

Tektronix®
COMMITTED TO EXCELLENCE

4631
HARD COPY UNIT

USER'S MANUAL

Tektronix, Inc.
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Fig. 1-1. 4631 Hard Copy Unit.

Section 1

Operating Instructions

Introduction

The 4631 Hard Copy Unit (Fig. 1-1) makes permanent, high-contrast copies from Tektronix 4010-family Storage Display Terminals and Tektronix 613 and 613-1 Storage Display Units. A copy is produced when a remote copy command is applied, or when the COPY button on the front panel is pressed.

After the image is applied to the paper (as it passes in front of the crt within the unit), the paper is cut and the image is heat-developed within the processor. The paper copy is then ejected into the paper tray in the top of the cover.

Safety Considerations

During processing, the 3M Dry Silver paper gives off an organic sublimate which condenses on the cooler surfaces of the Hard Copy Unit. Toxicologic tests conducted by 3M Company indicate that this substance is not toxic.

Tektronix recommends that its Hard Copy units be operated in a normally ventilated room. Some may experience an allergic reaction from inhaling the substance at concentrations that could be reached in an unventilated room.

Standard Accessories

The following standard accessories are included with the Hard Copy Unit:

- | | |
|----------------------------------------|-------------|
| 1 Users Manual | 070-1830-01 |
| 1 10-foot 15-pin interconnecting Cable | 012-0547-00 |

Hard Copy Paper

One roll of 3M® Type 777 Dry Silver Paper (Tektronix Part No. 006-1603-00) is included with the Hard Copy Unit. Refills may be purchased from Tektronix, Inc. using the above part number for single rolls. Paper may also be purchased in cartons of four rolls (Part No. 006-1603-01).

Loading the Paper Cassette

Connect the Hard Copy Unit power cord to the power line, then proceed with the following instructions. It is assumed that the Hard Copy Unit is installed as described in Section 3. Refer to Figs. 1-2a and 1-2b for nomenclature identification.

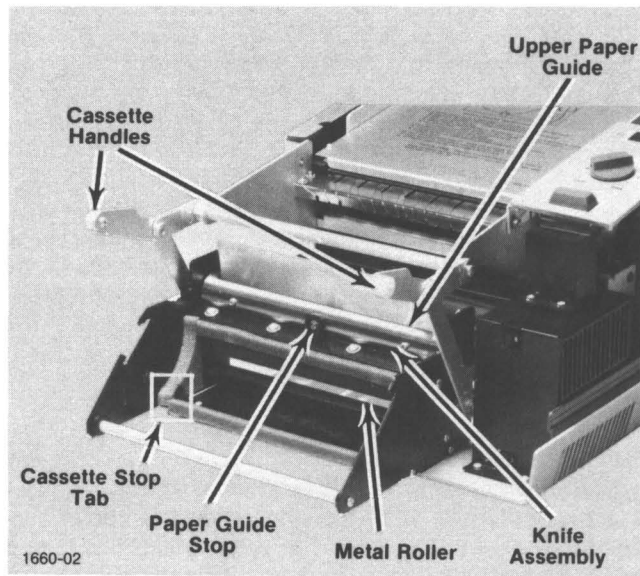
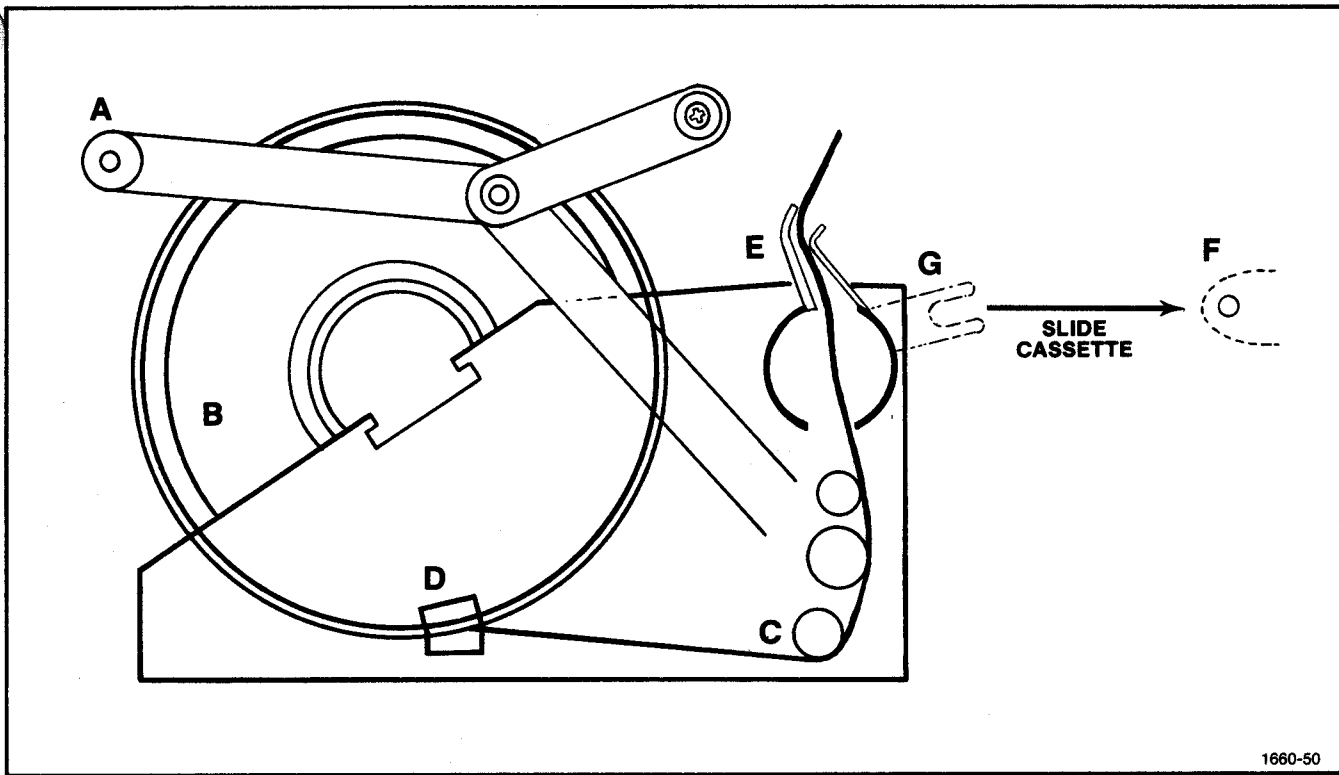


Fig. 1-2a. General paper loading illustration (right side of unit)



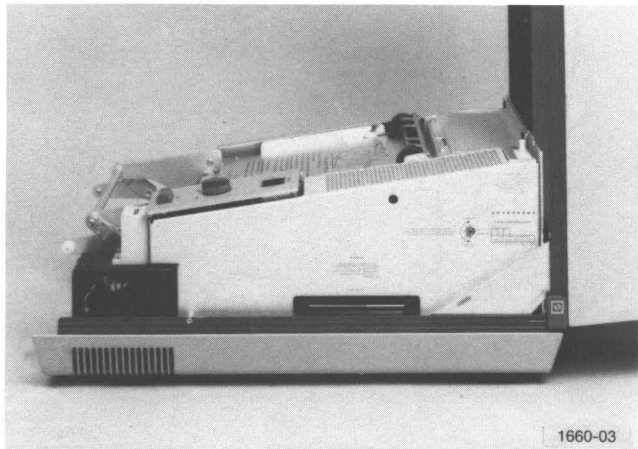
1680-50

Fig. 1-2b. General paper loading illustration.

