INSTRUCTION MANUAL

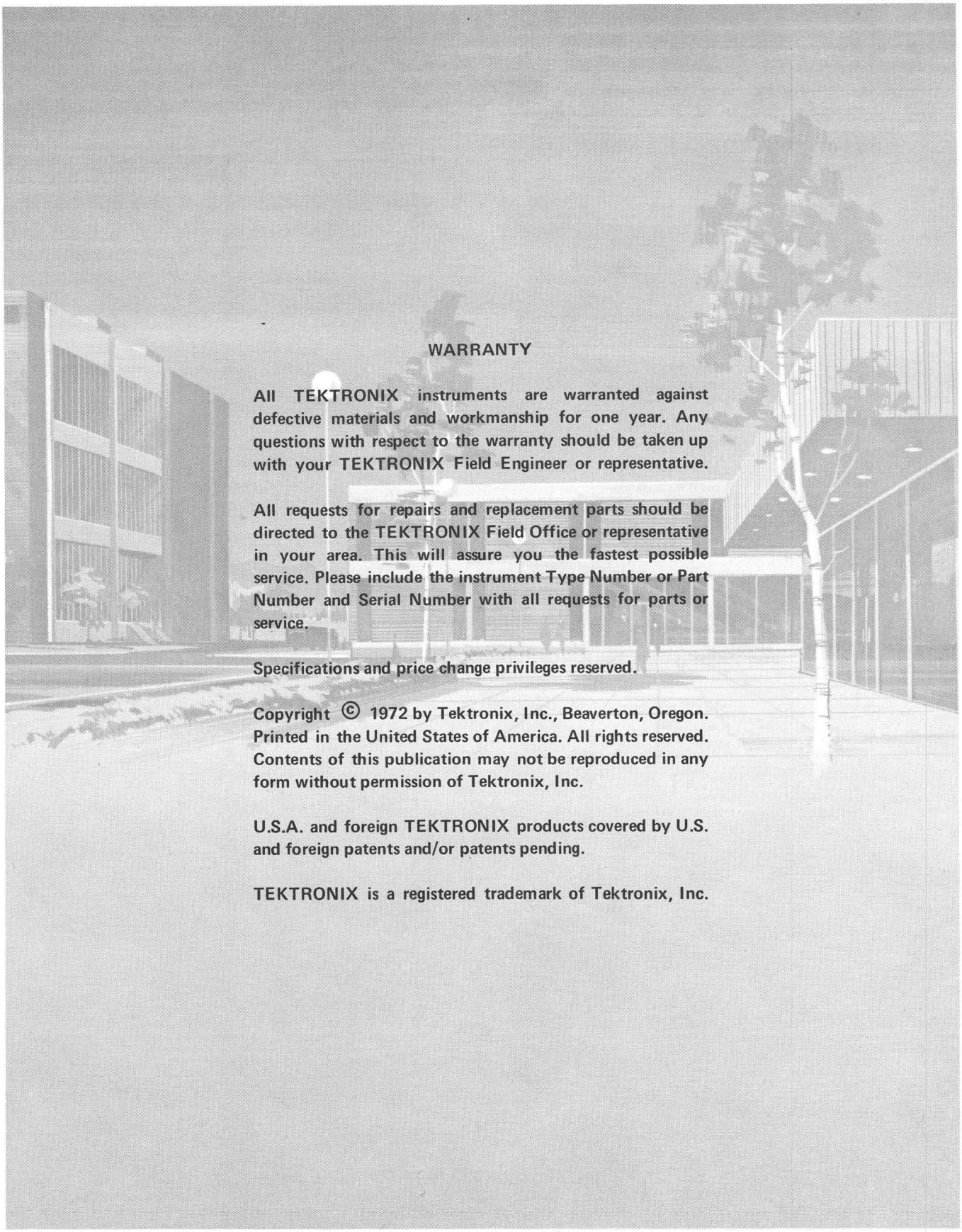
4610 and 4610-1 HARD COPY UNIT

MAINTENANCE

Serial Number _____

Tektronix, Inc. • P.O. Box 500 • Beaverton, Oregon 97005 • Phone: 644-0161 • Cables: Tektronix

070-1300-00



WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repairs and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

Specifications and price change privileges reserved.

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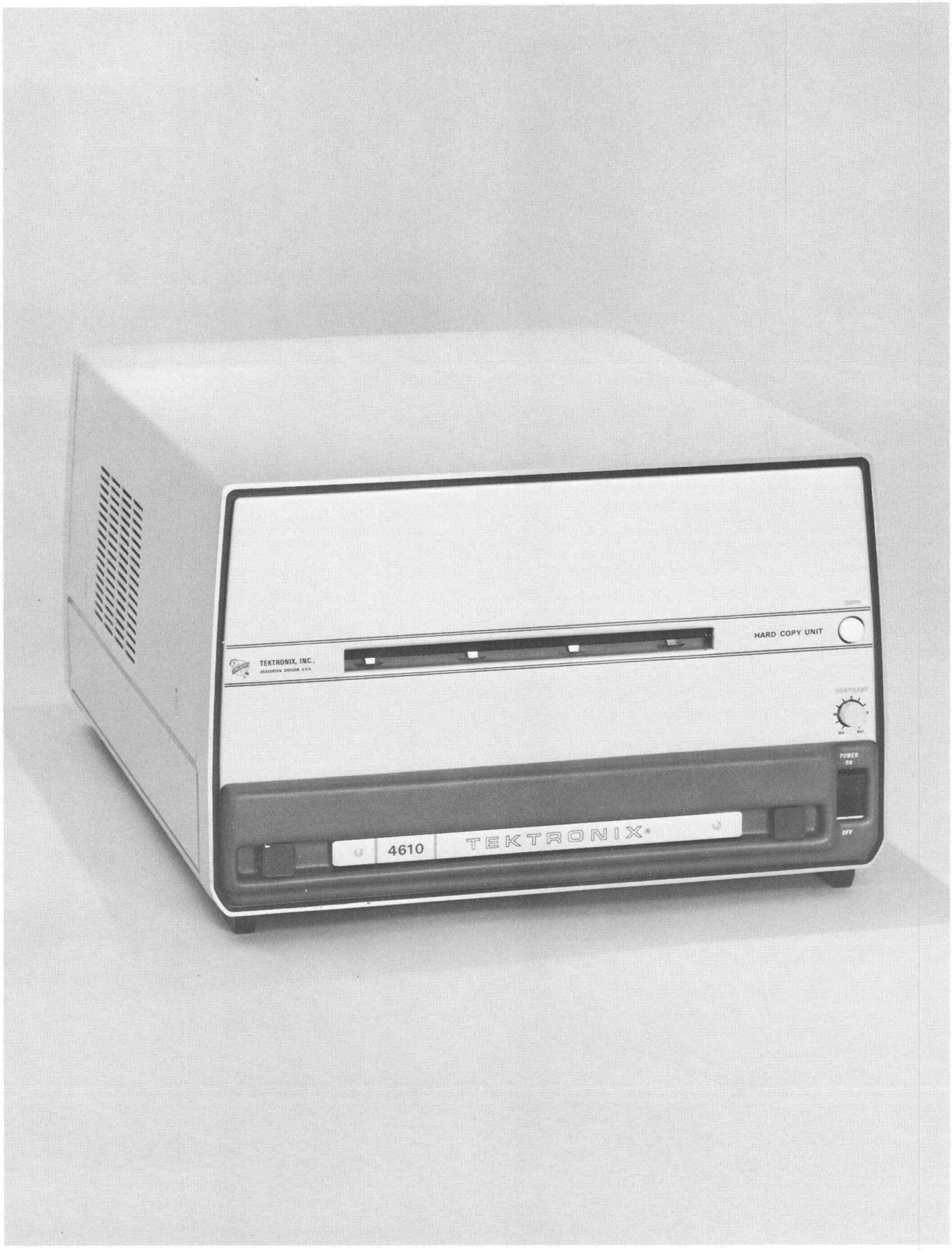


Fig. 1-1. 4610 Hard Copy Unit.

