

SERVICING

INTRODUCTION

Beyond the need for occasional cleaning of the face of the display and other outer surfaces of the Terminal, there is virtually no need for routine servicing of the Terminal. It has no lubrication points, no air filters, and (with the exception of the CRT) no vacuum tubes. The solid-state components provide stable operation, with little need for routine adjustment.

However, if a routine schedule and procedure is desired, a one-year interval and the following sequence is recommended. The disassembly and assembly instructions contained in this section should be referred to as necessary.

Servicing Procedure

- (1) Disconnect the line cord from the power source.
- (2) Unbolt the display unit from the pedestal and set them adjacent to each other on a work surface.
- (3) Remove the top from the display unit and the front from the pedestal.
- (4) Using a vacuum cleaner, remove dust accumulation from within both units. Use a soft-bristled brush to loosen dust which won't otherwise vacuum out. A soft cloth and a mild soap and water solution can be used to remove any really stubborn dirt.
- (5) Inspect the interior of both units for broken leads, loose connections, heat damaged components, etc. Correct as necessary. Investigate the cause of any heat-damaged components.
- (6) Remove the graticule mask and the filter from the front of the display screen. Then wash the face of the CRT and the back surface of the filter, using a soft cloth and a mild soap and water solution. Then replace the filter and graticule mask. *THIS STEP SHOULD NOT NORMALLY BE NECESSARY, SINCE A NEOPRENE MOUNTING RING SEALS THE SPACE BETWEEN THE FACE OF THE CRT AND THE FILTER. IT IS RECOMMENDED ONLY IF DIRT IS VISIBLE BETWEEN THE TWO SURFACES, OR IF THE DISPLAY APPEARS EXCESSIVELY DIM AND DIRT ACCUMULATION IS SUSPECTED.*

(7) Perform the check-out procedure found in this manual. Perform the adjustment procedure if the check-out procedure indicates that it is necessary.

(8) Put the covers back on the display unit and on the pedestal. Install the display unit on the pedestal, if desired.

(9) Clean the outside of the units, using a soft cloth and a mild soap and water solution. Use particular care in cleaning the external surface of the display filter.

Mounting the Display Unit on the Pedestal

Fig. 3-1 provides details for mounting the display unit on the pedestal. The units can be separated by reversing the procedure.

TROUBLESHOOTING INFORMATION

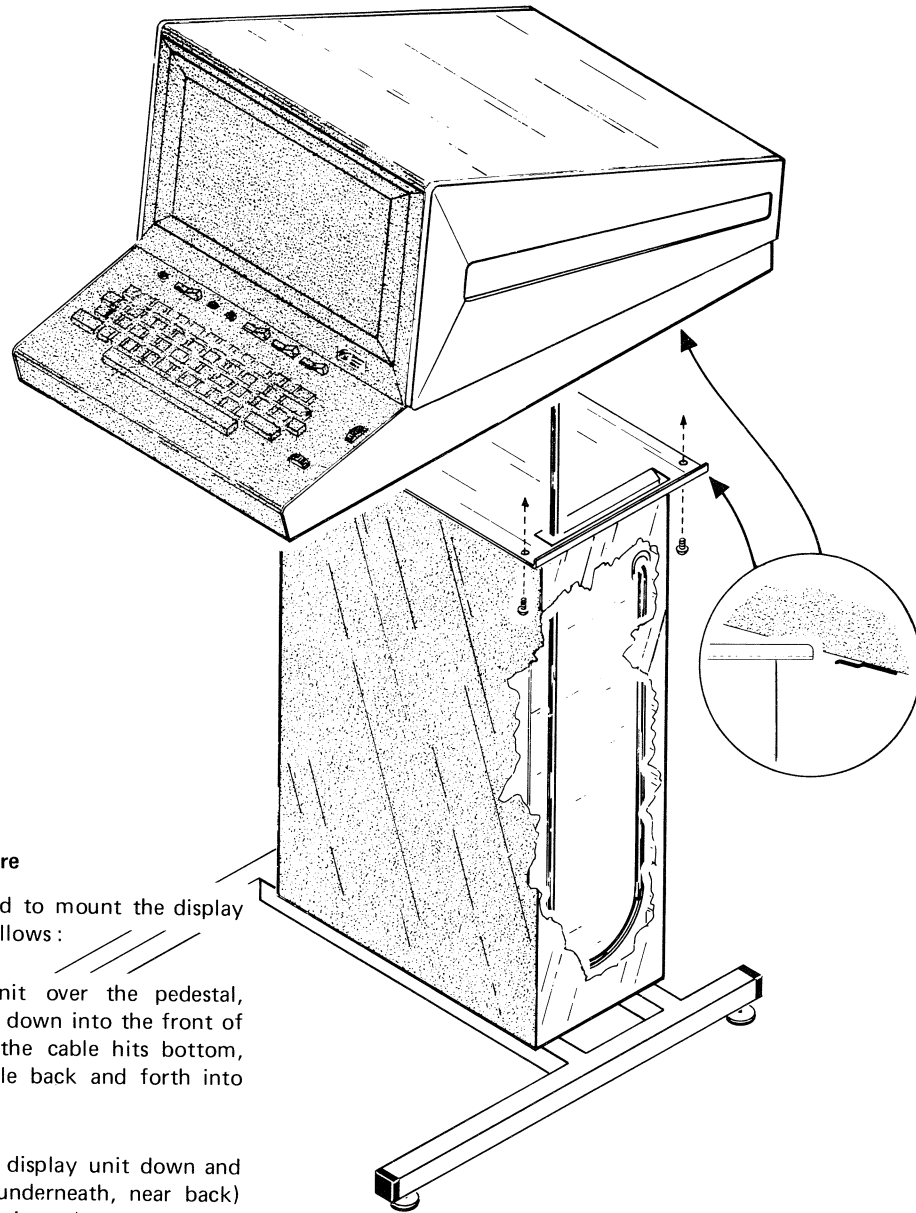
Troubleshooting of the Terminal can be done best if the various features of this manual are used to their fullest advantage. These features and recommended usage are listed here.

Controls and Operation. This information insures operator understanding of the Terminal features and operation.

Specification. A complete explanation of the Terminal capabilities is contained in the Specification, along with explanations of how to put the capabilities into use.

Performance Check. This provides a rapid means of checking for proper operation in a logical sequence under normal equipment configuration. It can also be used with the options and the interface unit removed, to indicate operating status of the basic Terminal.

Adjustment. The procedure follows a logical sequence of adjusting the basic Terminal (including verifying non-adjustable features).



Mounting Procedure

Two people are required to mount the display unit on the pedestal, as follows:

1. Lift the display unit over the pedestal, inserting the cable straight down into the front of the cable trough. When the cable hits bottom, double the remaining cable back and forth into the trough.
2. Tilt the back of the display unit down and place its hold-down lip (underneath, near back) under the pedestal top (see insert).
3. Lower the front of the unit in place. Then align the mounting holes by sliding the display forward.
4. Start the four screws through the pedestal top into the display unit. Then tighten the four screws.

Fig. 3-1. Mounting the display unit on the pedestal.

Block Diagrams and Circuit Diagrams. These diagrams and their associated descriptions provide an understanding of Terminal operation on a circuit as well as component level. The information contained therein is essential to efficient location of trouble.

Component Layout Illustrations. These appear in the Diagrams section and can be used as aids for locating components.

Interconnecting Wire Lists. A listing of cables, jacks and plugs, as well as an explanation of their use, is provided at the beginning of Section 6. Wire colors are also provided, using the standard code for resistors.

Semiconductor Information. An illustration of semiconductors appears near the beginning of the Diagrams section, and can be used for pin identification. An integrated circuit test clip is recommended for use in troubleshooting the in-line integrated circuits, since it makes their leads easily accessible.

Troubleshooting Procedure

To troubleshoot the basic Terminal, remove all accessory cards and the interface card. Then check operation by doing the Performance Check. Stop where the Terminal fails to respond properly, and troubleshoot the referenced area, using block diagrams, schematics, and associated descriptions. Replacement of suspected circuit cards is recommended as a fast means of confirming suspicions. If the Performance Check works satisfactorily in the basic Terminal, install option cards and the interface card one at a time and repeat the Performance Check until it fails. Then troubleshoot the last-inserted option card and the circuits with which it interacts.

Obviously, not all troubles can be high-lighted by the Performance Check or Calibration Procedure. However, they should prove beneficial in most cases, and should go a long way in guiding a technician to the trouble area.

Recommended Troubleshooting Equipment

A Logic Extender Card, TEKTRONIX Part No. 067-0653-00, is an efficient tool for circuit analysis. This card can be used as an independent plug-in card to make all minibus signals available to the Technician, providing level indicators for most of the lines. In addition, it provides a feature for injecting high or low level logic signals into the signal lines. The card can also be used as a extender for other circuit cards, and then permits interruption of any or all signals to the card which is attached to it.

Another extender card is available under TEKTRONIX Part No. 067-0664-00. This card can be installed into the minibus to make bus lines available at test points, and can also be used as an extender for cards installed in the minibus.

A -15 V to +400 V DC voltmeter and a 10 MHz frequency response oscilloscope are recommended test equipment for troubleshooting low-voltage and logic circuits. A -4000 V DC meter is required for troubleshooting the high voltage circuits.

WARNING

Dangerous voltages exist within the pedestal and display units. Normal electrical safety precautions should be observed at all times when working around exposed circuits within these units.

When troubleshooting the power supply circuits, a resistive dummy-load should be connected in place of the Terminal circuits. This avoids accidental damage to other circuits in the Terminal. Recommended loads are as follows:

Power Supply	Connector	Load
+15 V	J70	30 Ω , 15 W
-15 V	J73	30 Ω , 15 W
+5 V	J72	1 Ω , 50 W

DISASSEMBLY AND ASSEMBLY

Access to the Display Unit Circuitry

For access to the circuits within the display unit, remove the three screws at the top of the rear surface. Then lift the top panel up and forward.

The high voltage shield must be removed to obtain access to the majority of the circuits on the High Voltage and Z Axis circuit board. To remove it, first remove the left side panel (as viewed from the front). Then remove the three screws from the shield. Lift the shield out the side of the unit.

Keyboard Information

Perform the following procedure to get at the keyboard circuits:

- (1) Remove four screws from underneath the front of the keyboard.

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(2) Remove the four screws which hold the graticule mask in place and remove the mask.

(3) Remove two screws from the top-rear of the keyboard panel.

(4) Lift the keyboard out as far as the cables will allow. Then turn the keyboard over.

(5) The top surface of the circuit board can be accessed by removing the six screws which hold the keyboard assembly to the keyboard panel.

Key caps can be removed by pulling them directly away from the keyboard.

Keys can be removed by unsoldering the two contacts which hold them to the circuit board, and lifting them out of their access slots.

Pedestal Information

Access. Remove the six screws from the front cover and pull the cover off the front. Note that the line fuse is located in a holder at the bottom of the cover.

Circuit Card Removal. All cards connected to the mini-bus portion of the motherboard are held in by friction. This does not include the first card on the viewer's left (Deflection Amp and Storage Card). That card is fastened to the adjacent heat sink (which is silk-screened with the names of the card adjustments). To remove the card and the attached heat sink, remove the three screws which hold the heat sink in place. The screws are accessible at the back on the outside of the pedestal, second row in from the edge.

Power Supply Removal. Remove the cables which connect to the power supply circuit board. Remove the power plug which is connected to the transformer assembly.

At the bottom-front within the pedestal, remove the two screws which fasten the power supply side panels to the bottom of the pedestal.

On the outside at the back of the pedestal, remove the two screws on each side of the power supply heat sink.

Withdraw the power supply out the back.

When re-assembling the power supply, refer to Table 3-1 for cable-connecting information.

TABLE 3-1

Power Supply Plug Reference

P70—3 pin connector	—	3 brown on red wires
P71—5 pin connector	—	Pin 1—orange on red wire Pin 2—green on white wire Pin 3—green on white wire Pin 4—black on white wire Pin 5—black on white wire
+5V P72—6 pin connector	—	4 black on red wires
-5V P73—3 pin connector	—	3 black on violet wires
P74—1 pin connector	—	Violet on white wire
P75—10 pin connector	—	8 black wires (1 wire is white on black on some instruments)
P76—3 pin connector	—	Pin 1—red wire Pin 2—orange & green on red wire
P77—3 pin connector	—	Pin 1—brown on red wire Pin 2—green on white wire Pin 3—orange on red wire
P78—3 pin connector	—	2 brown on violet wires
P79—3 pin connector	—	Pin 1—brown on violet wire Pin 2—black on violet wire Pin 3—red on white wire

Silicon Grease. Silicon grease is applied to both sides of the mica insulators used with the following components: Q510, Q515, Q520, CR502, CR503. In addition, silicon grease is applied between the heat sink and the mounting plate on Q75.

Power Transformer Information

The power transformer (located in the pedestal) can be wired for use with 115 V or 230 V nominal line voltage, and can be set for any of three ranges within the nominal setting.

Instructions for connecting the transformer are contained on the inside of the pedestal front panel and are not repeated here. Note that the line fuse must also be changed when shifting between 115 and 230 volt operation. Instructions for fuse changing are contained on the panel which covers the transformer assembly.

Display Filter Removal, Cleaning, Installation

Removal. Remove the CRT mask after removing the four screws from its corners.

Place a small piece of tape on the surface of the filter, outside of the display area. This will be used as a reference during replacement. If a new filter is to be installed, it will be used for comparison.

Remove the angle brackets from the top and the bottom of the filter, after removing the two screws from the ends of each.