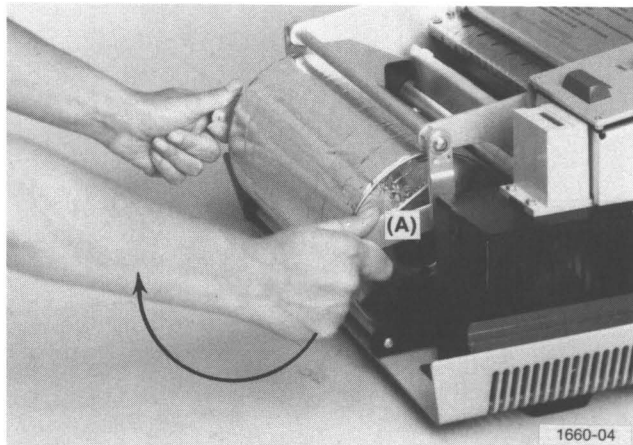
WARNING

Dangerous electrical potentials exist at several points throughout this instrument. Some transistor cases operate at fairly high voltage levels. When the unit is operated with the cover opened, do not touch the exposed connections or components. Disconnect power before cleaning the instrument or replacing parts.

1. Lift the instrument cover, and push it all the way back to latch it in the "up" position.



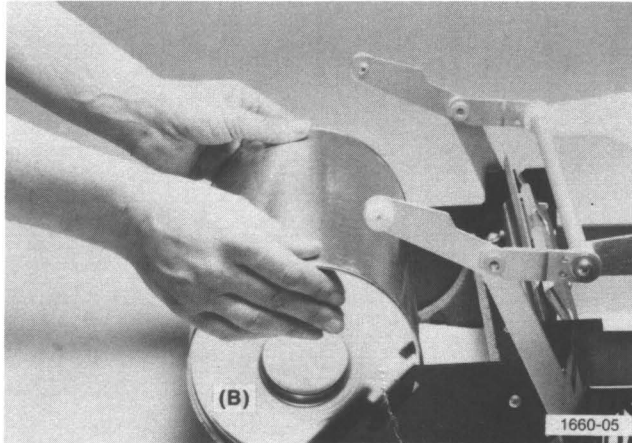
2. Push the cassette handles (A) down, then pull them out in an upward arc.



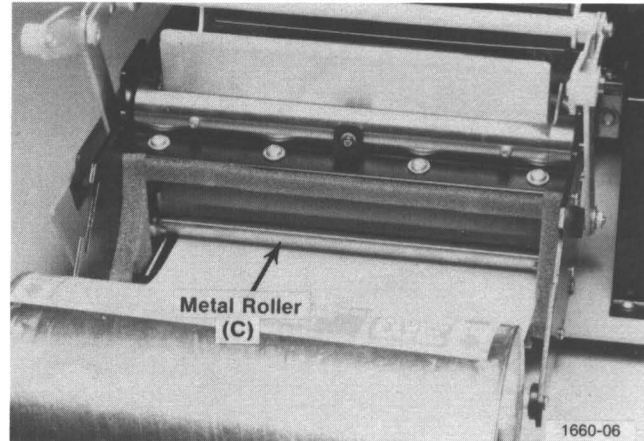
NOTE

Ignore the instructions printed on the cassette label.

3. If a paper cassette is installed (B), remove the cassette. (For shipment, a cassette is packed separately in the Hard Copy Unit shipping carton.)



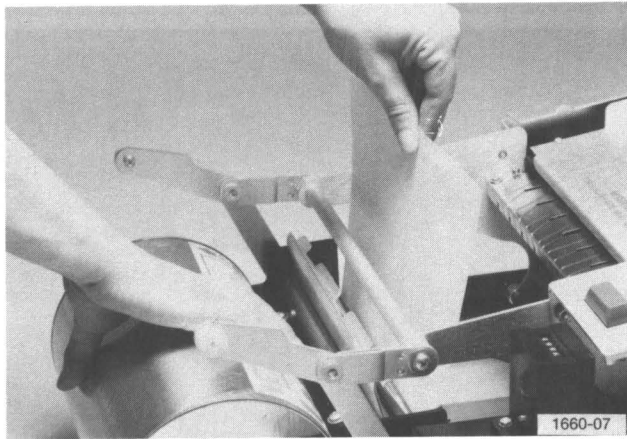
4. Tear the metallic light seal strip off the new paper cassette (B), and pull out 18 inches of paper. Insert the paper end under the metal roller (C), centered between the white lines marked on the cassette holder bottom plate.



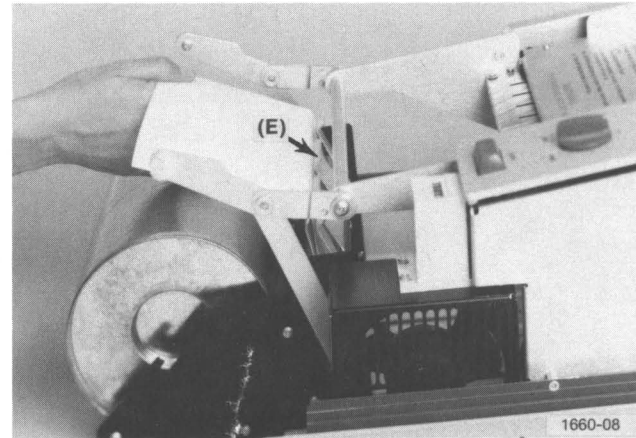
WARNING

Do not insert fingers into the opening at the bottom of the knife assembly. The sharp, paper-cutting edges are located at that point.

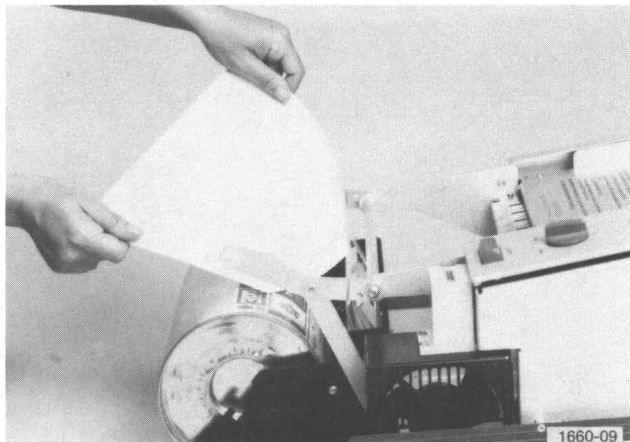
5. Pick up the paper end and take up the slack while placing the cassette cannister (B) into the frame. Rotate the cassette to engage the locator (D) into the cassette slot.