OPERATING INSTRUCTIONS

Introduction

The 4610 Hard Copy Unit (Fig. 1-1) is designed to make facsimile copies from the TEKTRONIX 4010-1 Computer Display Terminal. A copy is produced when the front-panel COPY pushbutton is pressed, or a remote signal (from the 4010-1) is applied.

After the paper is exposed, the image is heat-developed within the 4610, the paper is cut, and the copy is ejected at the front panel in ready-to-use sheet form.

The information in this manual refers to both the 4610 and the 4610-1 Hard Copy Units. The only difference between the two Units is the power requirements. The 4610 is factory wired for 115 VAC, 60 Hz or 115 VAC, 50 Hz, and the 4610-1 is factory wired for 220 VAC, 50 Hz.

Both Units are available with Option 1 (MUX); see Section 3 of this manual.

NOTE

For maximum paper life, the Hard Copy Unit should remain connected to line power at all times. Line power will be delivered to the paper cooler, even with the front-panel POWER switch at OFF.

Standard Accesories

The following standard accessories are included with the 4610:

1	Users Manual	070-1299-00
1[1]	Roll 3M[2] Type 777 Dry Silver Paper	006-1603-00
1	10-Foot Connecting Cable (specially designed for 4610/4610-1 interfacing)[3]	
1	8-Foot Detachable Power Cord[3]	

[1]Paper shipped with the Hard Copy Unit is 3M Dry Silver Paper. Refills may be purchased from Tektronix, Inc., or 3M Co. service centers.

[2]Registered trademark of the Minnesota Mining and Manufacturing Company.

Front-Panel Controls

POWER. Rocker switch for applying operating power to the electronic circuits and the paper processor. (Power is always supplied to the paper-supply cooler while the Unit is plugged in.)

CONTRAST. Varies the contrast of the copy delivered.

COPY. Pushbutton to initiate production of a copy from the Unit. (If the MUX Option is in use, copies can also be initiated by a signal from a 4010-1—see "MUX Option Operation" in Section 3.)

Operating the 4610

Connect the supplied 10-foot cable between the 15-pin female connector (J525) on the rear of the 4010-1 pedestal and the 15-pin female connector (J701) on the rear of the 4610. (Alternative connections necessary for the operation of the MUX Option are explained under "MUX Option Connections" in Section 3.)

After the 4610 and the 4010-1 are properly connected and the paper is loaded, making a copy requires only that the front-panel COPY pushbutton be pressed. Be sure the power cord is plugged in and that the POWER switch (lower right corner of the front panel) is ON.

[3]To order replacement parts, consult the Mechanical Parts List in the back of this manual or your local Tektronix, Inc. Applications/ Field Engineer or Representative.

When the paper supply is used up, the paper cassette must be replaced using the procedure given under the heading "Loading The Paper Cassette". Incorrect loading of the paper can result in the paper jamming or a copy not being delivered.

Internal adjustments are to be made only by qualified technical personnel, except for the temperature adjustment (see information under the heading "Processor Temperature Adjustment" in Section 2).

Loading the Paper Cassette

Connect the Hard Copy Unit to the power line using the power cord provided with the instrument, then proceed with the following instructions (see Fig. 1-2):

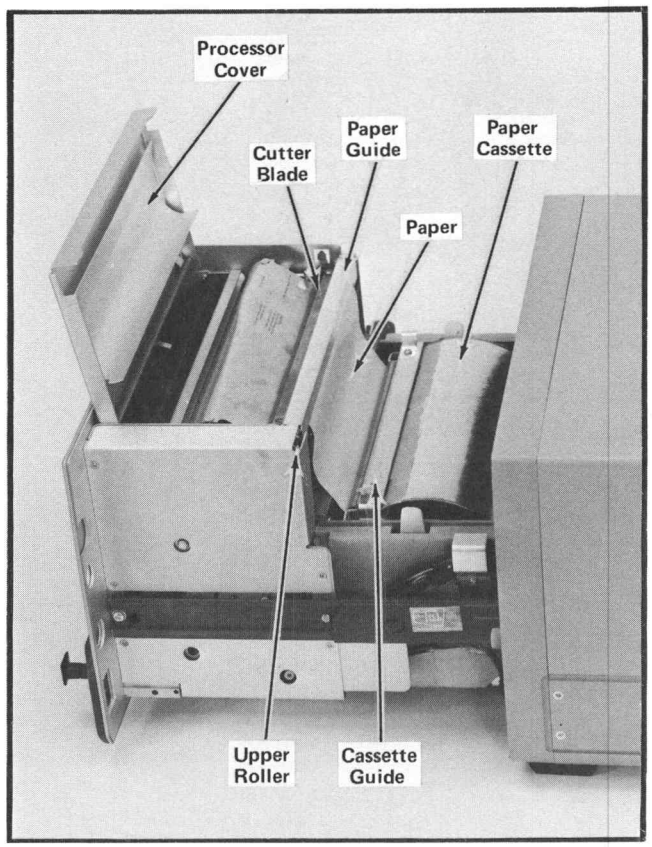
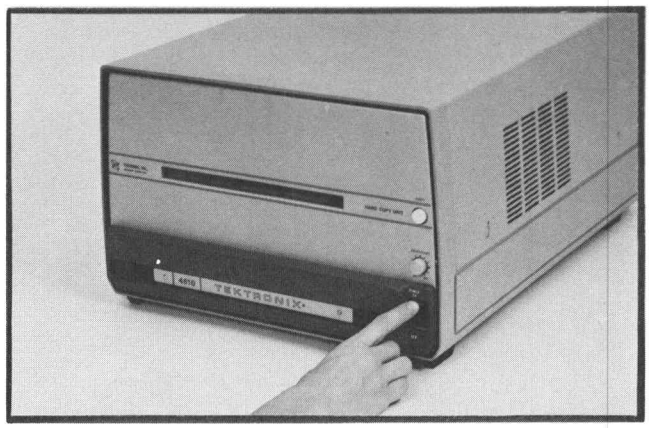
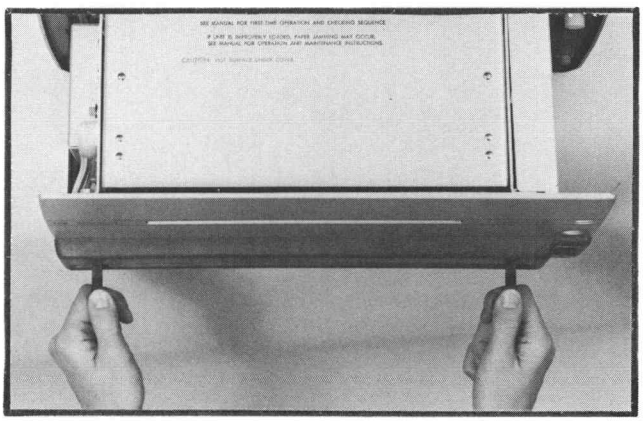


Fig. 1-2. General paper loading illustration (right side of processor).

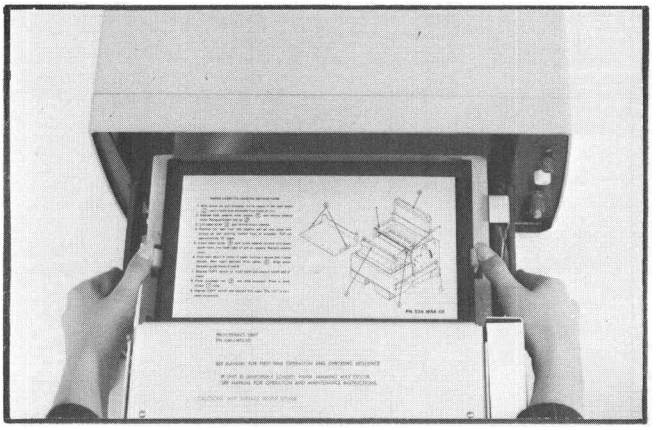
1. Push the POWER switch ON.