Lift the filter out of the neoprene mounting ring. It may be necessary to use a thin-bladed device to aid in removal. Use caution to avoid scratching or breaking the filter.

Cleaning. Clean the face of the CRT and the under-side of the filter, using a soft cloth and a mild soap and water solution. Note that the under-side can be distinguished from the outer surface by the masking tape if the original is being re-installed. If the old filter is being replaced with a new one, the under-side can be determined by comparing it with the old filter. Note that less glare from reflected light is apparent on the outer surface than on the under surface of the filter.

Installation. Put the filter in place in the recess in the neoprene mounting ring. The outer surface should be flush with the edge of the frame when properly installed. It may

be necessary to use a non-abrasive device (such as a toothpick) to work the filter into place.

Install the angle brackets and fastening screws.

Clean the outer surface of the filter, using a soft cloth and a mild soap and water solution.

Install the face mask and fasten it in place with the four screws.

CRT and Deflection Yoke Removal and Installation

WARNING

The CRT may implode if it is scratched or struck severely. Do not handle the CRT by its neck. Wear protective clothing and a face shield when handling the CRT.

Introduction. There are two types of yoke-mounting hardware in use in the Terminal. The original type (integral yoke-mounting bracket) is shown in Fig. 3-2(A). Fig. 3-2(B)

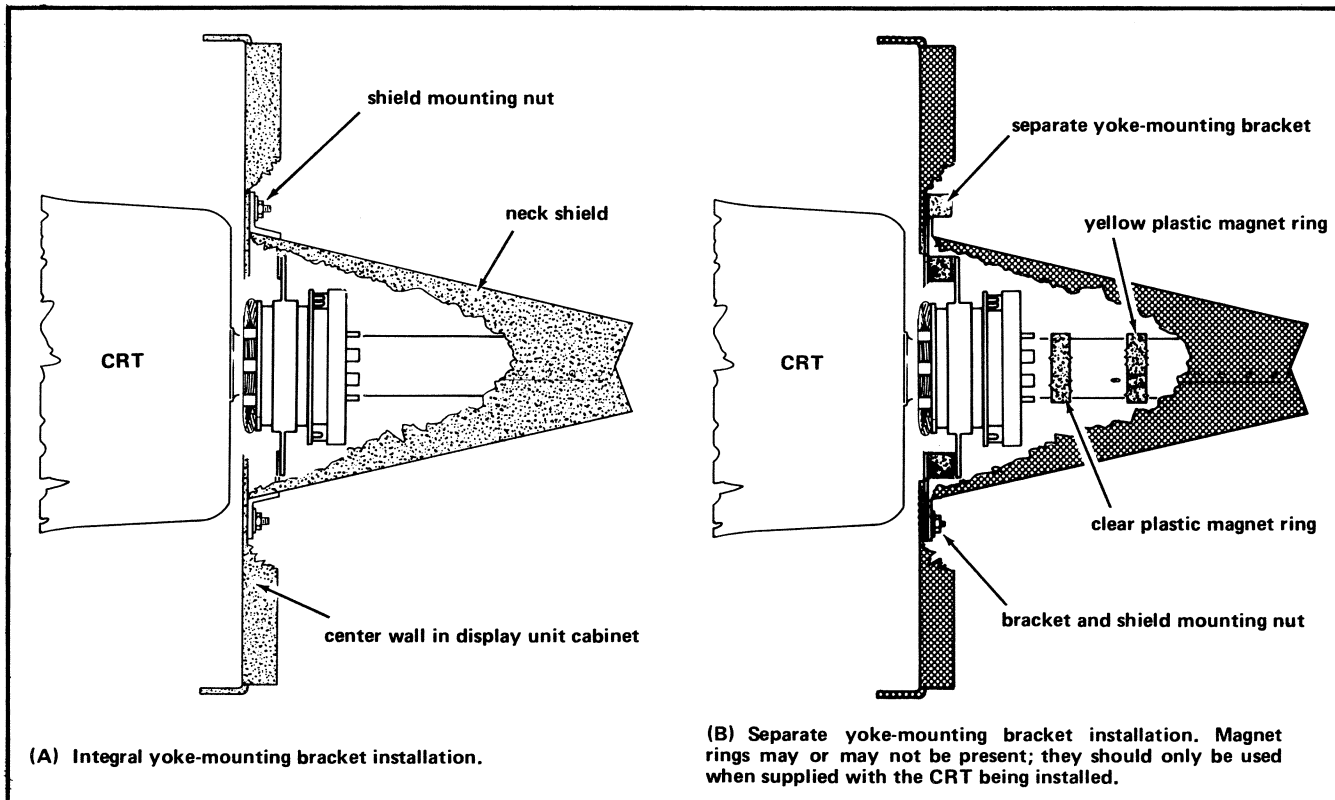


Fig. 3-2. The two types of yoke-mountings.

depicts the latest version (separate yoke-mounting bracket). CRT and yoke replacement procedures are considerably different for the two types. To determine the type being used, remove the top cover from the display unit cabinet and check for the presence or absence of the separate yoke-mounting bracket.

CRT Removal. Refer to the illustration in the Mechanical Parts List as necessary during this procedure. Remove the top from the display unit cabinet. Disconnect the plug from the rear of the neck shield by pulling gently and evenly on the leads. Disconnect the plug which connects to the leads coming from the deflection yoke near the middle of the CRT. The leads may come out of the top or bottom at the front of the neck shield.

Remove both side panels from the display unit after removing two screws from each.

If the unit contains an integral yoke-mounting bracket, loosen the two nuts which fasten the neck shield to the center wall in the display unit, permitting the shield to move freely.

If a separate yoke-mounting bracket is installed, remove the rear panel from the display unit. Then remove the two nuts which hold the neck shield to the center wall. Remove the neck shield and replace (but don't tighten) the nuts, holding the yoke bracket in place. The CRT may or may not have one or two magnet rings installed on its neck. See Fig. 3-3. If rings are installed, note that the ring positions are marked as in Fig. 3-3(A) and then slide the ring(s) off the neck of the tube.

Remove the four screws which hold the CRT mask in place at the front of the display unit.

Place a small piece of masking tape on the front surface of the filter, outside of the CRT display area. It will be used for installation reference.

Remove the four nuts from the corners of the frame which holds the CRT in place. Then remove the frame and filter assembly from the front of the CRT. There are two types of frame assemblies in existence. The latest version has grounding clips fastened to each corner of the frame which holds the CRT in place. The clips are separate items in the early version, and may remain on the studs when the frame is removed; in this event, remove the clips before proceeding.

Slide the CRT out the front of the unit, avoiding side pressure which may break the neck of the CRT. A second person should feed the deflection cable and plug through the hole in the center wall to avoid its getting caught. **DO NOT HOLD THE CRT BY ITS NECK.**

Set the CRT face-down on a flat surface. The neoprene mounting ring will keep the faceplate from contacting the surface.

Yoke Replacement. With the CRT removed, remove the nuts and washers which hold the neck shield or yoke-mounting bracket in place. Remove the shield or yoke-mounting bracket.

Unscrew the two bolts which fasten the yoke-mounting strap to the mounting bracket or shield.

Install the new yoke. Note that the metal tang fastened to the yoke is toward the top.

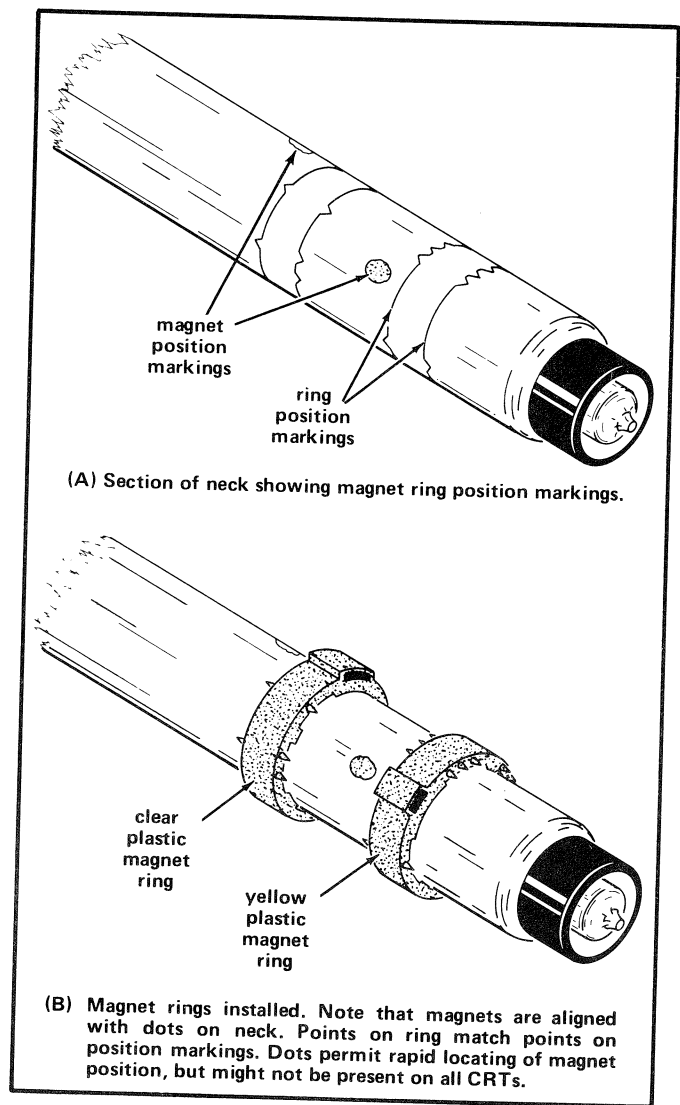


Fig. 3-3. CRT Magnet ring location details. The magnet rings should be used only when supplied with the CRT.

Install the yoke-mounting bracket or shield, as appropriate, in place on the center wall. Leave the nuts loose enough to permit the yoke to align with the neck of the CRT during replacement.

CRT Installation. At each side, loosen (don't remove) two screws which hold the center wall in place, permitting the wall to be moved easily. Then position the wall so that the neoprene bumpers on the front of the CRT shield are just started past the tangs on the cabinet. Re-tighten the two screws at each side of the center wall.

Insert the CRT and attached neoprene mounting ring into the display unit cabinet, carefully aligning the neck with the yoke. Avoid side pressure on the neck. With the CRT partially inserted, a second person should feed the deflection plug and cable through the top or bottom, depending upon whether the CRT is inserted with the deflection cable on the top or on the bottom.

This paragraph pertains only to the early version of the frame assemblies in which the corner clips are separate from the frame. Remove the corner clips from the frame. Place a corner clip on each screw attached to the cabinet near each corner of the face of the CRT. The plane containing the hole should be outermost, with the lip aligning with the step in the neoprene mounting ring. See Fig. 3-4. (The clips may be difficult to align at this time, but will be adjusted as necessary in a later step.)

CAUTION

During the following procedure, the neck shield mounting nuts must be loose enough for the assembly to move around easily, avoiding pressure on the neck.

Remove the filter and the two angle brackets from the frame. The angle brackets are held in place by screws at each end.

Put the frame in place, fitting it over the neoprene mounting ring. Install it carefully to avoid distorting the neoprene mounting ring. If necessary, slide the CRT forward slightly to make it easier to install the frame.

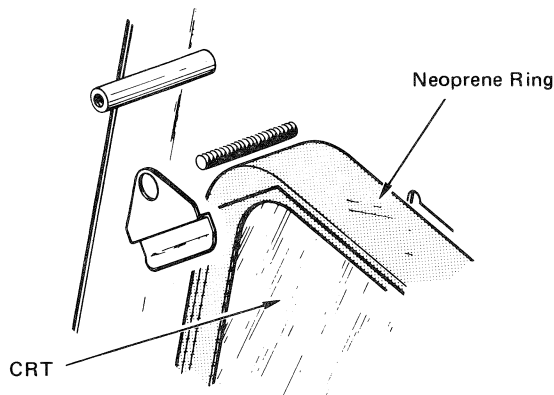


Fig. 3-4. Positioning of Corner Clips.

While holding the frame in place, install the four spacer sleeves over the corner screws, aligning the sleeves with the frame, clips, and screws as required. It may be necessary to lift up on the bottom of the frame. If the early version of the frame is installed, it may be necessary to adjust the clips while installing the spacers.

Start the nuts onto the top screws, then place the nuts on the bottom screws, pressing in and up on the bottom of the frame as necessary.

If the early version of the frame is installed, check that the clips at the bottom corners are properly in place, extending over the step in the neoprene ring; then push each clip as far toward the corner as possible and tighten the bottom nuts. Repeat at the top corners. If the latest version frame is installed (corner clips fastened to the frame), simply tighten the four nuts, drawing them up evenly.

Check the alignment of the CRT with the display unit cabinet. The edge of the display area should be parallel with the top edge of the display unit frame. If it isn't, loosen the corner nuts slightly, adjust the CRT, and retighten.

Using a soft cloth and a mild soap and water solution, clean the face of the CRT and the rear surface of the filter. (The rear surface is the side opposite to that having the tape attached. It can also be identified as the side exhibiting the most glare from reflected light.)

CAUTION

Avoid touching the face of the CRT or the back of the filter during the rest of the procedure. Otherwise, the filter will have to be removed for cleaning.

Set the filter in place in the recess in the neoprene mounting ring, with the side containing the masking tape on the outer surface. (The outer surface is the side exhibiting the least glare from reflected light.) The filter should fit flatly on all edges. Otherwise, it may break when tightened in place. When properly installed, the front surface of the filter should be approximately flush with the front surface of the frame. If it is not, it may be improperly seated in the neoprene ring. A toothpick, or other non-abrasive object may be used to move the lip on the neoprene ring sufficiently to allow the filter to move past the lip. If the early version of the frame is installed, a possible cause of improper seating could be that a corner clip may be mounted insufficiently far into the corner of the frame. In that case, loosen the appropriate corner screw, push the clip into the corner and retighten.