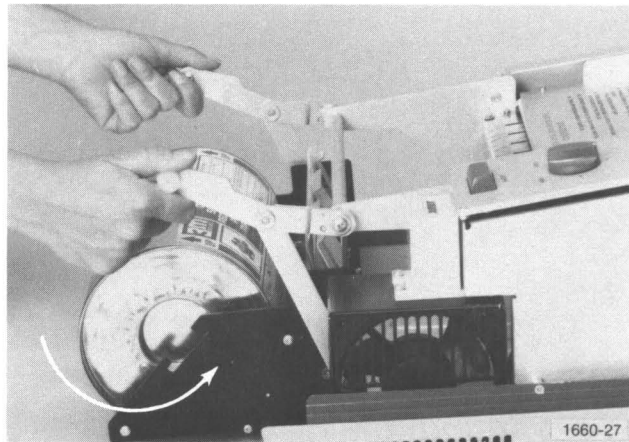
6. Pull the upper paper guide (E) toward the paper cassette until the stop contacts the guide bar. Thread the paper end up through the bottom of the knife assembly, and out the top of the upper paper guide.



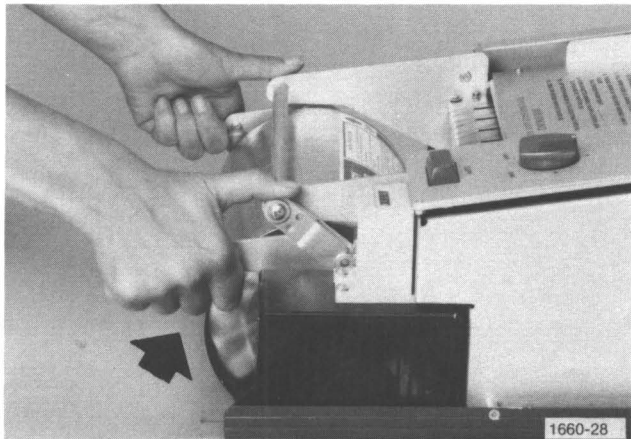
7. Pull the excess paper tight, and tear off evenly at the guide plate (E).



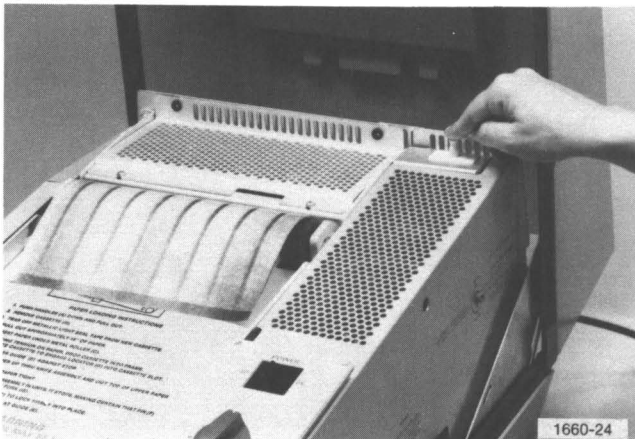
8. Check that the stop on the paper guide is still against the guide bar, then push the cassette assembly in until it stops, making certain that pin (F) is engaged by fork (G).



9. Lift both handles (A) to lock the cassette assembly firmly into place.



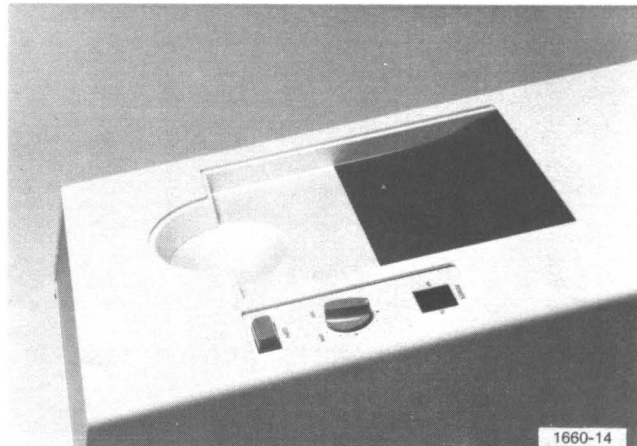
10. Push the POWER switch on, then depress the cover interlock button (upper right rear corner) two seconds to recycle.



11. Lift the cover latch (lower right-rear corner) and close the cover.



12. Push the COPY button and discard the first copy (which will be black because of exposure to light.)



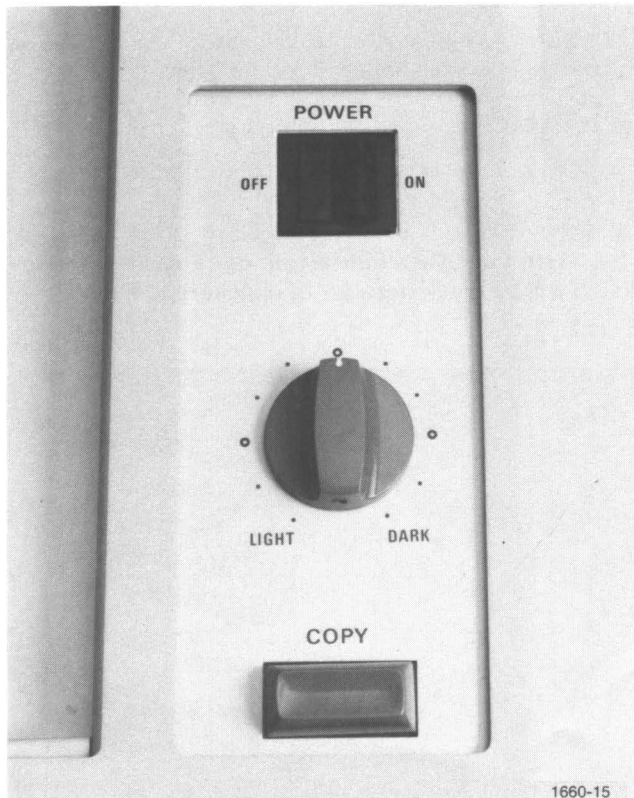


Fig. 1-3. The Control Panel.

The Control Panel (Fig. 1-3)

POWER. The POWER switch is a rocker switch that applies operating power to the electronic circuits, drive motor, and paper processor.

LIGHT-DARK. The LIGHT-DARK control varies the darkness of the delivered copy.

COPY. The COPY switch is a pushbutton that initiates production of a paper copy from the Hard Copy Unit.

Operating the Hard Copy Unit

Make certain that the Hard Copy Unit is properly wired for the available voltage supply and the POWER switch is in the ON position; the unit is connected to a power source and to the terminal or display unit; the paper cassette is loaded; and that a 10-minute warmup period is observed. (Installation and wiring instructions are located in Section 3.)

Making a copy then requires only that the control panel COPY pushbutton be pressed, or a remote copy command applied.

When the paper supply is depleted (indicated by red marks on the last few copies), replace the paper cassette using the procedure given under "Loading the Paper Cassette." Incorrect loading of the paper can result in paper jams or a copy not being delivered.