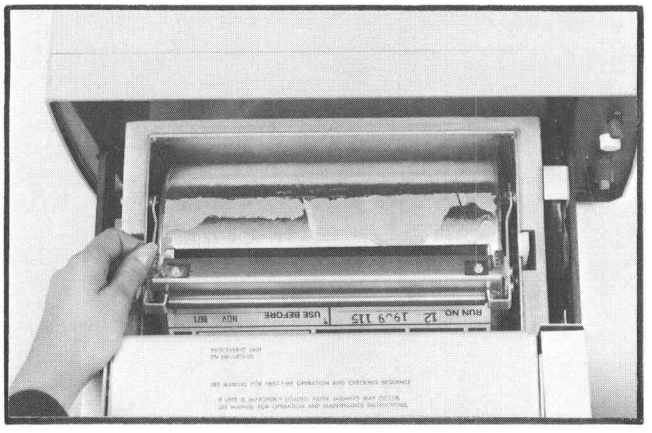




2. Pull the processor out by grasping the two latch knobs and pulling until the processor is locked in the fully extended position. In this position, the stop latches (one on each side of the processor) snap into a hole provided in each slide.

3. Press outward on both cassette cover latches and remove the cassette cover.





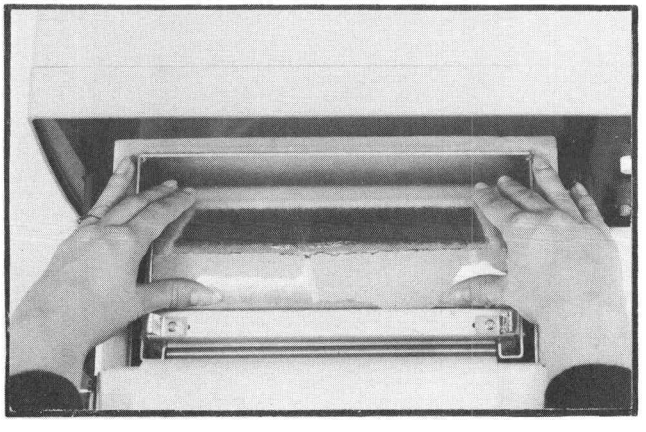
4. Swing the cassette guide up and back and remove the empty cassette.

5. Remove the foil tape from the new cassette and set it into place with the slot up and the label toward the front of the processor.

NOTE

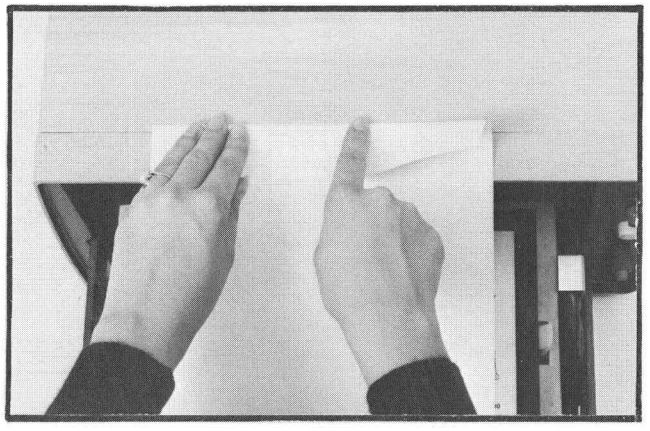
Ignore the instructions printed on cassette label.

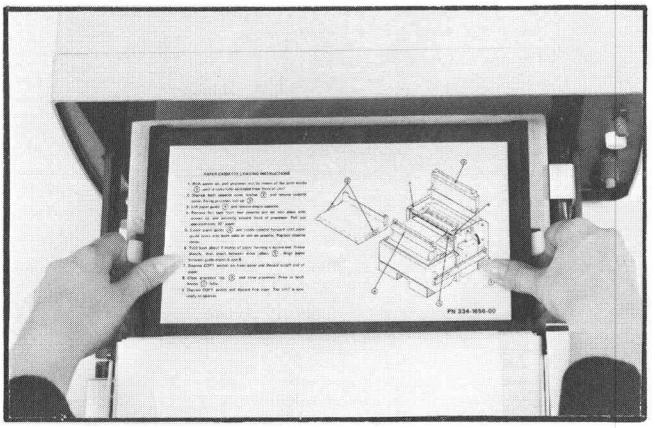
Pull out approximately 10 inches of paper. If the cassette has been loaded correctly, the shiny side of the paper will be up.



6. Swing the cassette guide back into place. Rotate the cassette forward until both ends of the cassette guide lock into the slot.

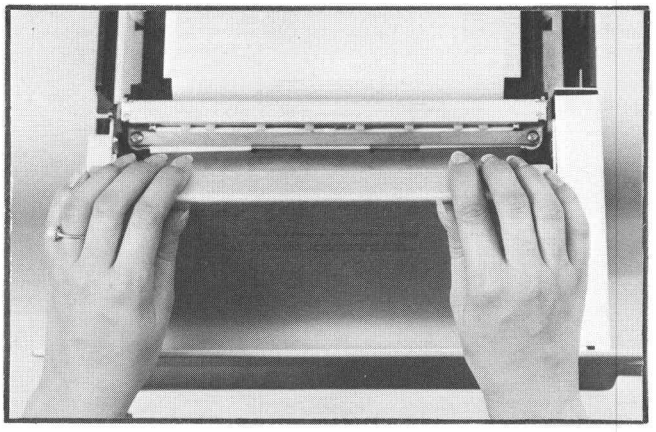
7. Replace the cassette cover by pushing down firmly until both cover latches snap into the fully latched position.

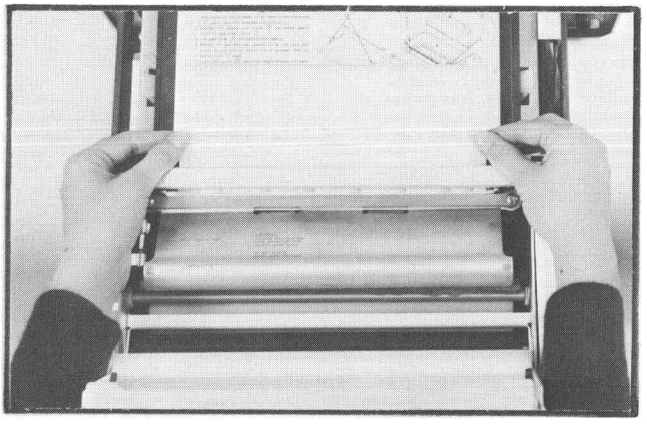




8. Fold back evenly about 2 inches of paper and crease sharply.

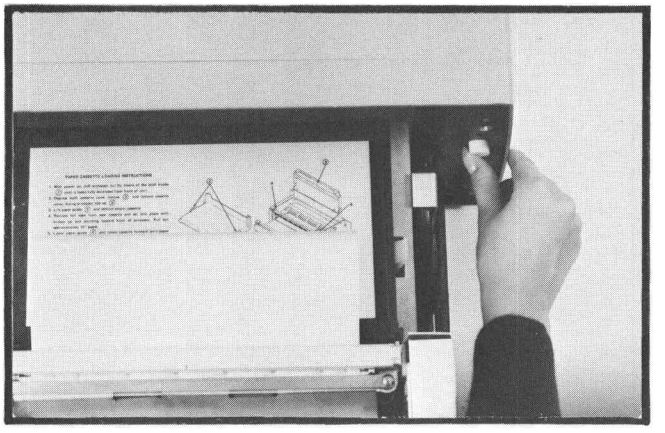
9. Swing up the processor cover.