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Put the angle bracket in place over the top and bottom edges of the filter, fastening them each in place with two screws. Note that filter breakage may occur if the front surface of the filter is not approximately flush with the front edge of the frame.

Remove the masking tape which was put on for identification. Then clean the surface of the filter, using a soft cloth and a mild soap and water solution.

Put the face mask in place, and install the four screws.

Inside the unit, slide the deflection yoke-mounting bracket or neck shield (as appropriate) up against the center wall and tighten the nuts which hold it in place.

Loosen the side screws which hold the center wall in place and slide the center wall forward, keeping the pressure in line with the neck of the CRT. Do not permit the center wall to move toward the back or the shield may slip off the tangs. *AVOID SIDE PRESSURE AGAINST THE CRT NECK.*

Tighten the side screws while holding the assembly in place.

This paragraph pertains only if the unit contains a separate yoke-mounting bracket. If magnet rings were supplied with the CRT, install them; align them as illustrated in Fig. 3-3. Remove the deflection yoke-mounting bracket nuts. Slide the neck shield into place. Replace the nuts and tighten them moderately.

Reconnect the deflection cable plug and the base plug. Note that they are both keyed for proper alignment.

Clean the front of the filter and replace the graticule mask, fastening it in place with the four screws.

Turn the Terminal on. After approximately one minute, press PAGE, put the rocker switch to LOCAL, and enter CTRL SHIFT K and CTRL Z to obtain a crosshair display. Place the vertical thumbwheel at its upper limit, placing the horizontal line near the top of the display. Loosen the neck shield mounting screws sufficiently to permit moving the yoke-mounting bracket or shield. Then rotate the bracket or shield until the horizontal line is parallel with the top surface of the cabinet. Tighten the mounting screws. Fasten the rear cover, side panels, and top cover in place.

PERFORMANCE CHECK/ADJUSTMENT

PERFORMANCE CHECK

General. This procedure can be used under normal operating conditions with all circuit cards installed. Since it uses LOCAL operation, no computer connection is required. Checks are referenced to a circuit and/or to a step in the Adjustment Procedure to permit rapid evaluation of incorrect results. In event of an improper response, recheck the step with all optional and interface cards removed from

the pedestal to determine if the Terminal itself is at fault. Steps requiring position measurement should be made without parallax. That is, the line of sight should be perpendicular to the viewing area; this can be achieved by closing one eye and checking that the reflection of the viewing eye is in line with the point being observed.

Activity	Results	Circuit/Adjustment
Turn the Terminal on	Indicator on left of keyboard glows	Power Supply; Steps 1 and 2
Wait 30 seconds	Face of display becomes bright	Storage circuits; Step 6
Press PAGE	Erase cycle occurs	Storage circuits
Wait 5 seconds	Alpha cursor appears in top-left of display, approximately 1.4 cm \pm 6 mm from left edge and 1.2 cm \pm 6 mm from top edge of display area	High Voltage and Z Axis circuits; Deflection circuits; Terminal Control (TC) Circuits
Wait about 2 minutes	Cursor disappears	View/Hold circuits
Press SHIFT	Cursor re-appears	View/Hold circuits
Select LOCAL; Enter ten 8s	8s are written in line and remain stored on display	Keyboard; Deflection circuits; Character Generator; Storage circuits; Step 6
Wait 5 minutes and press SHIFT	Check for fade-positive and drop-out effects	Storage circuits; Step 6
Enter LINE FEED	With LF CAUSES CR option OUT, cursor moves vertically to next line; with LF CAUSES CR option IN, cursor moves to next line and to margin at left of display	TC
Enter 8s to complete a line (74 characters)	Cursor resets to next line and to margin at left of display	TC
Press PAGE	Erase cycle occurs; cursor goes home	
Enter 34 LINE FEEDs	Cursor goes to bottom-left corner of display	
Enter 35th LINE FEED	Cursor moves to margin 1 position at top-center of display	TC
Enter thirty-seven 8s	8s written and stored; cursor moves to next line and back to margin 1	TC
Enter 5 Space commands	Cursor moves 5 spaces to right	TC
Enter RETURN	Cursor moves to margin at center of display	TC

PERFORMANCE CHECK (cont)

Activity	Results	Circuit/Adjustment
Enter PAGE	Display erases; Alpha cursor goes home	
Enter each written character indicated on keyboard	Check for proper writing and focus of selected character	Keyboard; TC; Steps 8, 9
Enter PAGE	Display erases; cursor goes home	
Enter CTRL SHIFT K CTRL Z	Crosshair cursor appears but does not store	TC; step 10
Move vertical thumbwheel to upper limit	Horizontal line moves up near top of display; approximately 1.4 cm \pm 6 mm spacing exists between ends of line and edges of display area	TC; Deflection Amplifier; Step 5
Move horizontal thumbwheel to mid-position	Vertical line is positioned near center of display; bottom of line should be approximately 1.2 cm \pm 6 mm from bottom edge of display area; horizontal line should be approximately 1.2 cm \pm 6 mm from top edge of display area	TC; Deflection Amplifier; Step 5
Check horizontal line straightness	All points should be within 2% of length of mean straight line	Deflection Amplifier; Step 5
Move vertical line to a position near the left edge of the display area, using the horizontal thumbwheel, and check vertical line straightness	All points should be within 2% of length of mean straight line	Deflection Amplifier; Step 5
Enter PAGE	Crosshair disappears, Alpha cursor appears at top-left corner	TC
Enter CTRL SHIFT K CTRL Z	Crosshair returns	
Enter any key except PAGE or RESET	No effect	
Position the crosshair intersection to approximate mid-screen and enter RESET	Crosshair disappears and Alpha cursor appears at top-left corner	TC
Enter CTRL SHIFT M	Cursor disappears	TC
Enter Space RUBOUT Space _	No apparent effect	TC
Enter _	Dot appears in lower-left corner	TC
Enter 7 RUBOUT 7 _	45° diagonal line appears, starting from bottom-left corner	TC
Check line focus	Should be sharply focused	Step 11

PERFORMANCE CHECK (cont)

Activity	Results	Circuit/Adjustment
Check line straightness	All points on the line should be within 2% of length of mean straight line	Step 13
Press PAGE	Alpha cursor appears at top-left	TC
Enter CTRL G (BEL)	Rings bell	TC
Enter CTRL I (HT)	Cursor moves one space to right	TC
Enter CTRL H (BS)	Cursor moves one space to left	TC
Enter CTRL J (LF)	Cursor moves down one line	TC
Enter CTRL K (VT)	Cursor moves up one line	TC
Enter CTRL SHIFT M (GS)	Selects Graph Mode; cursor disappears	TC
Enter Space RUBOUT Space _ + RUBOUT \emptyset @	Vector appears	TC
Enter CTRL SHIFT K CTRL W (ESC ETB)	Copy of display is made if Hard Copy Unit is attached and energized	TC; Hard Copy TARSIG Amp; Hard Copy Selector; High Voltage and Z Axis circuit; Storage circuit; steps 16 through 21
Enter CTRL SHIFT K CTRL L (ESC FF)	Display erases; Alpha cursor homes	TC
Enter CTRL SHIFT M (GS)	Cursor disappears	TC
Enter @ @	Dot appears near display center	TC
Enter CTRL SHIFT O (US)	Alpha cursor appears with bottom-left corner at dot	TC
Enter CTRL SHIFT M (GS)	Cursor disappears	TC
Enter @ _	A line is written near display center	TC
Enter CTRL M (CR)	Alpha cursor appears at left margin opposite the line	TC
Enter CTRL SHIFT K CTRL Z (ESC SUB)	Alpha cursor disappears; crosshair cursor appears (should not be entered at keyboard with switch at LINE)	TC
Put LOCAL/LINE switch at LINE; Enter any character at keyboard	Crosshair cursor disappears; Alpha cursor appears	TC
Put LOCAL/LINE switch at LOCAL	Performance Check completed	

Introduction

Adjustment of the Terminal normally is required only when it ceases to properly perform its intended functions, or after circuit repairs have been made. However, if adjustment is to be performed on a routine schedule, an interval of one year between adjustments is recommended. Adjustment should be preceded by a thorough cleaning and inspection as outlined in the Servicing section. Adjustment should be performed in a +20°C to +30°C environment and should be preceded by a thirty minute warmup period.

Equipment Required

The following equipment is required in this procedure: Variable voltage source which has an output capability of at least 2 A at 100, 110 or 120 VAC, or at least 1.25 A at 200, 220 or 240 VAC. The instrument output should be variable to at least plus and minus 10% from the stated value.

Oscilloscope. Dual trace with vertical deflection factors of 5 mV and 2 V per division, and sweep rates of 0.1 μ s, 0.5 μ s, 1 ms and 10 ms per division; frequency response should include DC to at least 10 MHz.

Voltmeter. Range at least -25 V DC to +400 V DC; accuracy within at least .05% at +15 V, 0.1% at -15 V, 0.2% at +5 V and at least 1% at all other voltages. High voltage range to -4000 V DC, accurate to within at least 0.5% at -3850 V DC.

Circuit Card Extender. TEKTRONIX Part No. 067-0664-00.

TEKTRONIX 4610 Hard Copy Unit. Required only for 4010-1 Terminal calibration.

Index of Adjustments

The following can serve as an index, or as an adjustment record. It can also be used as a short form adjustment procedure for technicians experienced in adjusting the Terminal. If used as a record of adjustment, copies should first be made to avoid repetitive writing on the copy in the manual.

Preliminary—Set the equipment up for adjusting. Page 4-6

1. Low Voltage Power Supply Check/Adjustment (R27—Reg Voltage, on Power Supply Board in pedestal) Page 4-9

See Table 4-1 and 4-2 for details.

2. +5 V Over-Voltage Check/Adjustment (R50—Crowbar, on Power Supply Board in pedestal) Page 4-11

Adjust R50 for 4.8 V at Q99 base. Short R26-R27 junction to R43-C43 junction to open F41. Replace F41 with 6 A fast-blow fuse.

3. High Voltage Check/Adjustment (R82—HV, on High Voltage and Z Axis Board in display unit) Page 4-11

Adjust R82 for -3850 V at TP64.

4. Intensity Check/Adjust (R130—Intensity, on High Voltage and Z Axis Board in display unit) Page 4-12

With Cursor Brightness on TC-1 fully CW adjust R130 fully CW, then CCW until no dot appears after an erase cycle.

5. Display Positioning Check/Adjustment (X GAIN, Y GAIN, X POS, Y POS, X GEOM, Y GEOM on Deflection Amp and Storage Board in pedestal) Page 4-12

Adjust X POS to center horizontal Gin line; with vertical thumbwheel at upper limit, adjust Y POS so horizontal line is the same distance from the top of the display area as the bottom of the vertical line is from the bottom of the display area; rotate neck shield or yoke-mounting bracket (depending upon assembly type) for parallelism between horizontal line and top of display area; with vertical line near left edge of display area, adjust X GEOM for straight vertical line; with horizontal line near top of display, adjust Y GEOM for straight horizontal line; adjust X GAIN for 18.75 cm (7.4 inches) horizontal line; adjust Y GAIN for 14.04 cm (5.53 inches) between bottom of vertical Gin line and bottom of top line of Alpha Mode characters.

6. Storage Check/Adjustment (NORM COLL, OP LEVEL in Deflection Amp and Storage Board in pedestal) Page 4-14

Adjust NORM COLL for presence (at Deflection Amp and Storage Board pin 30) of CE value written on shield; adjust OP LEVEL for presence (at Deflection Amp and Storage Board pin 33) of STORAGE LEVEL

value written on shield for same CRT, or to value midway between fade-positive and dropout for replacement CRT. Re-adjust OP LEVEL as necessary to avoid fade-positive after erase cycle, or drop out from fully written page.

7. Cursor Brightness Check/Adjustment Page 4-15
(R28, Cursor Brightness on TC-1 in pedestal)

Adjust R28 for desired non-storing Alpha cursor intensity.

8. Corner Focus Check/Adjustment Page 4-15
(FOCUS ADJUST on High Voltage and Z Axis Board in display unit)

Adjust FOCUS ADJUST for sameness of diagonal legs of K written in corner of display. Compromise for sameness in four corners.

9. Alpha Focus Check/Adjustment Page 4-16
(R20—Alpha Focus, on High Voltage and Z Axis Board in display unit)

Adjust Alpha Focus for center-screen focus of K.

10. Crosshair Cursor Intensity Check/ Adjustment Page 4-16
[R29 (R85 on boards numbered 670-1729-04 and lower)—Cursor Brightness on TC-2]

Adjust R29 (R85 on boards numbered 670-1729-04 and lower) in Gin Mode so that the cursor is visible, but does not store.

11. Vector Focus (R10—Vector Focus, on High Voltage and Z Axis Board in display unit) Page 4-16

In pseudo vector mode, adjust Vector Focus for sharpest curved lines positioned near center of display.

12. Vector Drawing Time Check Page 4-16

2.6 ms negative-going pulse at pin 2 on Deflection Amp and Storage Board following entering of A at keyboard.

13. Vector Dynamic Geometry Error Check Page 4-16

Enter PAGE CTRL SHIFT M Space RUBOUT Space _ 7 RUBOUT 7 _ and then check for $\leq 1.5\%$ deviation from mean straight line.