Except for the processor temperature, internal adjustments should be made only by qualified technical personnel. (See information under "Processor Temperature Adjustment" in Section 2.)

Section 2

Correcting Copy Problems

Cause and Correction of Paper Jams

Since paper jams can occur as a result of incorrect paper loading, be sure the instructions under "Loading the Paper Cassette" in Section 1 are carefully followed. If the paper is correctly loaded, check that the power cord is plugged in and that the POWER switch is in the ON position. If, under these conditions, no copy is delivered when the COPY button is pushed, proceed to the flow chart (Fig. 2-1).

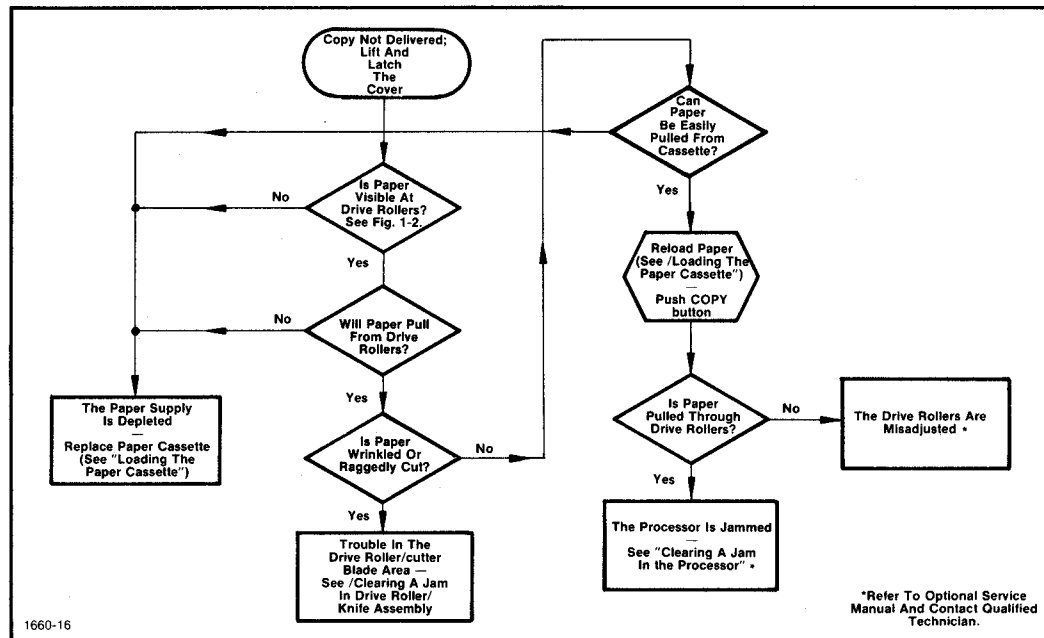


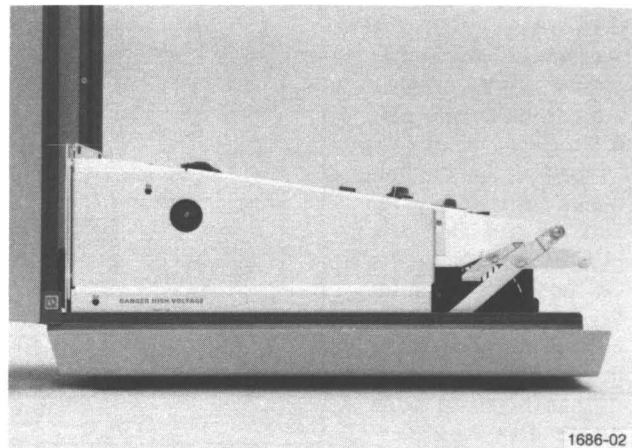
Fig. 2-1. Troubleshooting flow chart.

Clearing a Jam in the Drive Roller/Knife Assembly

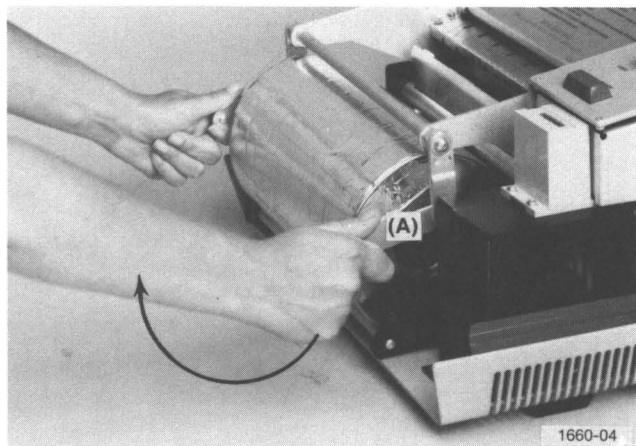
WARNING

Before attempting to clear a paper jam, be sure to remove or secure anything which might come in accidental contact with the drive rollers or chains (i.e., jewelry, necktie, long hair, shirt-tail, etc.).

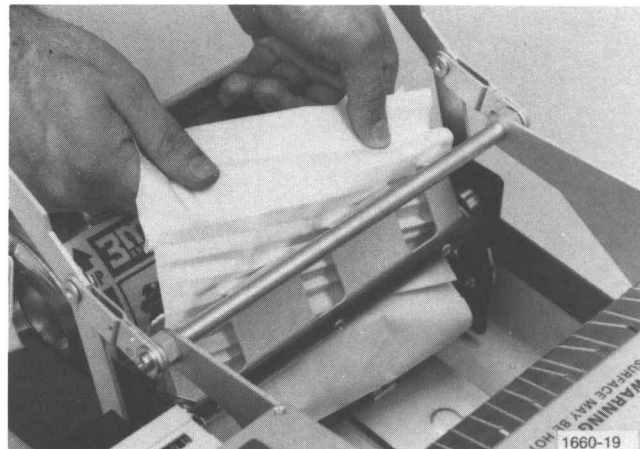
1. Lift the instrument cover, and push it all the way back to latch it in the "up" position.



2. Push the cassette handles down, then pull them out in an upward arc.

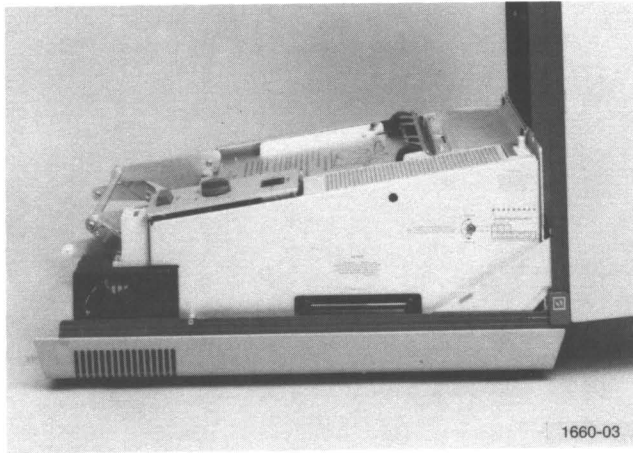


3. Remove the wrinkled and jammed paper from within the knife assembly. Scraps of paper which cannot be removed may be reached with tweezers. After the paper jam is cleared, reload the paper, using the procedures given under "Loading the Paper Cassette."