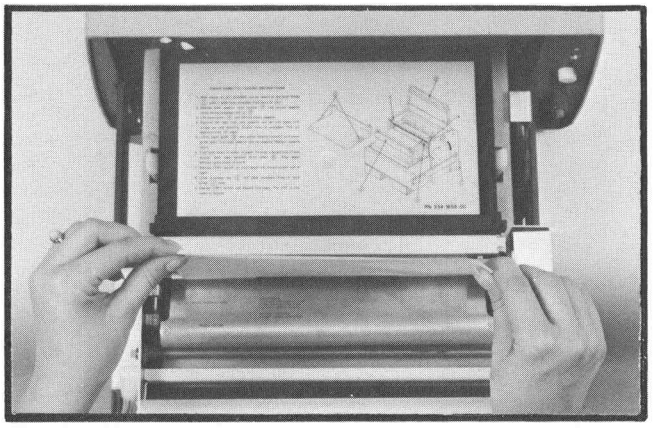




10. Insert the paper between the drive rollers until it contacts the upper cutter blade, being sure the paper is centered between the left- and right-hand ends of the rollers.

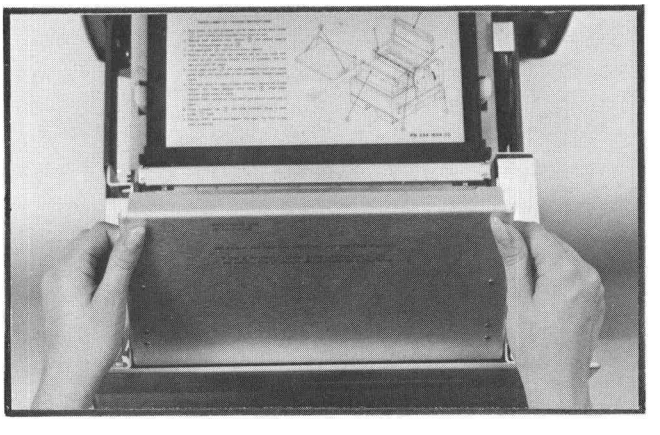
11. Push the front-panel COPY button to begin the copy cycle.

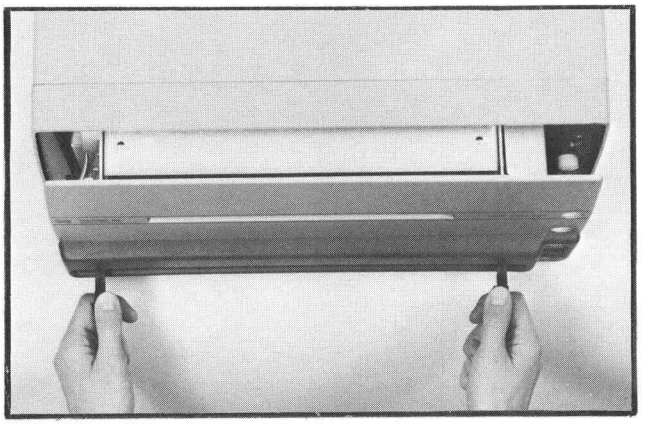




12. As the paper emerges, guide it up and away from the processor. When the cycle is complete, discard the cut end of paper.

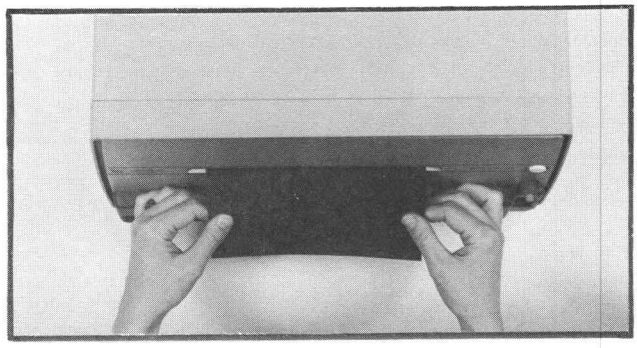
13. Close the processor cover.





14. Push the processor into the cabinet and push in the front-panel latching knobs.

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



CORRECTING COPY PROBLEMS

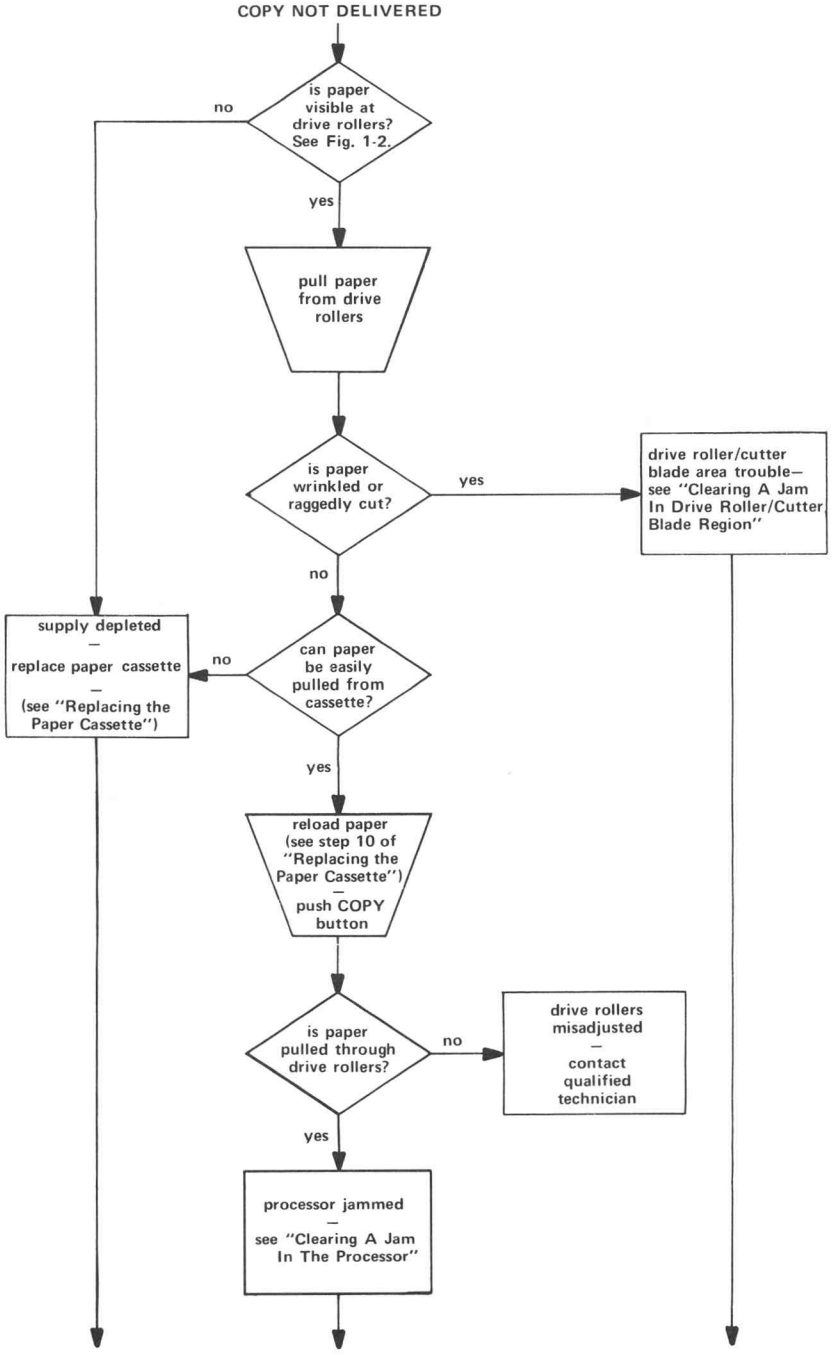
Cause and Correction of Paper Jams

Since paper jams are usually the result of incorrect loading of the paper, be sure the instructions under "Loading The Paper Cassette" in Section 1 are carefully followed. If the paper has been loaded correctly, check that the power cord is plugged in and the POWER switch is ON. If, under these conditions, no copy is delivered when the COPY button is pushed, perform the following procedure:

1. Pull the processor unit to the fully extended position.

2. Swing open the processor cover.

3. Proceed to the following flow chart.

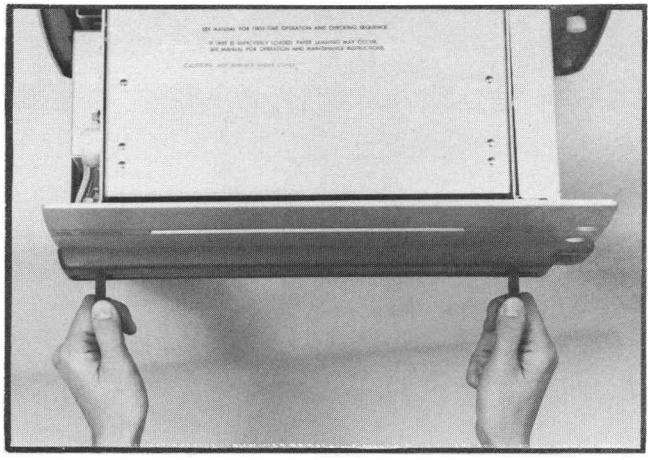


WARNING

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

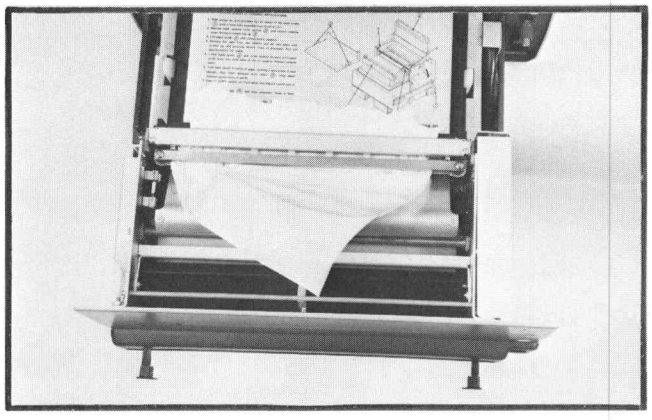
Clearing a Jam In Drive Roller/Cutter Blade Region

If no copy is delivered and paper pulled through the drive rollers is wrinkled or raggedly cut, proceed with the following instructions:

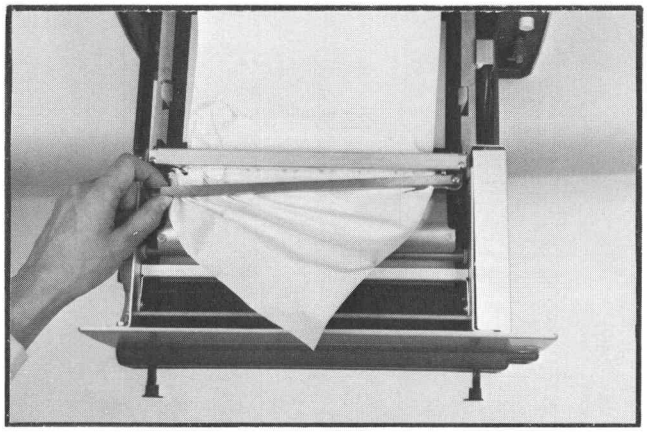


1. Push the POWER switch OFF.

2. Pull the processor out using the two front-panel latching knobs, and swing the cover up.

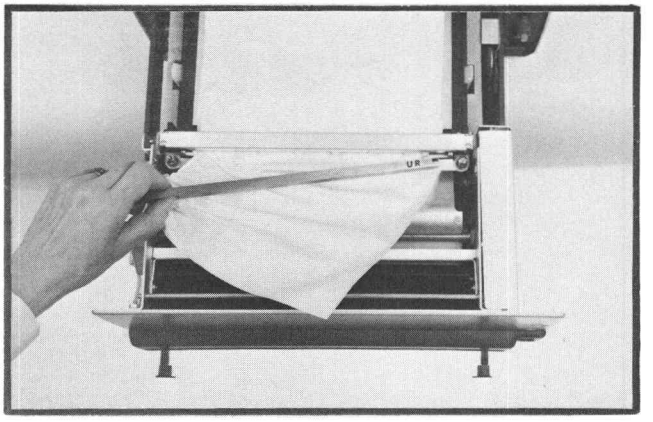


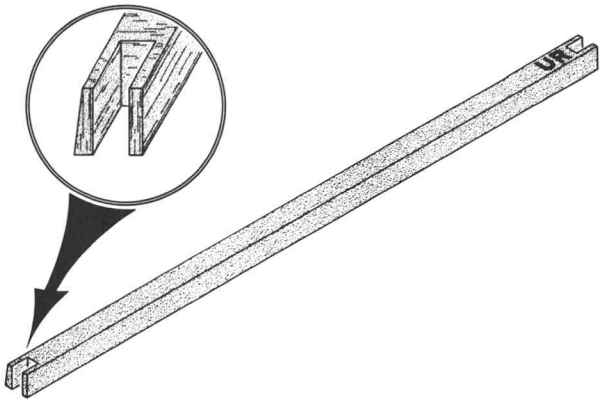
3. Tear the paper behind the drive rollers, and pull 6 to 8 inches from the cassette.



4. Using a Phillips-head screwdriver, remove the screw from one end of the cutter blade. Pry up that end of the cutter blade, and . . . .

pull the entire blade from the processor.



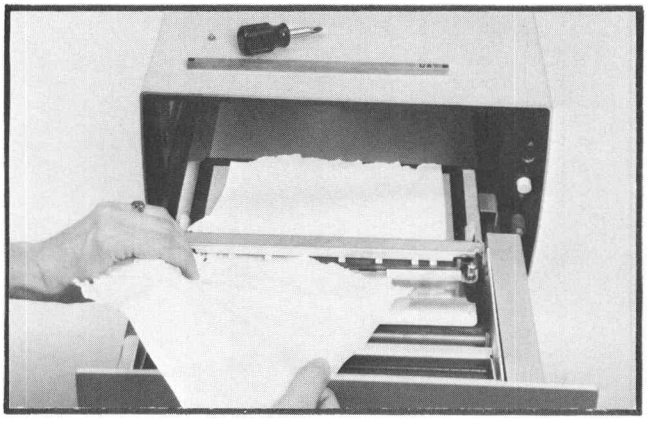


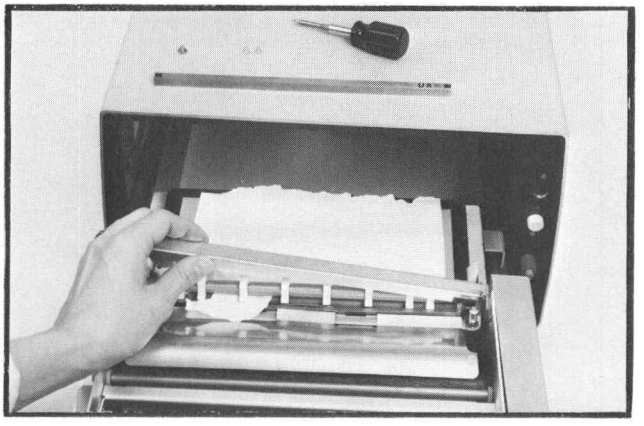
NOTE

When the cutter blade is removed, take care to note its physical position in the processor (i.e., left side, right side, top, etc.). If the blade is replaced in any other position (upside down or backwards) it will not cut. A notation on the blade with a felt pen before removal (as UR for upper right) will aid in proper replacement.

5. Remove paper fragments. Replace the cutter blade and the screw.

   If all paper fragments have been removed, proceed to step 10; if not, proceed to step 6.