14. Vector Parallelism Page 4-17

Enter PAGE CTRL SHIFT M Space RUBOUT Space @ 7 RUBOUT Space @ 7 RUBOUT ? _ Space RUBOUT ? _ Space RUBOUT Space @ and check that the difference between horizontal lines is $\leq 2\%$ of vertical line length and that the difference between vertical lines is $\leq 2\%$ of horizontal line length.

15. Control Character Response Check Page 4-17

Check control character response as outlined in step 15 of the detailed procedure.

16. (4010-1 Only) Hard Copy Interrogate Pulse Width Check/Adjustment (HC INTERR on Deflection Amp and Storage Board in pedestal) Page 4-18

Adjust HC INTERR for 300 ns pulses on pin 4 of Deflection Amp and Storage Board.

17. (4010-1 Only) Hard Copy Amplitude Check/Adjustment (HC Y AMP, HC X AMP on Deflection Amp and Storage Board in pedestal) Page 4-18

Adjust HC Y AMP for scan 1/4 inch below and 1/8 inch above page full of written characters; adjust HC X AMP for scan 1/8 inch beyond left and right edges of page full of written characters.

18. (4010-1 Only) Hard Copy Intensity Adjustment (Hard Copy Intensity on side of display unit) Page 4-19

Position Hard Copy Intensity just below level at which the Hard Copy scan bar stores.

19. (4010-1 Only) Hard Copy Damping Check/Adjustment (R21—Hard Copy Damping on Hard Copy TARSIG Amplifier Board in display unit) Page 4-19

Observe at TP32 on Hard Copy TARSIG Amplifier Board during Hard Copy scan. Adjust Hard Copy Damping for maximum negative-going pulses with minimum ringing.

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20. (4010-1 Only) Hard Copy Threshold Check/Adjustment (R35—Hard Copy Threshold on Hard Copy TARSIG Amplifier Board in display unit) Page 4-20

Adjust Hard Copy Threshold for pulse overlap of 1/3 pulse height of pulses observed at TP32 and TP30 on the Hard Copy TARSIG Amplifier Board during Hard Copy scanning.

21. (4010-1 Only) Hard Copy Writing Check Page 4-21

Check for five satisfactory copies of same full screen display.

22. Restoring Original Conditions Page 4-21

Turn Terminal off; remove line plug; reset transformer wiring and fuse; reset option straps; remove jumper(s) (2 jumpers from 021-0065-00 Interface, or 1 jumper from 021-0074-00 Interface, or two jumpers from TTY Port Interface). Reconnect output cable or reset the control switch (cable on 021-0065-00 or TTY Port Interfaces; switch on 021-0074-00); remove extender card and insert Deflection Amp and Storage Card.

Preliminary Procedure

Turn off the Terminal power switch (at top of pedestal) and remove the line cord from the power source.

WARNING

Dangerous voltages exist within the Terminal display unit and pedestal. Normal electrical precautions should be observed whenever working within those units while the covers are removed.

Although the Terminal can be adjusted without separating the display unit and pedestal, it is much more convenient if they are separated and placed alongside each other on a work bench. To separate them, remove the four screws which hold the display unit to the pedestal. The screws are located underneath the display unit mounting plate which is on top of the pedestal. (Refer to the mounting procedure illustration in Fig. 3-1, if necessary.) Support the front of the display unit while the last screw is being removed. Then move the display unit back about 1/2 inch and lift up on it. Withdraw enough cable from the top of the pedestal to permit the display unit to be set down on a bench adjacent to the pedestal as shown in Fig. 4-1.

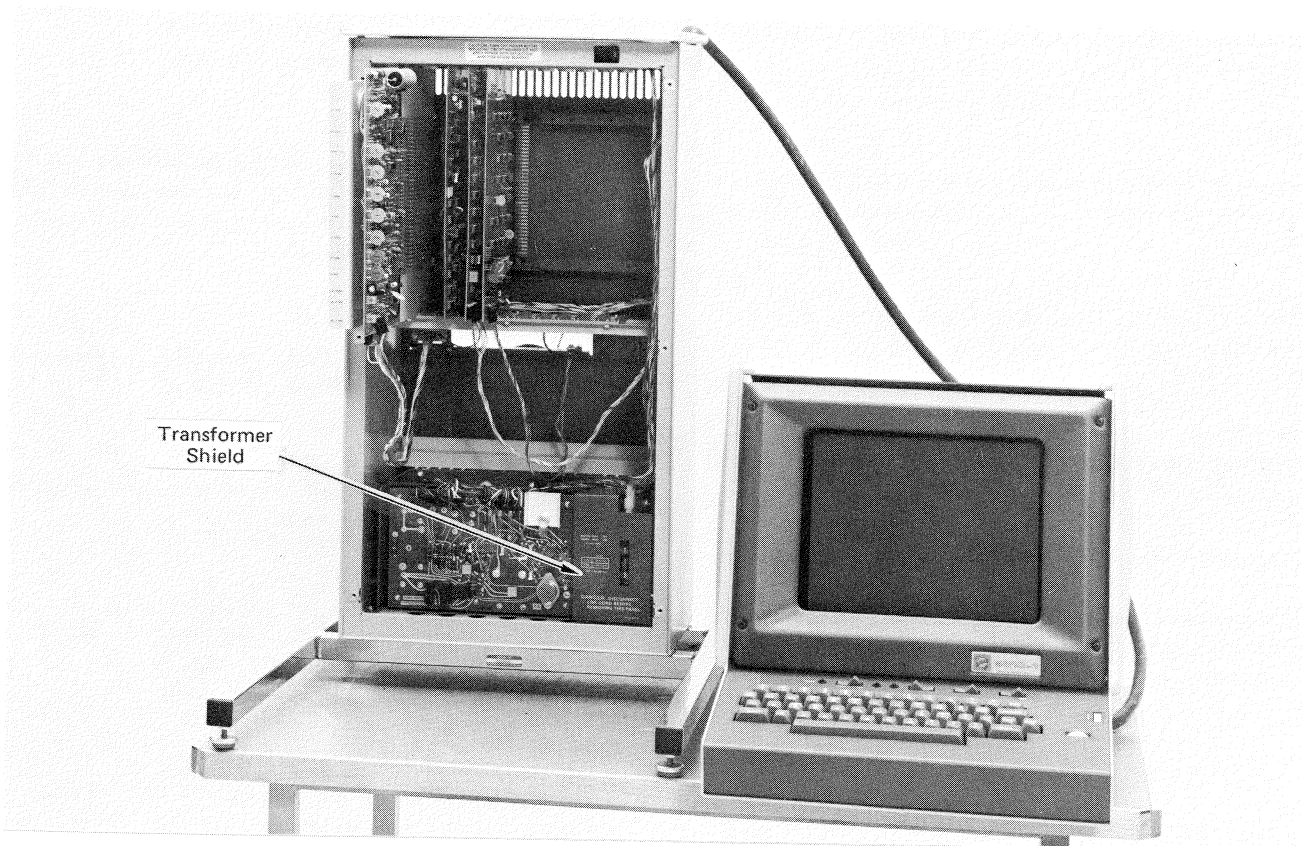


Fig. 4-1. Setup for Adjusting.

Remove the three screws from the back of the top cover on the display unit. Remove the cover by lifting the back of it up and forward.

Remove the six screws from the pedestal's front cover and remove the cover. The line fuse is mounted in a holder in the front cover and is removed with it.

Remove the three screws which hold the heat sink and the attached Deflection Amp and Storage card (left card) in place. These screws are accessible from the back of the unit, about one inch from the side. Then remove the heat sink and circuit card assembly by pulling alternately at the top and bottom of the heat sink.

Install a circuit card extender, TEKTRONIX Part No. 067-0664-00 in the vacated slot. Then install the Deflection Amp and Storage assembly in the extender card.

CAUTION

The Deflection Amp and Storage card is keyed to fit only in the left jack on the mother board. Since the extender card defeats this keying, make certain that the extender is never placed in any other jack while the Deflection Amp and Storage card is attached to it.

This procedure does not include accessory cards which may be used with the Terminal (such as Display Multiplexer or Audio Recorder Interface). Therefore, remove all cards other than the Deflection Amp and Storage card, TC-1, TC-2, and the Communication Interface Card from the top section of the pedestal. Set them aside until the procedure is completed. If a Display Multiplexer card was installed

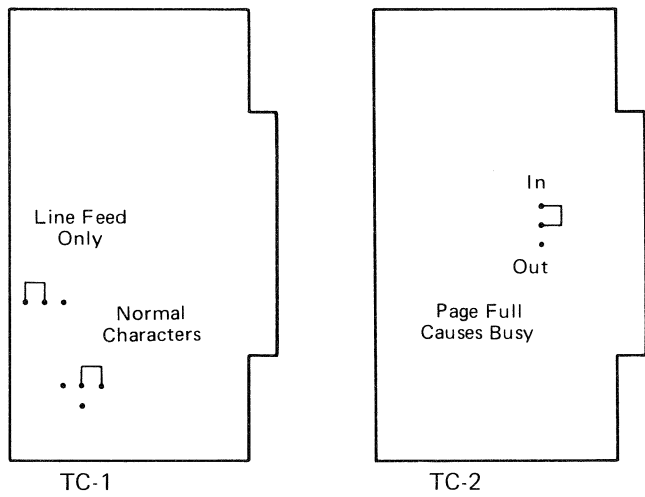


Fig. 4-2. TC-1 and TC-2 strappable option selections for adjusting the terminal.

and a cable connected from it to J35 on the Motherboard, disconnect the cable from J35 and install a Display Multiplexer Bypass Strap between J35 and J36. (J35 and J36 don't exist in standard Motherboards No. 670-1734-00)

Pull TC-1 and TC-2 out and check the strap options shown in Fig. 4-2. If different, record their original positions and change them to agree with Fig. 4-2.

Determine the type of Interface card installed. If it is a Data Communication Interface 021-0065-00, check it against Fig. 4-3 and change the straps as necessary, recording the original setting. Then disconnect the cable from J360 and strap J360 pin 1 to J360 pin 7 on the card. Jumper U67 pin 10 to U67 pin 11. (This connects TSTROBE to CSTROBE.) This can be done quite easily if an Integrated Circuit Test Clip is first connected to U67. Install the card in the minibus.

If the Interface is an Optional Data Communication Interface 021-0074-00, set the selector switch (rear panel) to the LOOP BACK position. Set the TRANSMIT BAUD RATE switch and the RECEIVE BAUD RATE switch both to 9600. Record the previous positions for later reference. On the Interface card, connect U68 pin 6 to U47 pin 9 (this connects TSTROBE to CSTROBE). Install the card in the minibus.

If a TTY Port Interface is installed, disconnect the Relay Card cables from the J161 and J162 connectors on the Control Card. Set the card straps as shown in Fig. 4-4. Record the original positions of any straps that have to be changed. Connect J162 pin 2 to J162 pin 3; connect J161 pin 6 to J162 pin 7. Connect U81 pin 3 to U81 pin 6 (this connects CSTROBE to TSTROBE). This can be done most easily if an Integrated Circuit Test Clip is first attached to U81. Install the card in the minibus.

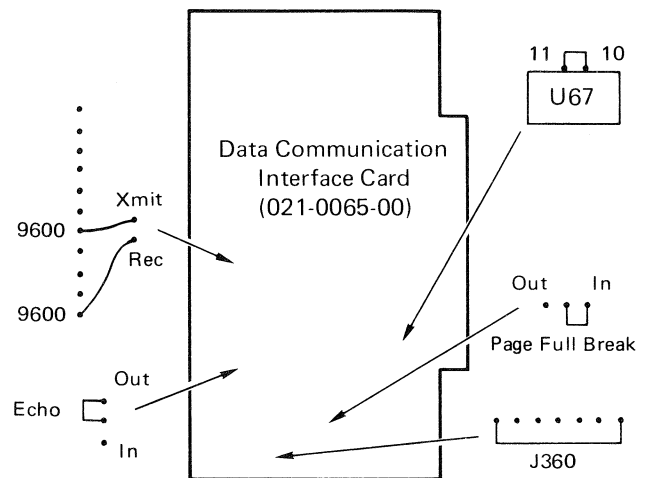


Fig. 4-3. Data Communication Interface (021-0065-00) strappable option and jumper positions for adjusting the Terminal.