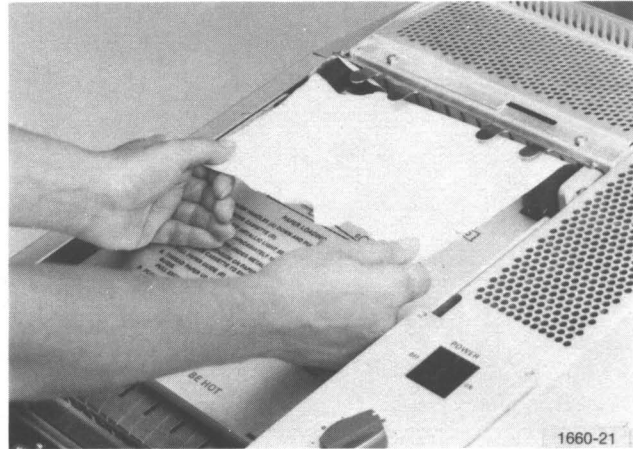


Clearing a Jam in the Processor

1. Push the POWER switch OFF. Make certain the instrument cover is latched in the "up" position.



2. Clear paper which may be wrinkled and jammed against the paper guide at the back edge of the processor.



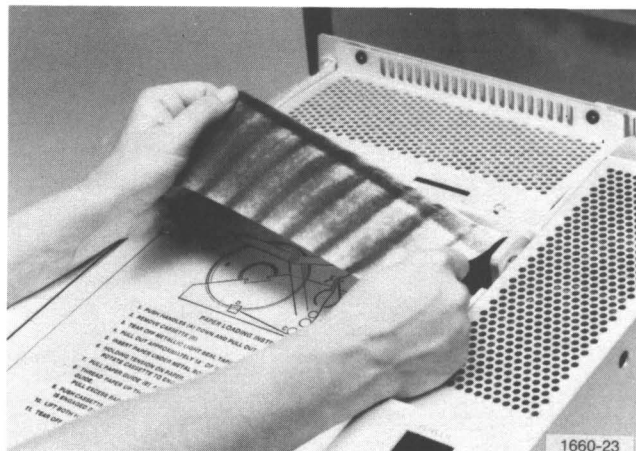
WARNING

When working around the processor, use caution to contact only the jammed paper. The processor becomes very hot when the Hard Copy Unit is in operation.

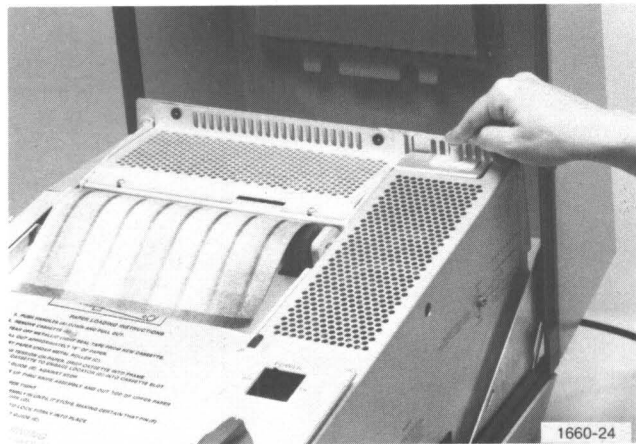
3. If paper has been carried into the return side (bottom side) of the processor belt, it may be necessary to remove the rear paper guide to reach it. Use a Phillips-head screwdriver to remove the two screws which attach the guide to the processor. Remove the guide.



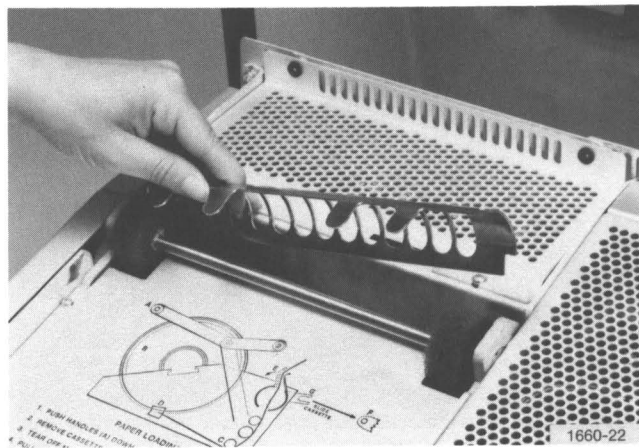
4. Remove wrinkled paper and paper fragments from the rear paper guide area.



5. Push the POWER switch ON and depress the interlock button for a few seconds to clear any paper which may be trapped within the processor. Close the cover and push the COPY button. If copies run through freely, the paper jam is corrected; unplug the Hard Copy Unit and proceed to step 6. If paper is still trapped within the processor, refer to optional Service manual (070-1831-01) and contact qualified technician.



6. Put the rear paper guide back into place and install the attaching screws. The forward curved edge should not contact the sponge rollers. Close the cover, plug in the Hard Copy Unit, and push the POWER switch ON. Push the COPY button; the first copy will be dark due to exposure to light.



Causes of Poor Copies

Copies that are too light or too dark can be caused by incorrect adjustment of the LIGHT-DARK control, incorrect temperature adjustment, or paper that has aged or become insensitive. (The paper should be used before the date stamped on the paper cassette.)

To correct for copies that are too light or too dark, first check the position of the front-panel LIGHT-DARK control. If darker copies are desired, rotate the LIGHT-DARK control clockwise in 30 degree increments, running a copy after each adjustment, until the desired darkness is reached. If lighter copies are desired, rotate the LIGHT-DARK control counterclockwise in a similar manner.

If the above procedure does not solve the problem, compare the Indication column in Table 2-1 with the hard copy to determine the specific problem, then follow the directions given in the Correction column.

¹Paper stored for too long a time or at too high a temperature will lose its sensitivity. Refer to "Paper Storage" in Section 3.

TABLE 2-1
Darkness Problems Caused by
Temperature and/or Paper

Problem	Indication	Correction
Temperature Setting Too High	White portions of the display appear as gray, and gray portions appear as black	Refer to information given under "Processor Temperature Adjustment"
Temperature Setting Too Low	Gray portions of the display appear as white, and black portions appear as gray	
Over-age or insensitive paper ¹	White portions of the display appear as gray and black portions appear as a darker gray	Replace the paper cassette

Processor Temperature Adjustment

To adjust the processor temperature for darker copies, lift the instrument cover and make certain it latches in the "up" position. The processor temperature is controlled by a potentiometer located in the right rear corner of the Hard Copy Unit, just forward of the Line Voltage shield (Fig. 2-2.). Using a small insulated screwdriver, turn the adjustment approximately 15°. (Turning the adjustment clockwise increases the processor temperature, darkening the copy; counterclockwise decreases the temperature, causing lighter copies.) Close the instrument cover, wait about 1 minute, then run two copies (the first copy will be dark due to exposure to light).