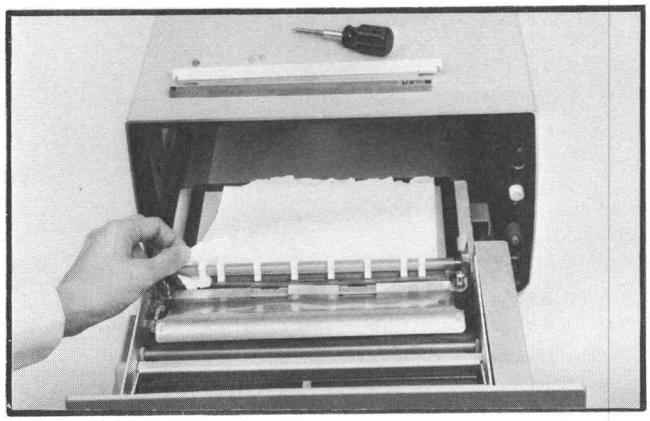


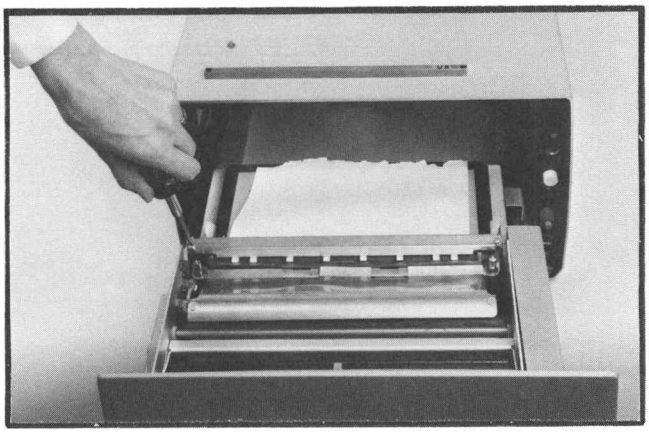


6. Using a Phillips-head screw driver, remove the screws from each end of the paper guide, and lift the paper guide out.

7. Pull all remaining paper fragments out from between the drive rollers.

8. Be sure the plastic paper guides are all realigned flat against the top roller.





9. Replace the paper guide. Partially tighten one screw. While pushing the paper guide toward the front of the processor, fully tighten the other screw. Now fully tighten the first screw.

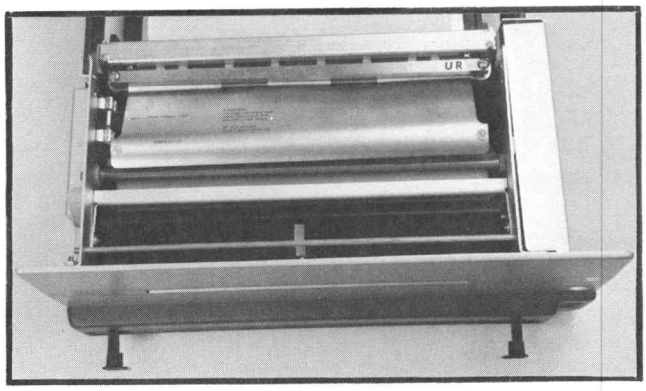
10. Re-thread the paper following the "Loading The Paper Cassette" instructions in Section 1 (beginning with step 8).

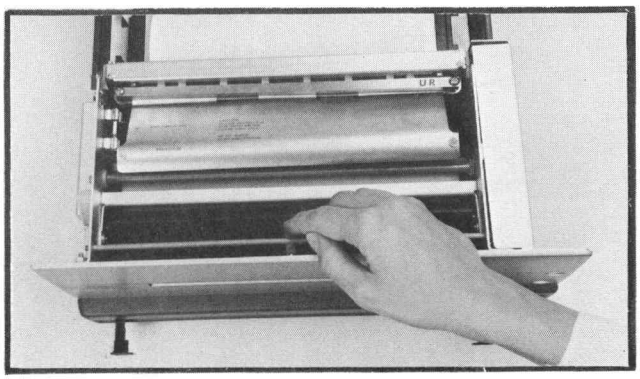
Clearing a Jam in The Processor

If the flow chart has led to the "processor jammed" block, proceed with the following instructions.

1. Push the POWER switch OFF.

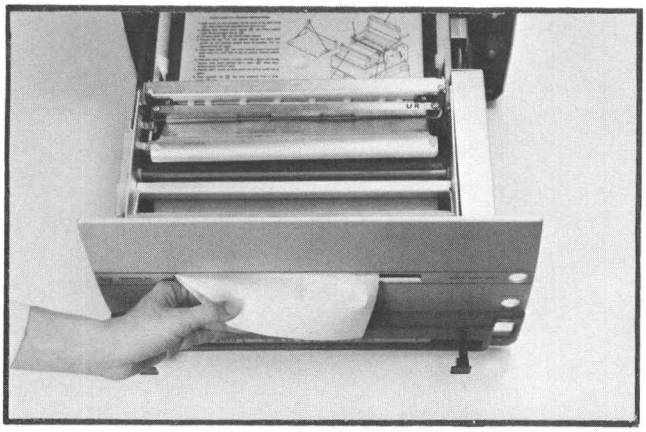
2. Pull the processor out to the fully-extended position using the front-panel latch knobs, and remove the cover.



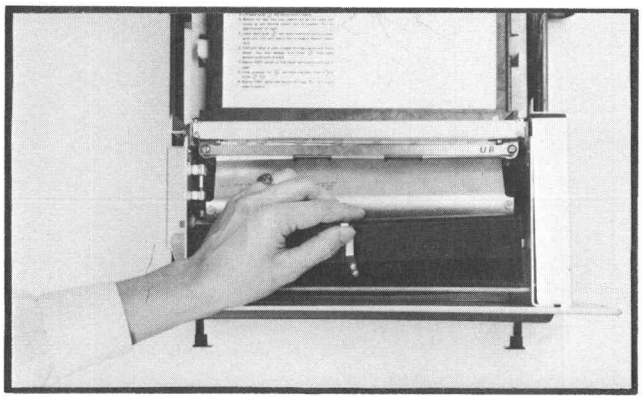


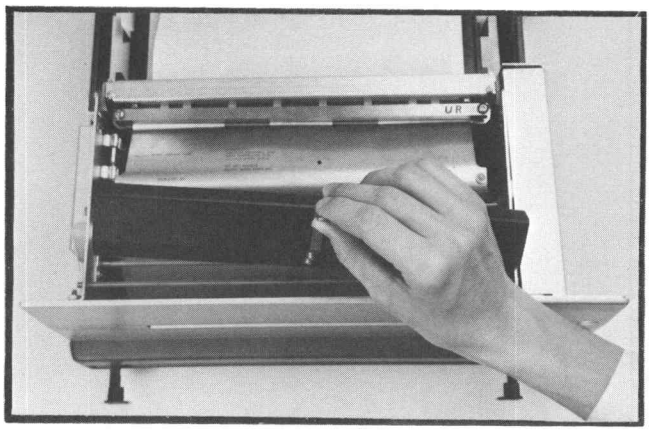
. 3. Push the spring latch down . . . .

and remove the exit guide assembly.



6. Push the POWER switch OFF. If there are any bits of paper still in the processor, they can be removed with the use of tweezers or long-nose pliers (being careful to avoid gouging the drum).



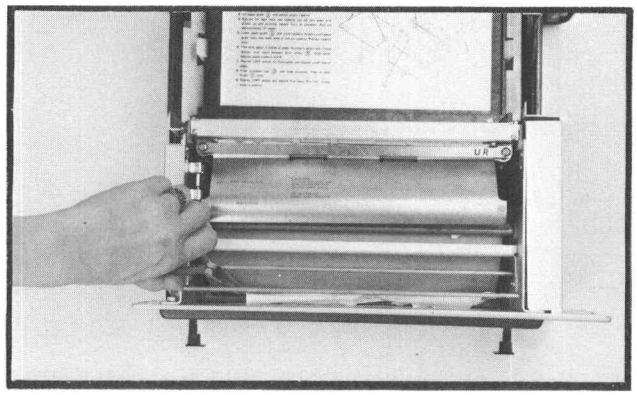


4. Remove all paper fragments possible from the slot in the front of the processor.

WARNING

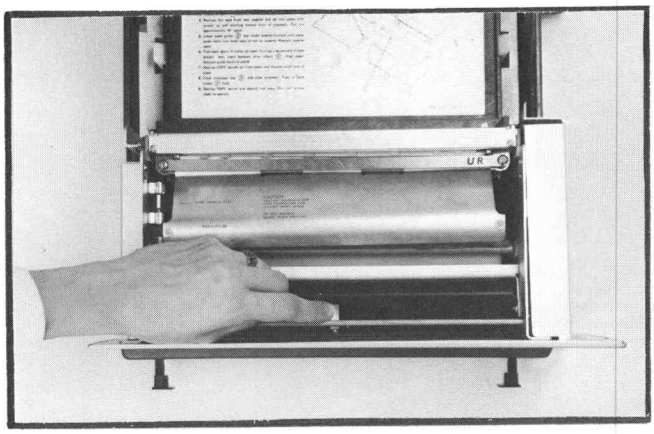
Do not put hands into the processor. The drum becomes very hot during processing.