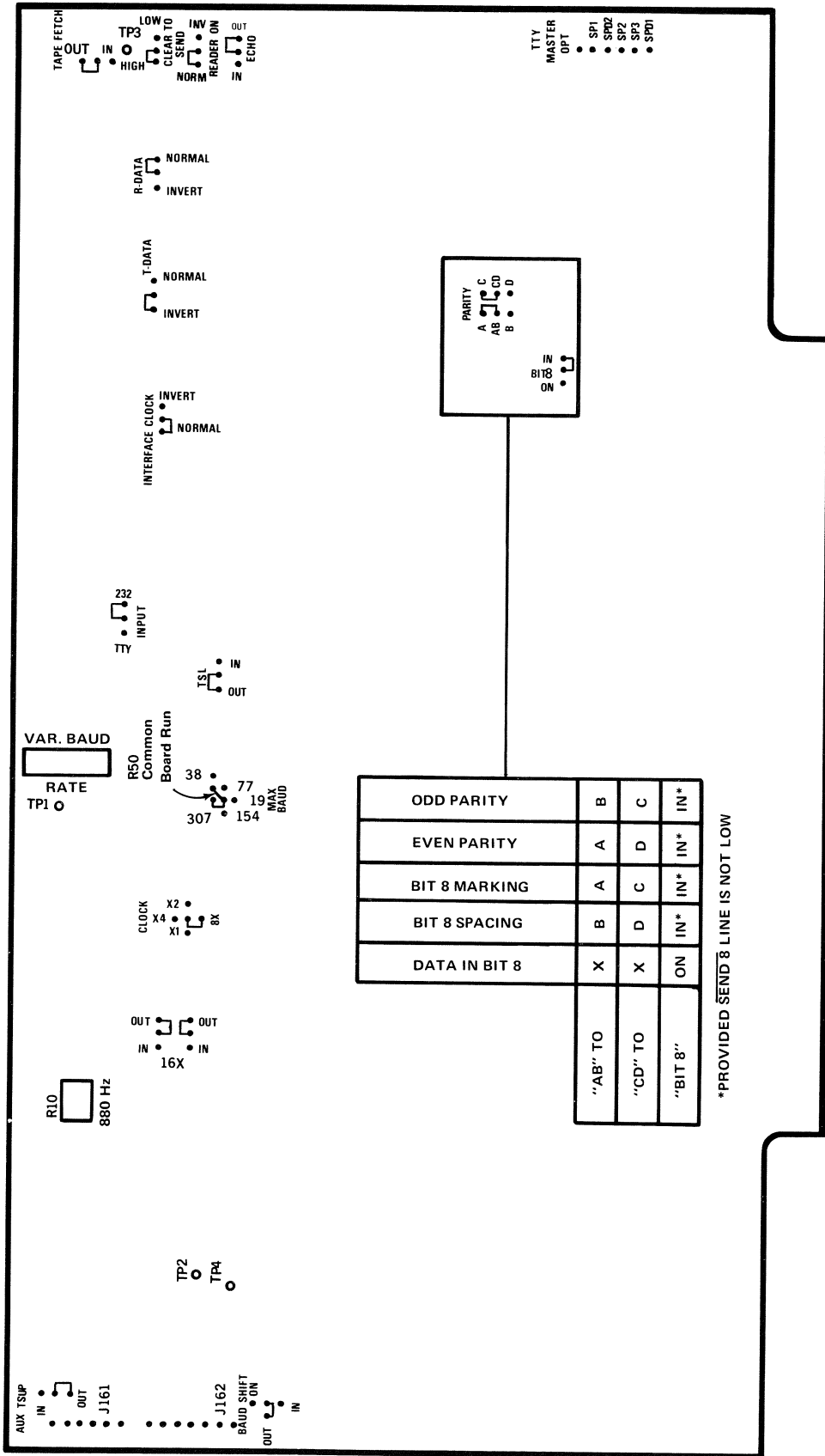


Fig. 4-4. TTY Port Interface strap option positions for calibrating the Terminal.

CAUTION

Do not put the Terminal in Graph Mode with the LOCAL/LINE switch at LINE and the TSTROBE to CSTROBE jumper connected. Doing so may damage the display screen.

At the lower right corner of the pedestal, remove the shield which covers the transformer terminals. (It is held in place by two screws on top.) Determine what voltage the transformer is wired for by comparing the connections against the diagram on the inside surface of the pedestal cover. If a variable AC power supply is available, it will be set to that value. If the indicated supply is not available, record the transformer wiring condition so that it can be restored upon completion of the adjustment procedure. Then rewire the transformer connections to agree with the available voltage supply. See diagram inside the front cover for instructions.

Install an appropriate slow blow fuse (2 A for 115 V or 1.25 A for 230 V) and replace the shield to minimize shock danger. If the fuse mounted in the front cover is to be used during the adjustment, it can be pushed (not pulled) from its holder, or the holder assembly can be removed from the front cover, as desired.

WARNING

Dangerous voltages exist in the fuse and transformer circuits. Keep the line cord disconnected while working in those areas.

Check the remaining fast blow fuses for proper sizes. Their values should be: F21—2 A, F41—6 A, F61—2 A.

Detailed Procedure**1. Low Voltage Power Supply Check/Adjustment (R27—Reg Voltage)****NOTE**

Early power supply boards had filaments connected from J78—pin 1 (–20 V) to J71—pin 1 (+20 V). Some later boards had the filaments connected from J78—pin 1 (–20 V) through a selectable resistor to J71—pin 1 (+20 V). The selectable resistor was used to drop the filament supply to the proper level. The procedure that follows pertains to boards marked PA.

a. After the preliminary procedure has been completed, connect the line cord to a variable power source (autotransformer) which is set to the voltage for which the transformer is wired.

b. Turn the Terminal power switch ON, and place the LOCAL/LINE switch at LOCAL.

c. Using a voltmeter which has .05% or better accuracy at 15 V, adjust R27 to obtain +15.000 V at the +15 V test point indicated in Fig. 4-5. (Connect the voltmeter reference lead to the ground point shown in Fig. 4-5.)

d. Measure the various power supply voltages as listed in Table 4-1. Test points are shown in Fig. 4-5. Record all voltages in Table 4-2. (Make duplicate copies of Table 4-2 for future use.)

TABLE 4-1
Power Supply Voltage Limits

Supply	Limits Voltage	Ripple (P-P)	Comments
+15 V	+14.025 to +15.075	10 mV	Adjust R27 for +15.000 V; readjust if necessary to compromise so that +15, +5, and –15 V supplies are all within limits with line voltage at mid-position as well as at high and low limit
+5 V	+4.9 to +5.1	10 mV	
–15 V	–14.850 to –15.150	10 mV	
–20 V Unreg	–17.6 to –22.4	2.8 V	Not adjustable
+20 V Unreg	+17.6 to +22.4	2.8 V	
+20 V Fil	35.5 to 41 V more positive than –20 V supply value	2.8 V	
+175 V Unreg	+155 to +195	6 V	
+328 V Unreg	+289 to +367	8 V	

Adjustment—4010 Maintenance

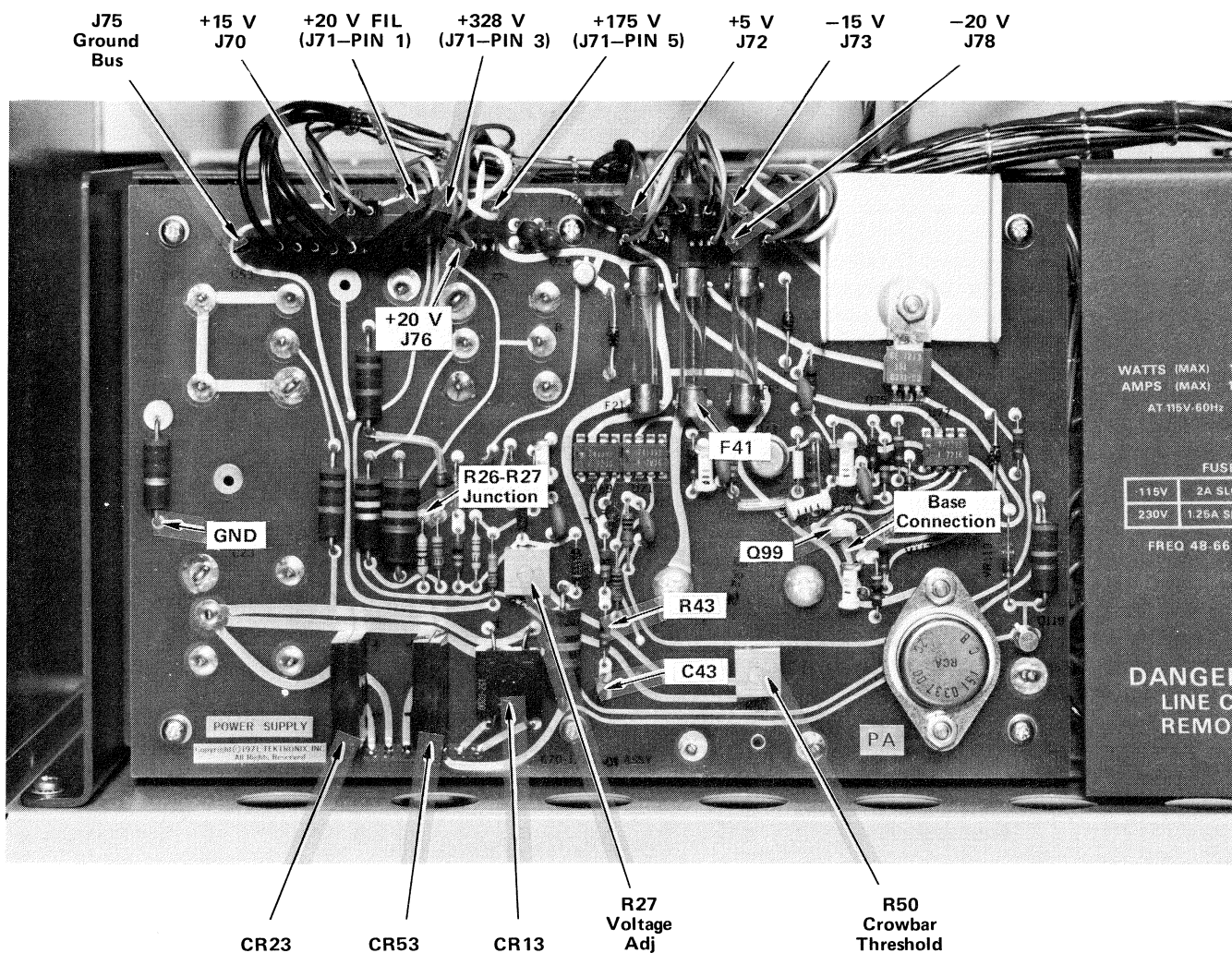


Fig. 4-5. Power Supply Adjustments and Test Points.

TABLE 4-2
Observed Voltages

Supply	(A) Center Line Voltage	(B) Low Line Voltage	(C) High Line Voltage	(D) Greater Deviation From (A)	% Observed Regulation $\frac{(D)}{(A)} \times 100$	Regulation Limit
+15 V						0.2%
+5 V						1.0%
-15 V						0.2%
-20 V						
Unreg						
+20 V						
Unreg						
+20 V Fil						
+175 V						
Unreg						
+328 V						
Unreg						
NOT APPLICABLE						

e. Using the test oscilloscope, check that ripple voltages do not exceed those values given in Table 4-1. If ripple appears excessive or marginal, move the voltage reference lead to the ground bus at J75 and recheck.

f. Change the variable power source to 10% below the center value for which the transformer is wired.

g. Measure and record the supply voltages, again using Tables 4-1 and 4-2. Then check the ripple of each supply.

h. Change the variable power source to 10% above the center value for which the transformer is wired.

i. Again measure and record the supply voltages and check ripple.

j. Analyze the results. All voltages should be within the specified values. The differences between voltages at center line and either high or low line should not show a regulation factor larger than that specified in Table 4-2.

k. Set the line voltage to the center voltage for which the transformer is wired.

2. +5 V Over-Voltage Check/Adjustment (R50—Crowbar, on Power Supply Board in pedestal)

a. Check the voltage at the base of Q99 for 4.8 V. Adjust R50 as necessary to obtain that value. See Fig. 4-5 for component locations.

b. Check over-voltage protection. A spare 6 A fast-blow fuse is needed for this check. If none is available, this step will have to be omitted.

(1) Using a shorting strap, momentarily connect the R26-R27 junction to the R43-C43 junction, expecting a flash from F41. See Fig. 4-5 for locations. The voltage at the +5 V test point indicated in Fig. 4-5 should drop to 0 V.

(2) Turn the Terminal power switch OFF and disconnect the line cord.

(3) Replace F41 with a new 6 A slow-blow fuse. (If F41 does not open, troubleshoot the power supply. All plugs should be removed from the board and dummy loads substituted during troubleshooting; logic circuitry may otherwise be damaged. Instructions are given in the Servicing Section. Check plug locations before removing, to insure their proper replacement.)

3. High Voltage Check/Adjustment (R82—HV, on High Voltage and Z Axis Board in display unit)

a. With the Terminal off, set the voltmeter to read -3850 V DC and connect it to TP64 on the High Voltage and Z Axis board in the back of the display Unit. See Fig. 4-6.

b. Reconnect the line cord and turn the Terminal power switch ON.

c. After about one minute, check for -3850 V at TP64. Adjust R82 (Fig. 4-6) as necessary to obtain that value.

d. Set the variable power source first to 10% below the transformer center voltage and then to 10% above it and check that the high voltage remains between -3735 and -3965 volts at both positions.

e. Set the variable power source to the transformer center voltage.

f. Turn the Terminal power switch OFF.

g. Disconnect the voltmeter from TP64.

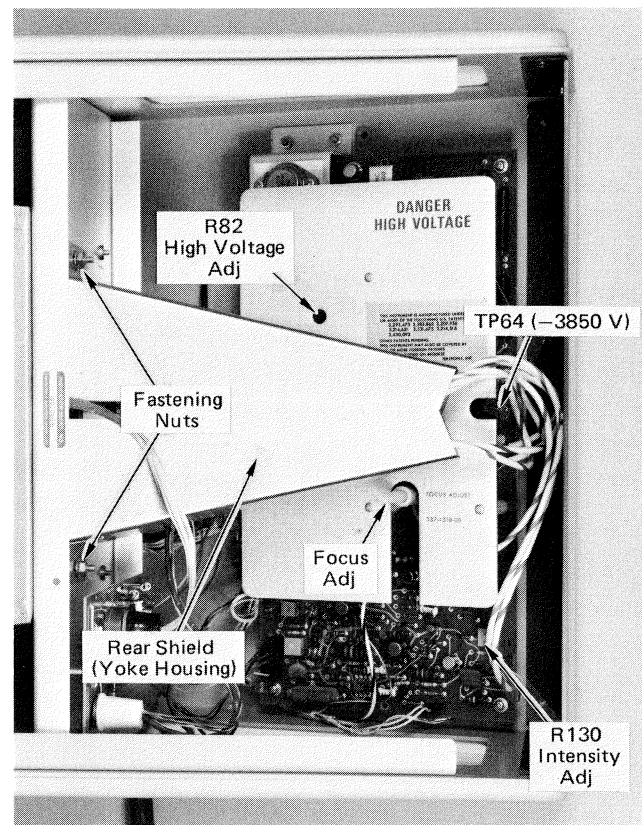


Fig. 4-6. High Voltage Adjustments and Test Points.