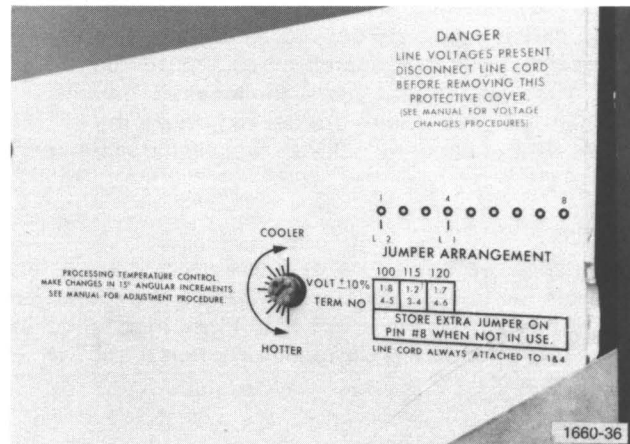


Fig. 2-2. Processor temperature adjustment location.

Section 3

Supplemental Information

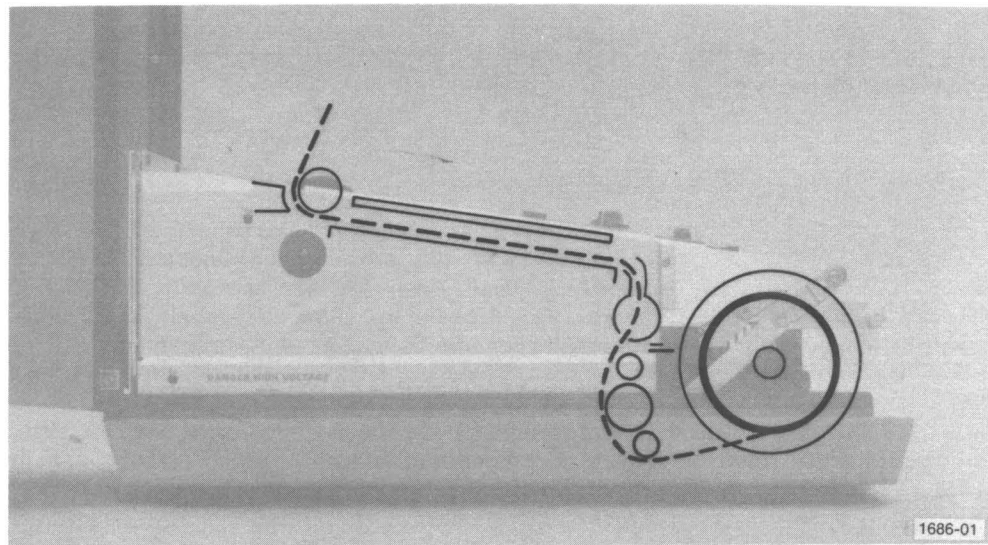


Fig. 3-1. Paper travel through Hard Copy Unit.

Paper Processing Unit

The front section of the processor pulls paper from the cassette, past the cathode ray tube (crt), and through the knife assembly, where the paper is cut. The rear section of the processor pulls the paper across a heated plate that develops the image produced by the crt (Fig. 3-1).

Instrument Features

1. A BUSY output pulse notifies other equipment in the system when a copy is being made.

2. A hard copy may be made by pressing the control panel COPY pushbutton, or by receiving a remote Copy command.

3. Total copy time is approximately 18 seconds (36 seconds for 4014-1 and 4015-1 high-resolution copies).

Paper Characteristics

The light-exposed image on the 3M Type 777 paper is developed with heat. The image will remain stable in normal environmental conditions. High humidity or temperatures above 55°C (130°F) tend to darken the background of the paper, but the image remains readable. The paper may be written upon with pen or pencil. Refer to Table 3-1 for additional 3M Type 777 paper characteristics.

TABLE 3-1
3M Type 777 Paper Characteristics

Characteristic	Information
Paper Thickness	0.003 inches
Development Conditions	2 to 6 seconds at 260°F to 285°F
Roll Size	8 1/2 inches X 500 feet

Paper Storage

Unexposed paper. The shelf life of the unexposed rolls of paper is six months, providing the paper is not removed from its protective wrapper, and is stored at low room temperature. Since the paper is heat-sensitive, a storage temperature of approximately 40°F is recommended.

Exposed paper. No special precautions need be taken. However, temperatures above about 55°C (130°F) or high humidity levels will tend to darken the background of processed copies.

WARNING

Dangerous electrical potentials exist at several points throughout this instrument. Some transistor cases operate at fairly high voltage levels. When the unit is operated with the cover opened, do not touch the exposed connections or components. Disconnect power before cleaning the instrument or replacing parts.

Processor Cleaning

Inspect the processor after each empty paper cassette is removed; clean the processor if necessary. Chemical powder (from the paper) builds up on the interior surfaces, and on the face of the crt. A vacuum cleaner and soft brush (1" paint brush) are the recommended cleaning tools.

Lubrication

The Hard Copy Unit is properly lubricated at the factory. It may be necessary to relubricate certain parts if sluggish operation occurs.

Remove the cassette as previously described, and refer to Fig. 3-2. Apply a small amount of Houghtons Cosmolube 102-T2470 (Tektronix Part No. 006-1229-01)

to each end of all three rollers in the cassette assembly. It is not necessary to remove the rollers; the lubricant will work in. Put a small amount of Cosmolube on the cutter arm actuator at the right end of the cutter and to each end of the cutters where they make contact at all times. Rub a little stick lubricant, such as Door-Ease, along the rest of the moving cutter.

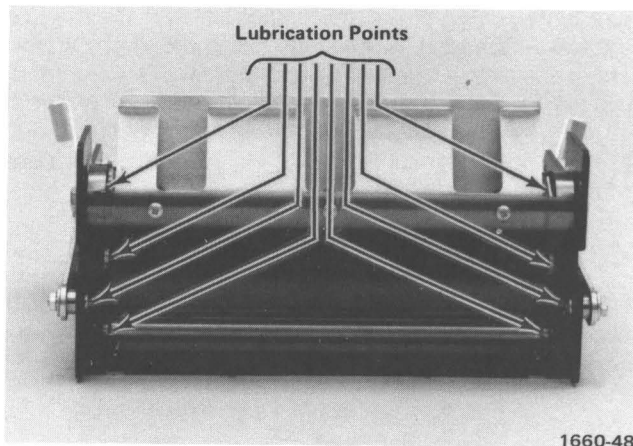


Fig. 3-2. Cassette Assembly Lubrication Points.

Use Cosmolube on the bearings at each end of the drive roller that runs just above the crt. Also put a small amount on the outside of these bearings where they slide into the slots on the cassette assembly.

Remove the chain cover from the side of the processor unit by removing the single Phillips screw at the front and the two at the back (accessible through holes). Oil holes are provided at each end of the four rollers in the processor. These can be seen at the four corners of the unit. Put a drop or two of Union AW 313 Turbine Oil (Tektronix Part No. 006-0626-01) in each hole. Put a drop of oil on the shaft of the chain idler sprocket.

The two clutches should not require lubrication. However, if a definite indication of sticking occurs, place a drop of oil at each end of the clutch and check operation several times. If trouble persists, the clutches will need to be replaced.