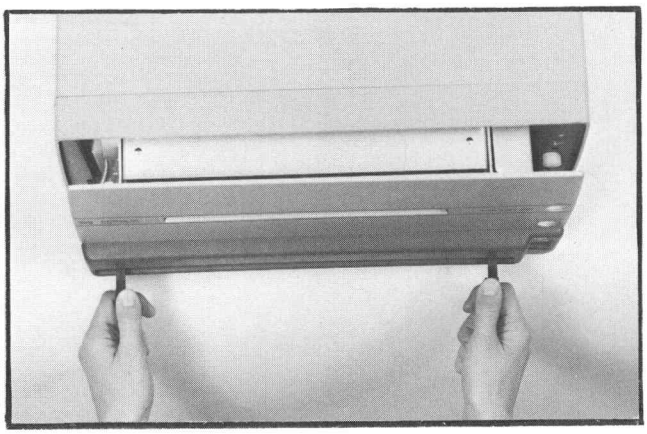
5. Push the POWER switch ON. As the drum rotates, remove remaining paper fragments from the front slot.



7. Replace the exit guide assembly, ...

put the spring latch back in place, ...





and replace the processor cover.

8. Slide the processor back into the cabinet and push in the front-panel latching knobs.

CONTRAST PROBLEMS

Partial Information Loss

By partial information loss we mean any part of the information stored on the 4010-1 Computer Display Terminal which does not appear on the hard copy delivered by the 4610. This can be anything from a small portion of a character to an interruption in a graph.

This problem CANNOT be solved in the 4610, and is strictly a 4010-1 adjustment. Refer to the Hard Copy Amplifier information in the 4010 and 4010-1 Maintenance manual.

Causes of Poor Contrast

This problem can be caused by misadjustment of the CONTRAST control, incorrect temperature adjustment, or paper which has aged or become insensitive.

To correct poor contrast, first check the position of the front-panel CONTRAST control (see Fig. 2-1). In most cases, best contrast is obtained with the control indicator (comparing the control to the face of a clock) between the "12:00" and "2:00" positions. If more contrast is required, rotate the CONTRAST control clockwise in 30° increments (i.e., "3:00", "4:00", etc.).

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

Processor Temperature Adjustment

In order to adjust the temperature setting, pull the processor unit to its fully extended position using the front-panel latching knobs. The temperature adjustment is located on the left side of the compartment containing the processor heater and drum (see Fig. 2-2). This adjustment can be turned, using long-nose pliers, through the hole in the side of the compartment.

TABLE 2-1

Contrast Problems Caused by Temperature and/or Paper

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

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

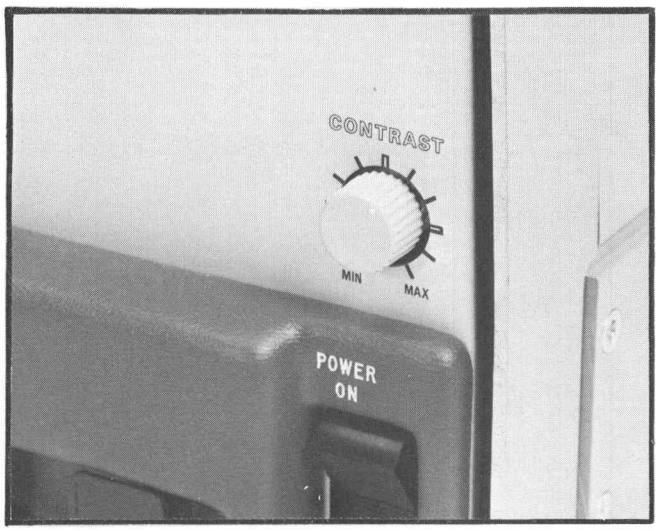


Fig. 2-1. 4610 front-panel CONTRAST control.

Turn this adjustment only 1/8 turn at a time, wait about 1 minute, then run another copy. If the processor temperature is excessive, thermal fuse F308 opens the circuit supplying power to the processor heaters. Normally, the temperature of the heaters is limited to a value below the melting temperature of F308 by the opening of switches S308 and S309. The location of F308 is shown in Fig. 2-3.

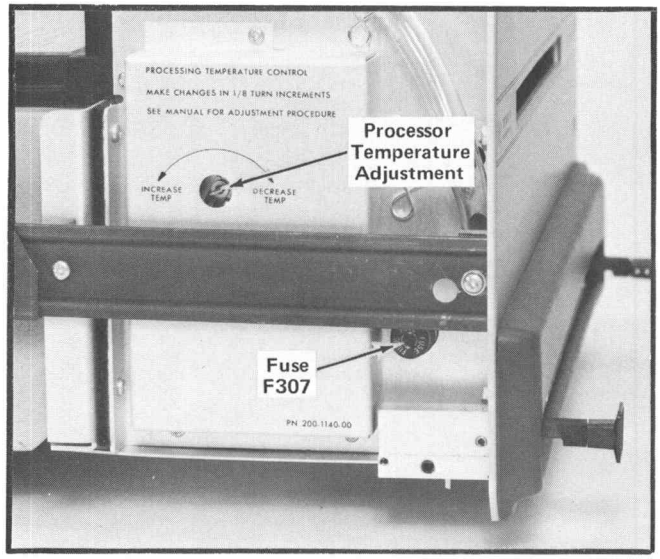


Fig. 2-2. Location of processor temperature adjustment and fuse F307.

Instrument Fuses

Refer to the parts list in the back of this manual for fuse part number, type, and rating. Fuses used in the 4610 are listed in Table 2-2.

WARNING

To avoid electrical shock, disconnect the 4610 power cord from the line voltage before changing fuses.

TABLE 2-2

Fuses Used in the 4610

Designation	Remarks
F300[2]	Line power input fuse. All power from the line is delivered to the 4610 through this fuse.
F301[2]	Power is supplied through F301 to the transformer that provides voltage to 4610 electronic circuits.
F303	Thermo-electric cooler circuit fuse. To change this fuse, the instrument is tipped up on either side and the

[2] Fuses F300 and F301 are located on the instrument rear panel on the inside of the cover for the voltage range selector. Be sure that the POWER switch is OFF and the instrument power cord is disconnected from the line power. Unscrew the two captive screws that hold the cover in place, and pull to remove the cover.

TABLE 2-2 (cont)

Description	Remarks
F303 (cont)	bottom cover removed from the instrument. The fuse is located underneath the center-rear portion of the chassis. Power is applied to this circuit whenever the line cord is plugged in.
F307	This fuse is in the drive motor circuit. The paper drive rollers will not rotate if this fuse opens. The location of F307 is shown in Fig. 2-2.
F308[3]	This fuse will open if the temperature of the processor becomes excessive. Normally, excessive heater temperature is prevented by the opening of switches S308 and S309.

[3]A spare thermal fuse (F308) is located on the inside of the left side panel of the processor as shown in Fig. 2-3A.

Changing Thermal Fuse F308

WARNING

Turn the POWER switch OFF, disconnect the power cord, and permit the processor to cool before attempting to change the thermo fuse. The inside of the processor, especially under the insulating blanket, is extremely hot during processing.