Adjustment—4010 Maintenance

4. Intensity Check/Adjustment (R130—Intensity, on High Voltage and Z Axis Board in display unit)

a. In this and subsequent steps employing Alpha Mode, the Terminal may go into Hold Mode, diminishing display brightness. Entering any character will restore the View Status; however, pressing the SHIFT key will restore View Status without otherwise affecting the display.

b. Turn the Terminal ON and after approximately one minute, momentarily press the PAGE key to initiate an erase and reset cycle.

c. Note the edges of the display area after the erase cycle has been completed. If the edges become obviously brighter than the rest of the display area (fade-positive, Fig. 4-9), turn the OP LEVEL (top-left in pedestal) fully counterclockwise. OP LEVEL will be adjusted properly in a later step.

d. At TC-1 in the top of the pedestal unit, turn R28 (Cursor Brightness) fully clockwise. (See Fig. 4-7 for location.)

e. Enter 37 space commands and 17 LINE FEED commands.

f. On the High Voltage and Z Axis board in the back of the display unit, rotate R130 (Intensity) to increase intensity until the Alpha cursor (located near display center) gets brighter and its flickering seems to diminish. The R130 location is shown in Fig. 3-5. (If the Alpha cursor doesn't appear, R28 on TC-1 may be set to the wrong limit.)

g. Press PAGE. The cursor should move to the top-left corner of the display. If the cursor was viewable in step f, and now has moved entirely out of the viewing area, turn X POS fully clockwise and Y POS fully counterclockwise to bring the cursor back into view.

h. Press PAGE and note that a dot appears at the bottom-left of the cursor position prior to the cursor coming back into view.

i. Alternately decrease the setting of R130 in small increments and press PAGE, until the dot can no longer be seen. The flickering cursor should remain.

5. Display Positioning Check/Adjustment (X GAIN, Y GAIN, X POS, Y POS, X GEOM, Y GEOM on Deflection Amp and Storage Board in pedestal)

NOTE

This procedure provides for an approximately centered display of specific size. Both positioning and size may be modified as desired by changing the adjustment parameters accordingly. All position and size measurements should be made with a minimum of parallax. This can be achieved by closing one eye and keeping the reflection of the viewing eye in line with the point being observed.

a. Enter CTRL SHIFT K and CTRL Z and place the keyboard thumbwheels near midrange. A crosshair cursor should appear on the display. If it does not, adjust the crosshair Brightness, R29, on TC-2 (R85 on boards numbered 670-1729-04 and lower) as necessary to obtain it. The R29 (R85) location is shown in Fig. 4-7.

b. Move the thumbwheels slightly and note if the previous crosshair position has stored on the display. If so adjust R29 (R85) to decrease the crosshair intensity slightly and repeat the check. Readjust R29 (R85) until the crosshair no longer shows.

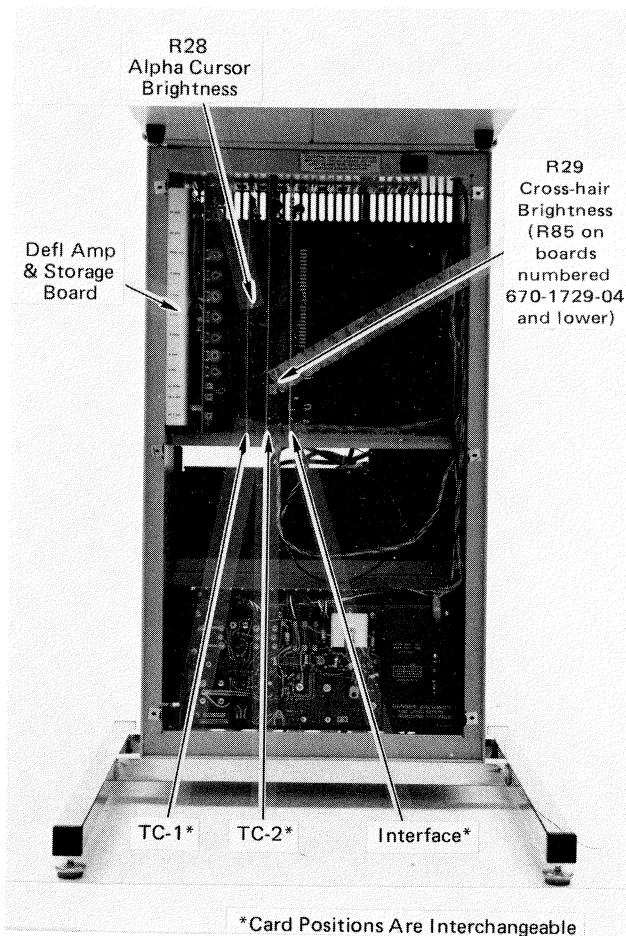


Fig. 4-7. Pedestal Circuit Card Information.

c. Put the vertical thumbwheel to its upper limit.

d. Enter PAGE and CTRL SHIFT K and CTRL Z to erase the display and regain the crosshair. (CTRL SHIFT K and CTRL Z must be entered to regain the crosshair cursor each time the display is erased, since PAGE also resets the Terminal to Alpha Mode.)

e. Check display positioning. It should meet the following requirements (see Fig. 4-8):

Horizontal line Should remain in view

Both ends occur before reaching edges of display area

Approximately centered horizontally in display area

Approximately 18.75 cm (7.4 inches) long

Parallel with top edge of display area

Deviation from mean straight line is within approximately 2.8 mm (0.11 inch)

Vertical Line

Bottom end occurs approximately 1.27 cm (0.5 inch) before reaching edge of display area.

Horizontal intercept is approximately 14 cm (5.5 inches) above bottom of vertical line

Approximately parallel with left edge of display area

When positioned near left edge of display area (by using horizontal thumbwheel), deviation from mean straight line is within approximately 2.1 mm (.08 inch)

f. If lines are excessively long, set X GAIN and/or Y GAIN (top-left in pedestal) fully counterclockwise.

g. Adjust display positioning as follows; adjustments are located near the top-left in the pedestal unless otherwise stated:

(1) Adjust X POS for approximate left-right centering of horizontal line.

(2) Adjust Y POS to approximately center the vertical line segment described by its lower end and the point of intercept with the horizontal line (vertical thumbwheel at upper limit). See Fig. 4-8.

(3) If necessary, rotate the yoke housing or yoke-mounting bracket (depending on type of assembly to obtain approximate parallelism between the ends of the horizontal line and the top edge of the display area. Two nuts hold the yoke housing in place behind the center divider in the display unit (Fig. 4-6). Final adjustment and tightening of the yoke housing is done in a later step.

(4) Adjust X GEOM for approximate straightness of the vertical line; vertical line to be positioned as close to the left edge of the display area as possible by using the horizontal thumbwheel.

(5) Adjust Y GEOM for approximate straightness of horizontal line, with vertical thumbwheel at its upper limit.

(6) Adjust X GAIN for 18.75 cm (7.4 inches) horizontal line length.

(7) Readjust X POS for horizontal line centering as necessary.

(8) Press PAGE and then enter four Zs. The Zs should store. If storing doesn't occur, increase the OP LEVEL setting while entering Zs until they store. Then press PAGE and again enter four Zs.

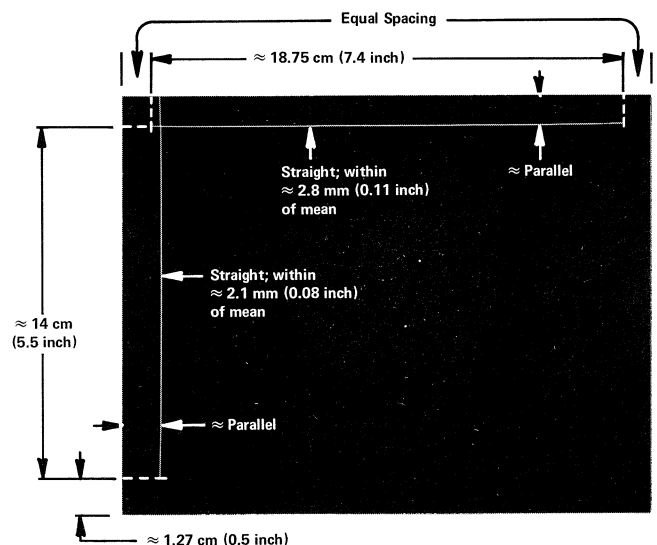


Fig. 4-8. Display Positioning, Using Cross-hair Cursor.

Adjustment—4010 Maintenance

(9) Enter CTRL SHIFT K and CTRL Z. The Zs should remain and the crosshair cursor should appear.

(10) Using the horizontal thumbwheel, place the vertical line so that it passes through a Z.

(11) Check vertical gain. The distance from the bottom of the vertical line to the bottom of a Z should be approximately 14.04 cm (5.53 inches). If it is not, adjust Y GAIN to compensate for 1/2 of the error, observing the adjustment effect at the bottom of the vertical line. Then repeat steps (8), (9), and (11).

(12) Check vertical position. The bottom of the vertical line and the top of the Z should be equidistant from their respective horizontal edges of the display area. If not, adjust Y POS to center the display vertically. Observe the bottom of the vertical line during adjustment. Then repeat steps (8), (9) and (12).

(13) Recheck parallelism between horizontal line and the top edge of the display area. Readjust the yoke housing rotation as necessary. Then tighten the yoke securing nuts.

(14) Recheck horizontal and vertical line straightness with lines positioned near the top and left edges, respectively. Readjust X GEOM for vertical line and Y GEOM for horizontal line straightness as necessary.

(15) Position the cursor lines to various places on the display area and check for line straightness. If necessary, readjust X GEOM and Y GEOM for best overall compromise.

6. Storage Check/Adjustment (NORM COLL, OP LEVEL on Deflection Amp and Storage Board in pedestal)

a. Perform this step for adjusting a Terminal in which the CRT has not just been changed.

(1) Note the CE voltage value written on the tag attached to the top of the CRT shield. Check for that value at pin 30 on the extender card which was installed during the preliminary procedure.

(2) Adjust NORM COLL (R257, on edge of card which is attached to the extender) to obtain the specified value at pin 30.

(3) Note the STORAGE LEVEL value written on the tag attached to the top of the CRT shield. Check for that value at pin 33 on the extender card.

(4) Adjust OP LEVEL (R222, on edge of extended card) to obtain the specified value.

(5) Put the LOCAL/LINE switch at LINE. Then go to step c.

b. Perform this step for adjusting a Terminal in which the CRT has just been changed.

(1) Adjust NORM COLL (R257, on edge of card which is attached to the extender) to obtain +100 V DC at pin 30 on the extender card.

(2) Connect the voltmeter to pin 33 on the extender card, expecting approximately +200 V DC.

(3) Set OP LEVEL (R222, on edge of extended card) fully counterclockwise. Then adjust it clockwise in moderate increments, pressing PAGE between increments, until a point is reached where the edges of the display area start to become obviously brighter, or "fades positive". (See Fig. 4-9). Record the voltage which exists on pin 33.

(4) Put the LOCAL/LINE switch at LINE and press the 8 key. The display should fill with 8s.

(5) Turn the OP LEVEL counterclockwise until the displayed numbers appear to degrade due to dots disappearing (dropping out). See Fig. 4-9. Record the pin 33 voltage at which this occurs. (Press the SHIFT key as necessary to maintain View status.)

(6) Determine the mid-voltage between the two recorded voltages. Set the OP LEVEL to obtain this value at pin 33.

c. Press PAGE and then press 8. The display should become filled with 8s. Wait approximately five minutes and view the display, checking for drop-out or fade-positive conditions. If drop-out occurs, adjust the OP LEVEL positive in five-volt increments and repeat the check. If fade-positive occurs, adjust in five-volt negative increments and repeat the check. (If both conditions occur, the CRT is near the end of its useful life, and a slight fade-positive condition must be tolerated if drop-out is to be avoided.)

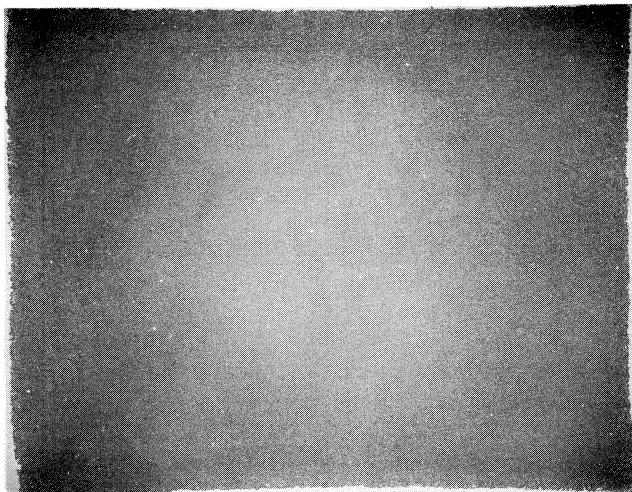
d. Upon completion of step c, measure the voltage at pin 33 on the extender card and write that value opposite STORAGE LEVEL on the tag on the CRT shield. Simply cross out the old value without obliterating it.

