105-0388-00			1	..ACTUATOR,CAM SW:TIMING	80009	105-0388-00
-25	401-0156-00			1	..BEARING,CAM SW:REAR,0.454 DIA CAM	80009	401-0156-00
					.(ATTACHING PARTS FOR ACTR ASSY)		
-26	211-0292-00			4	.SCR,ASSEM WSHR:4-40 X 0.29,PNH,BRS NI PL	78189	51-040445-01
					.(END ATTACHING PARTS)		
-27	179-1739-01			1	WIRING HARNESS:SWEEP BOARD	80009	179-1739-01

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-1	131-0570-00			1	CONN,RCPT,ELEC:25 CONTACT,MALE	71468	DB-25P
-2	200-0821-00			1	SHLD,ELEC CONN:R ANGLE U/W 25 CONT D SER	71468	DB51213
-3	331-0303-00			1	SCALE,CRT:GRID,CLEAR	80009	331-0303-00
	070-2505-00			1	MANUAL,TECH:INSTRUCTION	80009	070-2505-00

ACCESSORIES