The chains should not need lubrication. However, if they appear dry, use oil very sparingly.

The Cover

The top cover of the instrument is hinged at the back, and held in the down position by its own weight. When the instrument cover is tilted back, it is held in place by a latch at the right rear corner. To close the cover, lift the latch while tilting the cover down (Fig. 3-3).



Fig. 3-3. Closing the cover.

Rear-Panel Connector

The standard 4631 rear-panel contains a single 15-pin connector for attachment to a Tektronix storage terminal or display unit (Fig. 3-4a). For further information on the rear panel connector, refer to the Installation instructions in this section, or contact your local Tektronix Representative.

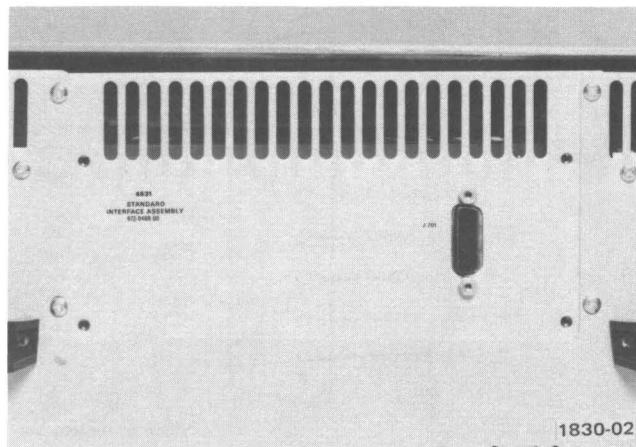


Fig. 3-4a. 4631 Rear Panel.

Options

An optional rear-panel (Fig. 3-4b) and display multiplexer is available at additional cost. It has connections for four 15-pin signal input cables. A rotary switch on the rear panel selects which of the inputs is copied when the front panel COPY button is pressed. When the switch is placed in the MULTIPLEX position, the multiplexer selects the first input to supply a remote COPY command; subsequent copy commands are stored and copied in

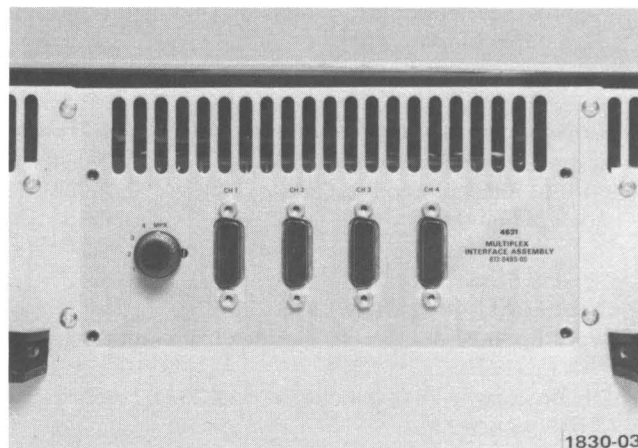


Fig. 3-4b. Optional Rear Panel.

rotation. The front-panel COPY button is disabled when in the MULTIPLEX mode. Connect to any of the four input sets as though it were a single input set, as described in the Installation Section.

The signal locations on the 15-pin connector are identical to those shown in Fig. 3-5, with the exception of the HCU signal added on pin 13, in place of COPY BUSY, and the WAIT output added on pin 14.

A copy counter (factory-installed at initial purchase) is also available at extra cost.

Optional Accessories—Available at Additional Cost

20-foot interconnecting Cable	012-0548-00
50-foot interconnecting Cable	012-0549-00
Service Manual	070-1831-01

Instrument Characteristics

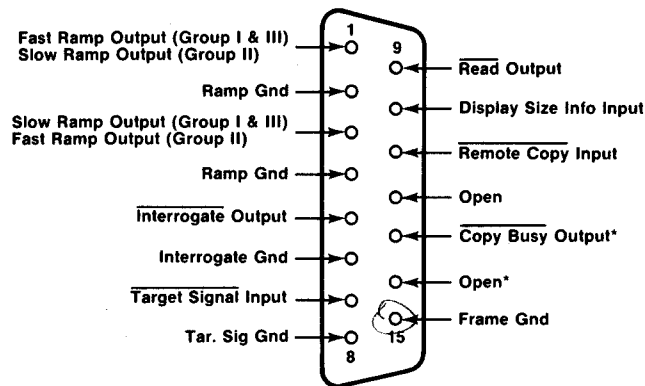
Warmup time — Allow 10 minutes from initial turn on.

Dimensions — 16.000 inches wide X 25.562 inches long X 11.635 inches high.

Weight — 65 pounds.

Installation

Installation of the Hard Copy Unit consists basically of selecting the proper line voltage and connecting to the power source, then connecting a 15-pin interconnecting cable to the connector on the rear panel. Once connected, the two securing screws on the cable connector should be tightened into the rear-panel connector. The signal locations on the 15-pin connector are shown in Fig. 3-5. Line Voltage selection is covered later in this section.



1830-04

*Refer to Options Text

Fig. 3-5. 15-pin connector signal locations.

Copy Format Selection

There are three possible settings for 10-pin harmonica connector P110 on the Timing Board. The location of this connector is shown in Fig. 3-6. The characteristics of these connector positions are shown in Table 3-2. Format A produces an 8.85 by 6.7 inch image, oriented horizontally; Format B produces a 7.1 by 5.4 inch image oriented vertically.

TABLE 3-2
Connector Position Characteristics

Connector Position	Format	Copy Time	Compatibility
I	A	18 sec	11 inch displays and 19 inch displays (low resolution)
II	B	18 sec	11 inch displays only
III	A	36 sec	11 inch displays and 19 inch displays (high resolution)

Use connector position I for most copy operations involving both 11 inch and 19 inch displays. From some 19 inch displays where graphic displays become complicated, an excellent copy can be obtained using connector position III.

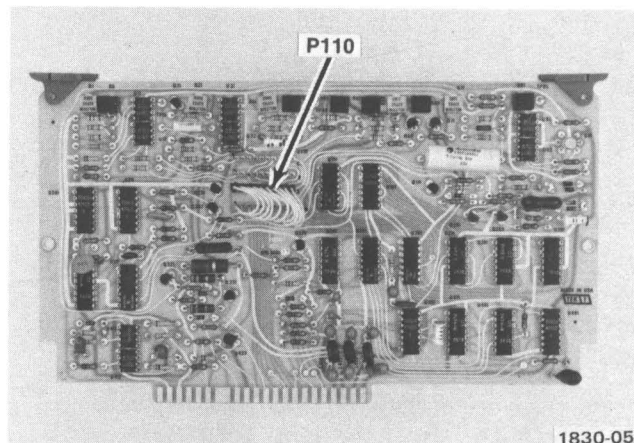


Fig. 3-6. Copy Format Selection Jumper.

Instrument Requirements

1. The instrument operating temperature range is from 0° C to +35° C.

2. The power source (factory wired options) may be 100-120 Vac, 48-62 Hz.

3. Maximum power consumption (at 115 V, 60 Hz) is 750 watts during initial warmup, and 240 watts during normal operation.