7. Cursor Brightness Check/Adjustment (R28—Cursor Brightness, on TC-1 in the pedestal)

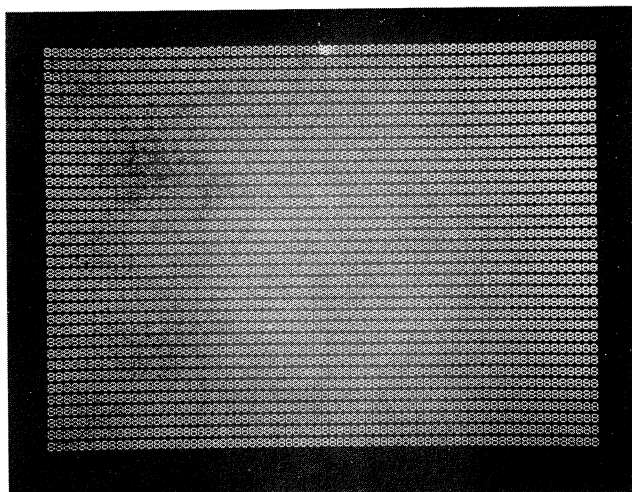
a. Put the LOCAL/LINE switch at LOCAL. Press PAGE to erase the display.

b. Note the intensity of the Alpha cursor. It should be bright enough for convenient viewing, but not so bright that it stores.

c. Adjust Cursor Brightness (R28 on edge of TC-1) to obtain the desired intensity. See Fig. 4-7 for adjustment location.



(A) Fade-Positive



(B) Drop-Out

Fig. 4-9. Display Conditions.

8. Corner Focus Check/Adjustment (FOCUS ADJUST on High Voltage and Z Axis Board in display unit)

a. Press PAGE. Enter a K and note the appearance of its two diagonal legs. They should appear similar. The dots which make up the lines should be round.

b. Adjust FOCUS ADJUST (alongside yoke housing in display unit—Fig. 4-10) in small increments, pressing K after each adjustment, until the dots achieve optimum roundness and the two diagonal legs appear similar. Press PAGE as necessary to keep writing in the corner of the display area.

c. Switch the LOCAL/LINE switch to LINE. Press K and the display should fill up with Ks. Compare the letters in the four corners. They should appear similar. If noticeable difference exists, slightly adjust FOCUS ADJUST, pressing PAGE and K and then recheck. Repeat until the best focus compromise is achieved for the four corners.

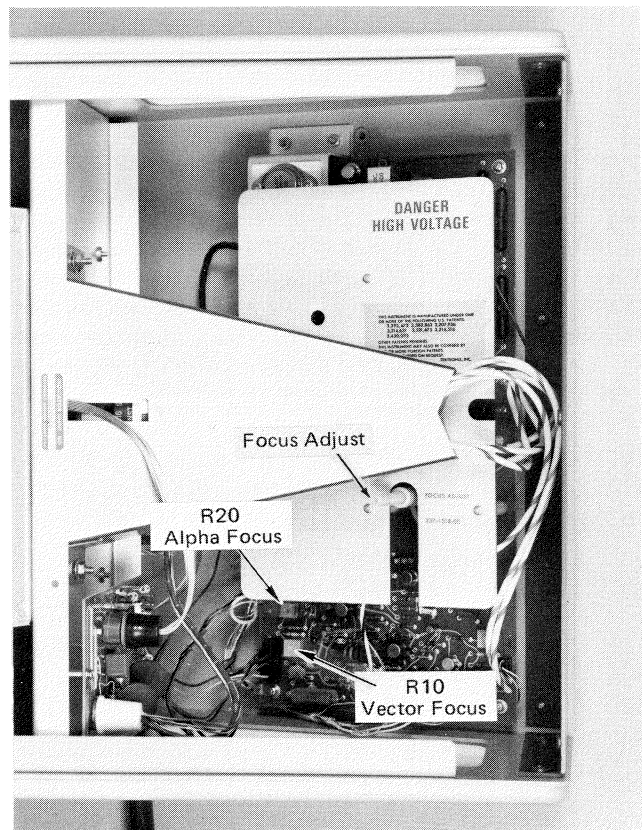


Fig. 4-10. Alpha Focus and Vector Focus Adjustment Locations.

9. Alpha Focus Check/Adjustment (R20—Alpha Focus, on High Voltage and Z Axis Board in display unit)

a. With a page full of Ks displayed as in step 8, check the center focus. It should be comparable to the corner focus.

b. To adjust, proceed as follows:

(1) Place LOCAL/LINE switch at LOCAL.

(2) Press PAGE.

(3) Using the Space Bar, LINE FEED, RETURN and K keys, enter several Ks in each of the four corners. Then position the cursor to the center of the display area.

(4) Alternately enter a K and adjust Alpha Focus (R20 in the display unit; Fig. 4-10) until center focus and corner focus are approximately the same.

c. Place the LOCAL/LINE switch at LINE. Then press PAGE.

d. Enter an 8 and the display should fill with 8s.

e. Check display. If uniform focus has been achieved and NORM COLL is properly set, the overall display should have approximately even brightness. If it appears to intensify or dim out as it approaches center, recheck the center focus against the corner focus. If this appears satisfactory, adjust NORM COLL (on extended card in pedestal) while observing the display. Adjust for most uniform intensity. This should occur slightly clockwise of point of brightest display.

10. Crosshair Cursor Intensity Check/Adjustment [R29 (R85 on TC-2 boards numbered 670-1729-04 and lower)—Cursor Brightness, on TC-2]

a. Put the LOCAL/LINE switch at LOCAL.

b. Press PAGE. Then enter CTRL SHIFT K and CTRL Z to obtain a crosshair cursor.

c. Move the thumbwheels and check to see if cursor stores.

d. If necessary, adjust R29 (R85) on TC-2 (see Fig. 4-7 for location of adjustment) so that the cursor can be seen but does not store.

11. Vector Focus Check/Adjustment (R10—Vector Focus, on High Voltage and Z Axis Board in display unit)

a. With the LOCAL/LINE switch at LOCAL and the crosshair cursor displayed, enter CTRL SHIFT M to put the Terminal in a pseudo vector mode. (See Fig. 4-11.) Note that the Terminal will not produce the display shown in Fig. 4-11 unless TSTROBE is connected to CSTROBE as explained in the Preliminary Procedure.

b. Place the rounded segments of the crosshair cursor at the center of the display area, using the thumbwheels.

c. Adjust Vector Focus (R10 in display unit; Fig. 4-10) for sharpest focus of the line segments near the center of the display area.

d. Turn the Terminal off. Remove the TSTROBE to CSTROBE jumper which was installed during the preliminary procedure. Then turn the Terminal on.

12. Vector Drawing Time Check

a. Connect the oscilloscope probe to pin 2 on the extender card. Set the oscilloscope sensitivity to 2 V/division and the sweep rate to 1 ms/division.

b. Press PAGE. Then enter CTRL SHIFT M.

c. Repeatedly press A at the keyboard, while checking the oscilloscope waveform.

d. CHECK—The negative-going waveform on the oscilloscope should be approximately 2.6 ms.

13. Vector Dynamic Geometry Error Check

a. Press PAGE. Then enter CTRL SHIFT M.

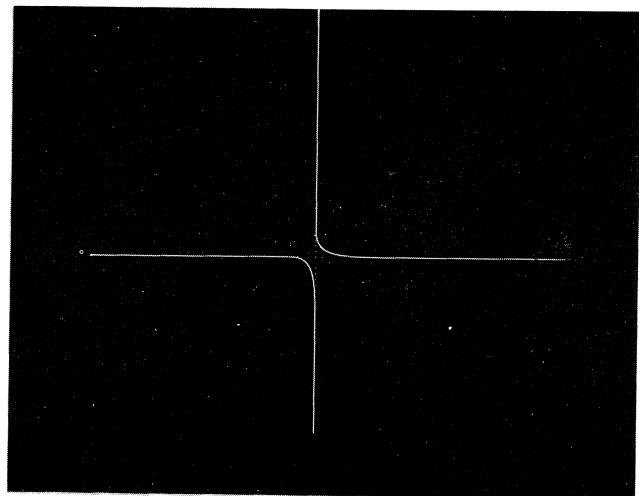


Fig. 4-11. Vector focus Display.

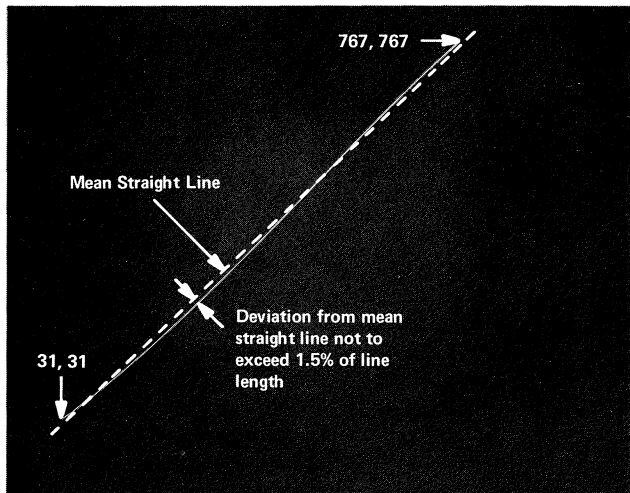


Fig. 4-12. Vector Dynamic Geometry Error.

b. Enter Space RUBOUT Space _ to set the beam to 31, 31.

c. Enter 7 RUBOUT 7 _ to draw a vector from 31, 31 to 767, 767.

d. CHECK—Deviation from a mean straight line should not exceed 1.5% of the line length. See Fig. 4-12. [If the gain were adjusted in accordance with this procedure, the line length should be approximately 19.1 cm (7.52 inches), and deviation from a mean straight line should not exceed approximately 3 mm (actually 2.865 mm) or 1/8 inch at any point.]

e. If the deviation from the mean straight line exceeds the specified amount, repeat step 5.

14. Vector Parallelism Check

a. Enter PAGE and CTRL SHIFT M.

b. Enter the following sequence to draw a rectangle:

```
Space RUBOUT Space @
7 RUBOUT Space @
7 RUBOUT ? _
Space RUBOUT ? _
Space RUBOUT Space @
```

c. Measure the length of all lines.

d. CHECK—Parallelism. The difference in the length of the horizontal lines should not exceed 2% of the vertical line length. The difference in the length of the vertical lines should not exceed 2% of the horizontal line length. With the Terminal adjusted as outlined in this procedure, the line length is approximately as follows: horizontal—18.75 cm (or 7.4 inches); vertical—13.48 cm (or 5.31 inches). Line length difference should not exceed: horizontal—approximately 2.7 mm (0.11 inch); vertical—approximately 3.8 mm (0.15 inch).

15. Control Character Response Check

a. With the LOCAL/LINE switch at LOCAL, enter the following at the keyboard and check the response:

CONTROL CHARACTER RESPONSE CHECK

Command	ASCII Equivalent	Response
CTRL G	BEL	Rings bell
CTRL I	HT	Moves cursor one space to right
CTRL H	BS	Moves cursor back one space
CTRL J	LF	Moves cursor down one line
CTRL K	VT	Moves cursor up one line
CTRL SHIFT M	GS	Selects Graph Mode
Space RUBOUT Space _ + RUBOUT ϕ @	SP DEL SP _ + DEL ϕ @	Draws a vector
CTRL SHIFT K and CTRL L	ESC FF	Erases display, homes cursor
CTRL SHIFT M	GS	Selects Graph Mode

CONTROL CHARACTER RESPONSE CHECK (cont)

Command	ASCII Equivalent	Response
@ @	@ @	Writes a point
CTRL SHIFT O	US	Switches back to Alpha without moving writing beam
CTRL SHIFT M	GS	Selects Graph Mode
@ _	@ _	Draws a vector
CTRL M	CR	Switches back to Alpha and moves writing beam to margin ϕ
CTRL SHIFT K and CTRL Z	ESC SUB	Selects Gin Mode and displays crosshair cursor
Put LOCAL/LINE switch at LINE; then enter any character at keyboard and return LOCAL/LINE switch to LOCAL		Crosshair cursor disappears and Alpha cursor re-appears

b. If a 4010-1 is being adjusted, and a Hard Copy Unit is available, proceed with the next step. Otherwise, go to step 22.

16. (4010-1 Only) Hard Copy Interrogate Pulse Width Check/Adjustment (HC INTERR on Deflection Amp and Storage Board in pedestal)

a. Turn the Terminal off and replace the TSTROBE to CSTROBE jumper which was removed in step 11d. Then turn the Terminal on.

b. Connect the Hard Copy Unit to the Terminal, via J525 which is located on the back of the pedestal unit.

c. Remove the paper from the Hard Copy Unit or disengage the paper drive. Then energize the Hard Copy Unit.

d. Connect the test oscilloscope to pin 4 on the extender card. Set the oscilloscope for a 300 ns 5 V signal. (0.1 μ s and 2 V/division recommended, including probe.)

e. Press MAKE COPY and observe the negative-going pulses. They should be approximately 300 ns duration at mid amplitude.

f. Adjust HC INTERR (on extended card) for 300 ns pulses. Press MAKE COPY as often as necessary to complete the adjustment.

17. (4010-1 Only) Hard Copy Amplitude Check/Adjustment (HC Y AMP, HC X AMP on Deflection Amp and Storage Board in pedestal)

a. Turn the Hard Copy Intensity (side of Terminal display unit—Fig. 4-13) fully clockwise.

b. Set the HC X AMP potentiometer (on extended card) fully counterclockwise. (This step assumes that the Terminal is wired so that the scan bar moves vertically on the display. If the Terminal is connected so that the bar moves horizontally, set the HC Y AMP potentiometer fully counterclockwise, rather than HC X AMP. Then adjust HC X AMP first in a manner similar to that described in the following steps.)

c. Put the LOCAL/LINE switch at LINE.

d. Press PAGE; then press 8 to write a page full of 8s.

e. Press MAKE COPY. The Hard Copy scan bar should store on the display area, but should be narrower than the stored 8s. (If no scan bar appears, Hard Copy Intensity on the side of the display unit may be in the wrong limit. If the scan bar appears and is wider than the stored 8 display, the HC X AMP potentiometer may be in the wrong limit.)

f. Check Hard Copy Y amplitude. The stored scan bar should extend approximately 1/4 inch below and 1/8 inch above the stored 8s, as in Fig. 4-14.

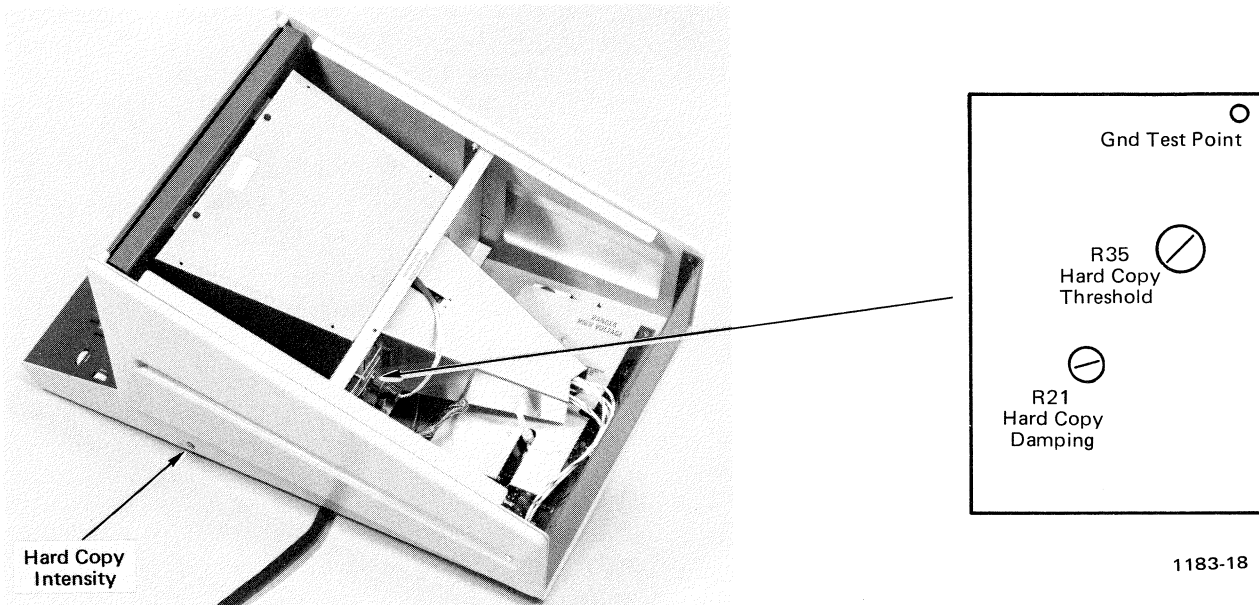


Fig. 4-13. Hard Copy Adjustment on Display Unit.

g. Adjust HC Y AMP (on extended card) in small increments, repeating steps d, e, and f until desired results are obtained. If the specified distance cannot be achieved both below and above the 8s, let the shorter end determine the setting.

h. Press PAGE and 8 to refill the page.

i. Insert the screwdriver in the HC X AMP potentiometer on the extended card.

j. Press MAKE COPY and adjust HC X AMP as the bar scans the display area, until the bar extends approximately 1/8 inch beyond each side. Again let the shorter end determine the setting. Press PAGE and 8 if necessary to refill the screen to complete the adjustment.

18. (4010-1 Only) Hard Copy Intensity Adjustment. (Hard Copy Intensity on side of display unit)

a. Press PAGE and MAKE COPY. Adjust Hard Copy Intensity (side of display unit) to a point just below that at which the scan bar stores. Repeat as necessary to eliminate storing at all points on the display area.

19. (4010-1 Only) Hard Copy Damping Check/Adjustment (R21—Hard Copy Damping on Hard Copy TARSIG Amplifier Board in display unit)

a. Set the test oscilloscope for 0.2 V/division and 0.5 μ s/division. Connect the channel 1 probe to TP32 on the Hard Copy TARSIG Amplifier board, attaching the probe ground lead to the ground test point (Fig. 4-13).

b. Set the oscilloscope for external triggering and connect a probe from the external trigger jack to pin 2 on the extender card in the pedestal.

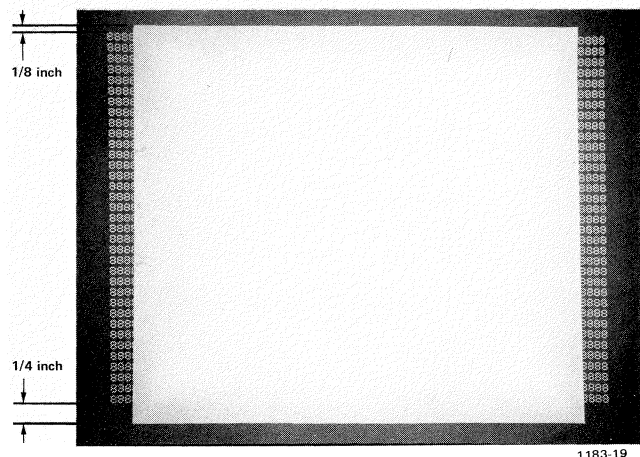


Fig. 4-14. HC Y AMP Adjustment Display.

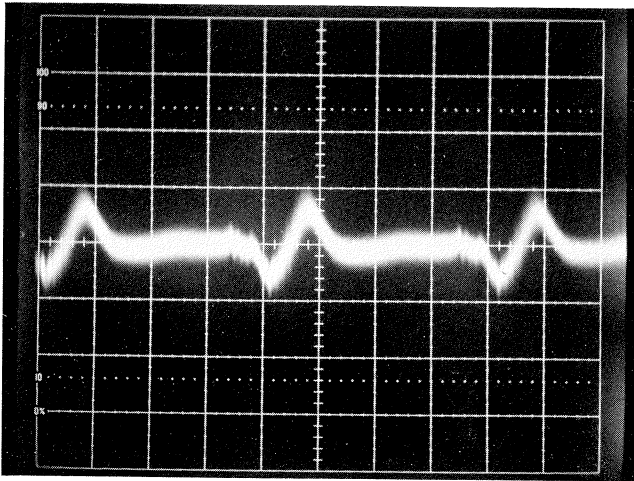
Adjustment—4010 Maintenance

c. Press PAGE and then press MAKE COPY. Adjust the oscilloscope triggering to obtain a stable display. The pulses resulting from scanning an empty screen should appear as in Fig. 4-15A.

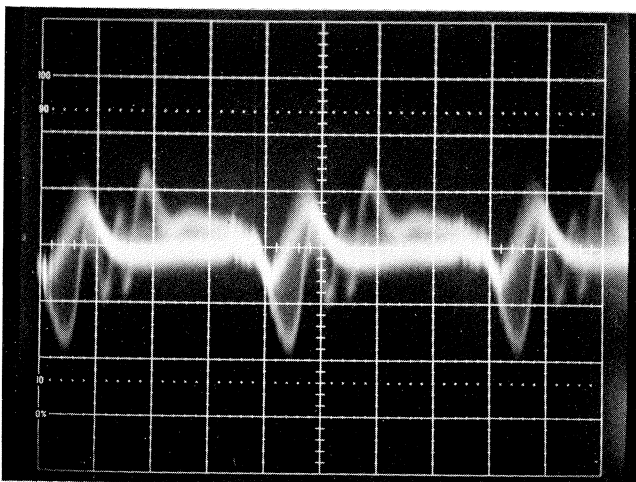
d. Preliminary adjustment. Adjust Hard Copy Damping (R21 on the Hard Copy TARSIG Amplifier board, Fig. 4-13) for maximum negative pulse amplitude with minimum ringing as in Fig. 4-15A.

e. Press 8 to fill the display. Then press MAKE COPY and observe the oscilloscope for a waveform as in Fig. 4-15B.

f. Readjust Hard Copy Damping to obtain maximum negative-going pulses with minimum ringing. The negative-going ringing should be half or less of the amplitude of the main negative-going pulses. See Fig. 4-15B.



(A) Waveform resulting from scanning an empty screen



(B) Waveform resulting from scanning a full screen 1183-20

Fig. 4-15. Hard Copy Damping waveforms; 0.2 V/division vertical, 0.5 μ s/division horizontal.

20. (4010-1 Only) Hard Copy Threshold Check/Adjustment (R35—Hard Copy Threshold, on Hard Copy TARSIG Amplifier Board in display unit)

a. The oscilloscope remains connected as in step 19.

b. Connect a probe from channel 2 of the oscilloscope to TP30 on the Hard Copy TARSIG Amplifier board (Fig. 4-13). Connect the probe ground lead to ground.

c. Set the oscilloscope for alternate trace operation, with each channel set for 0.2 V/division; sweep rate 0.5 μ s/division. (Neither channel should be inverted.) Set both input switches to ground and set both traces to the same reference point. Then switch both input switches to DC.

d. Press PAGE and 8 to refill the display.

e. Press MAKE COPY and observe the oscilloscope display for a waveform as in Fig. 4-16. The channel 1 display (TP32) should be above the channel 2 display, and the written pulses should overlap for approximately 1/3 of the distance between the two traces. Ringing should remain well separated. (Trace separation will probably end up being between 0.4 and 0.8 V.)

f. Adjust Hard Copy Threshold (R35, Fig. 4-13) to obtain a display as in Fig. 4-16.

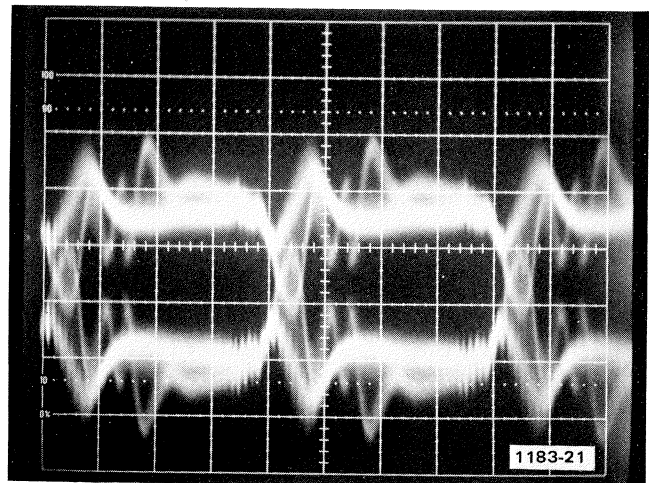


Fig. 4-16. Hard Copy Threshold Waveform; 0.2 V/division vertical, 0.5 V/division horizontal.

21. (4010-1 Only) Hard Copy Writing Check

a. Re-install the paper in the Hard Copy Unit or engage the paper drive, as appropriate.

b. Press PAGE and 8 to write a full page on the display unit.

c. Press MAKE COPY.

d. Examine the copy for writing quality. Assuming that the Hard Copy Unit is properly adjusted, writing quality is controlled by the following adjustments in the Terminal:

Condition	Possible Fixes
Information does not copy or information drop-out occurs	Increase Hard Copy Intensity setting on side of display unit (step 18) Adjust R35 to increase pulse overlap (step 20); Adjust R21 to increase pulse amplitude at TP32 (step 19); Adjust HC INTERR (top-left in pedestal) for 300 ns pulses at pin 2 on extender card (step 16).
Excessive background writing (noise)	Inverse of all fixes appearing immediately above.
Information missing around perimeter	Underscan caused by HC X AMP and/or HC Y AMP (top-left in pedestal) set too low (step 17).
Copy too small	HC X AMP and/or HC Y AMP set too high; step 17.

e. If the copy appears satisfactory, make five copies of the same full page display. The fifth copy should remain satisfactory, with minimum degradation due to repetitive scanning of the displayed data.

f. Disconnect the probes from the display unit.

22. Restoring Original Conditions

a. Turn the Terminal OFF and disconnect the line plug from the power source.

b. Remove the transformer protection plate and the line fuse.

c. If necessary, rewire the Terminal transformer to its previous configuration.

d. Replace the transformer protection plate.

e. Reset the option straps on TC-1 and the Interface Card to the condition recorded in the Preliminary Procedure.

f. Remove the jumper straps which were installed in the Preliminary Procedure. (Data Communication Interface 021-0065-00 on J360 and U67; Optional Data Communication Interface 021-0074-00 between U68 and U47; TTY Port Interface on J161 and J162.)

g. Reconnect the output cable to the Interface Card if a Data Communication Interface 021-0065-00 or a TTY Port Interface is installed; reset the rear panel switches to their previous positions if an Optional Data Communication Interface 021-0074-00 is in use.

h. Remove the extender card and install the Deflection Amp and Storage Card directly into the mother board, being careful not to disturb the adjustments. Replace the three screws (through the back of the pedestal) into the heat sink.

i. Install any accessory cards which are to be used with the Terminal. If desired, check them out, referring to their documentation.

j. Check that the proper fuse is installed in the pedestal cover (2 A slow blow for 115 V, 1.25 A slow blow for 230 V) and then replace the cover.

k. If desired, install the display unit on the pedestal unit, following the procedure in Fig. 3-1.