AC Power Requirements

CAUTION

The Hard Copy Unit is intended to be operated from a single-phase power source which has one of its current-carrying conductors (neutral) at ground (earth) potential. Operation from other power sources where both current-carrying conductors are live with respect to ground (such as phase-to-phase on a multi-phase system, or across the legs of a 117-234 volt single-phase three-wire system) is not recommended.

The Hard Copy Unit is designed to operate from a 110 volt nominal line voltage source that has a frequency of 48 to 62 Hz. In addition, any of three voltage ranges for 110 Vac may be selected. Voltage, current and power requirements are listed in Table 3-3.

TABLE 3-3
Operating Voltages

Nominal Voltage	Tolerance	Voltage Range	Frequency
100 Vac	±10%	90 to 110 Vac	48 to 62 Hz
115 Vac		104 to 126 Vac	
120 Vac		108 to 132 Vac	

WARNING

The following instructions are for use by qualified service personnel only. To avoid injury, do not perform the following instructions unless qualified to do so.

Dangerous voltages exist inside this unit if the power cord is connected to the voltage supply. Disconnect the power cord before changing transformer connections.

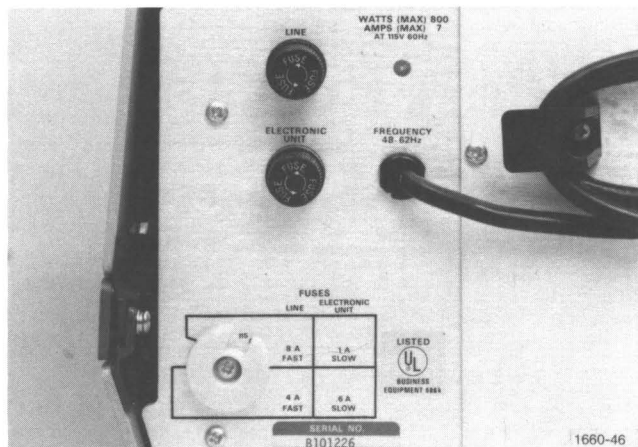


Fig. 3-7. Line Indicator and Fuses.

A fuse change and a transformer jumper arrangement permit the Hard Copy Unit to be modified to suit the voltage supply. A yellow disc on the back panel (Fig. 3-7) identifies (through a notch on the disc) the internal voltage setting for which the unit is wired when shipped from the factory. If, for any reason, the jumper arrangement is changed, loosen the securing screws and rotate the disc until the new voltage setting shows through the notch.

NOTE

Rotating the disc does not change the internal setting; it is an indicator only.

Line Voltage Selection

To change the Line Voltage selection, first disconnect the power cord from the power source, then lift and latch the instrument cover. The Line Voltage shield must then be removed, by removing the two screws which secure it to the back panel, and the two screws which secure it to the mainframe; this provides access to the jumper arrangement.

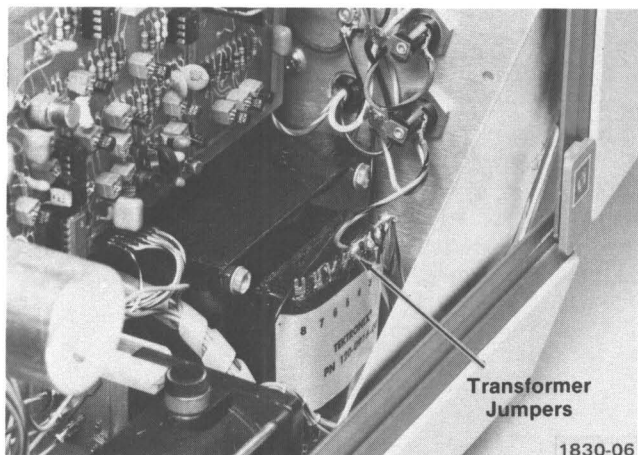


Fig. 3-8. Transformer Jumper Location.

Wiring instructions are shown on the Line Voltage shield at the right rear corner of the unit. The jumper arrangement is within the cover (see Fig. 3-8 and Fig. 3-9).

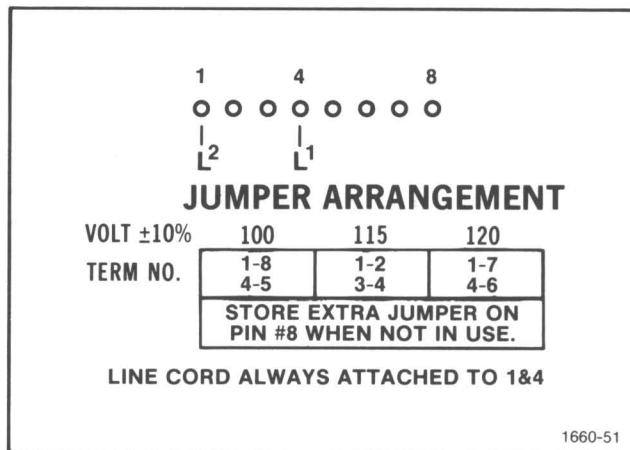


Fig. 3-9. Line Voltage Selection Wiring.

Fuses

There are six fuses in the Hard Copy Unit; two are located on the rear panel and four on the mainframe.

The value of the two fuses on the rear panel varies according to the line voltage to which the Hard Copy Unit is attached. For 100-120 Vac operation, the line fuse (upper fuse) is an 8 A fast-blow, and the electronics fuse is 1 A slow-blow.

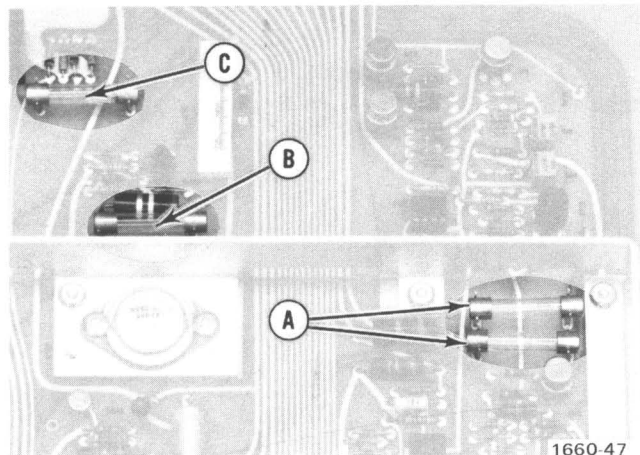


Fig. 3-10. Main board fuses.

The fuses on the mainboard are as follows (Fig. 3-10):

- A. Two 1.5 A fast-blow fuses which protect the Deflection Amplifier transistors.
- B. One 1/16 A fast-blow fuse which protects the crt bias circuit.
- C. One 0.6 A slow-blow fuse which protects the high voltage circuit.

The mainboard fuses may be made accessible (after turning the POWER switch off and disconnecting the power cord), by removing the six screws which attach the mainboard to the rear panel, and sliding the rear panel and mainboard out.

CAUTION

If any fuse in the Hard Copy Unit fails repeatedly, a qualified technician should be contacted to determine the cause of the trouble.