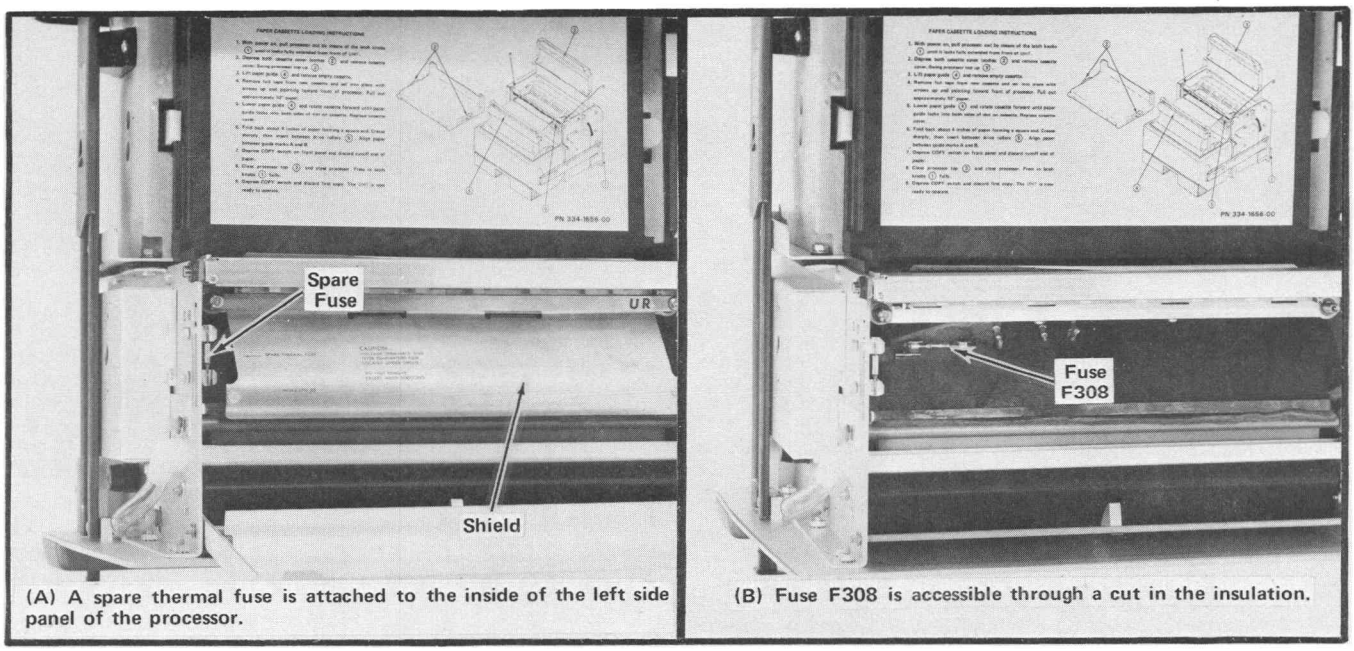
1. Using a Phillips-head screwdriver, remove the screw from one end of the cutter blade. Pry up that end of the cutter blade, and pull the entire blade from the processor.

2. Loosen the two screws beneath the shield, and pull the shield up and out of the processor (see Fig. 2-3A).

3. Access to the thermal fuse is through a cut in the insulating blanket (see Fig. 2-3B).

4. Fold back the cut section of the insulation and remove the fuse by carefully pushing apart the top of the fuse clip while prying up the fuse with a hook-tipped instrument. After one end of the fuse is free of the fuse clip, pry up the other end.

5. To avoid breakage when installing a new fuse into the fuse clip, carefully push down on both ends of the fuse simultaneously.



(A) A spare thermal fuse is attached to the inside of the left side panel of the processor.

(B) Fuse F308 is accessible through a cut in the insulation.

Fig. 2-3. Location of fuse F308 and spare fuse.

SUPPLEMENTAL INFORMATION

Paper Processing Unit

The front section of the processor is used to pull the paper from the storage compartment, past the CRT, and around a heated drum that develops the image produced by the CRT (see Fig. 3-1). The rear section of the processor is a cooled storage compartment in which the paper cassette is placed (see Fig. 3-2).

Instrument Features

1. A copy gate output pulse is available to notify other equipment that a copy is being made.

2. A copy may be made by pressing the front-panel COPY pushbutton or by a remote copy command.

3. Copies of the input are recorded on standard size paper (8 1/2 inches X 11 inches, ±0.25 inch).

4. A voltage range selector is provided on the rear panel for optimum instrument operation at low, medium, or high line voltages.

Instrument Requirements

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

2. Maximum power consumption (at 115 V, 60 Hz) is 1450 watts for the first 40 seconds after turn-on, 220 watts to 520 watts during normal operation, and 100 watts during standby operation.

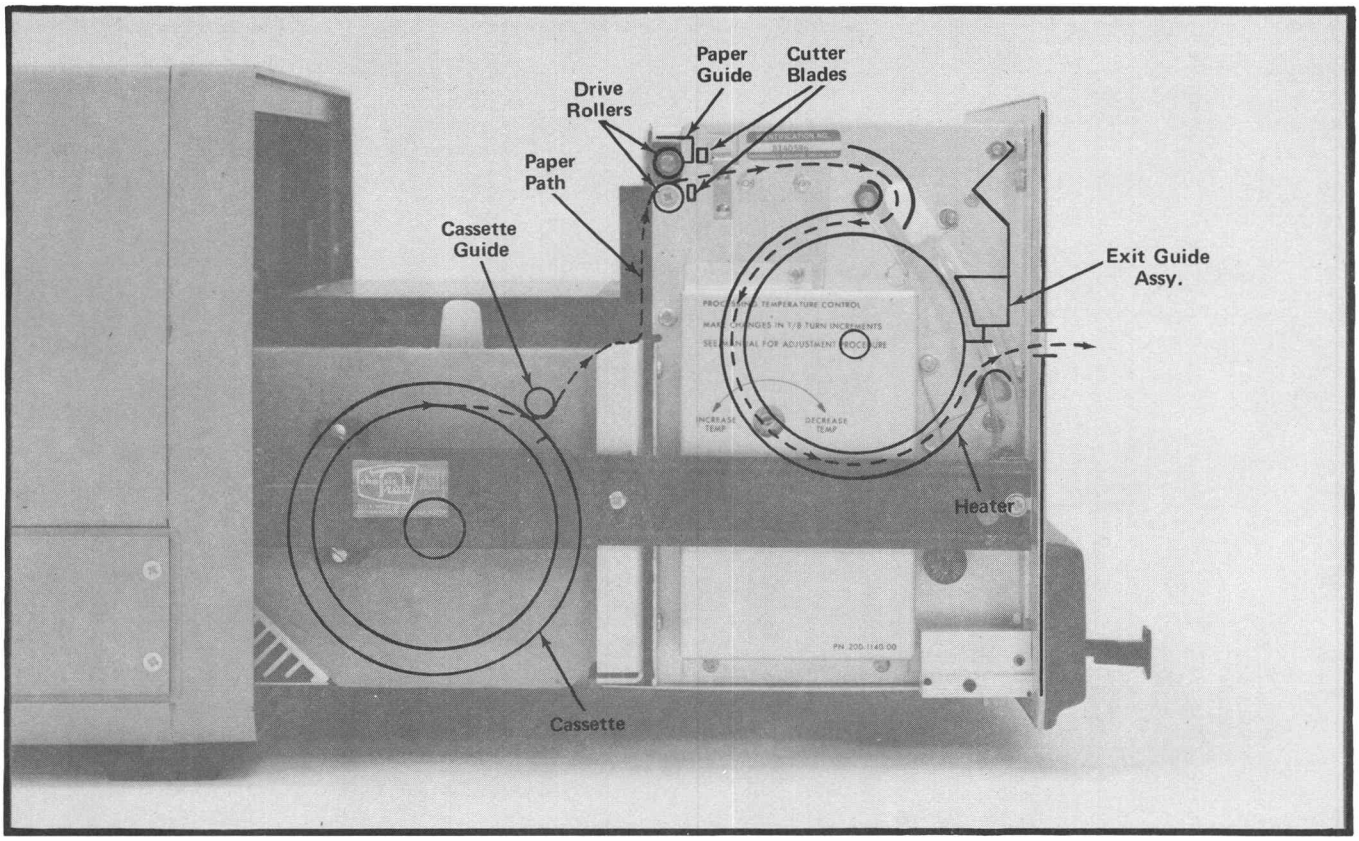


Fig. 3-1. Paper travel through the 4610 processor.

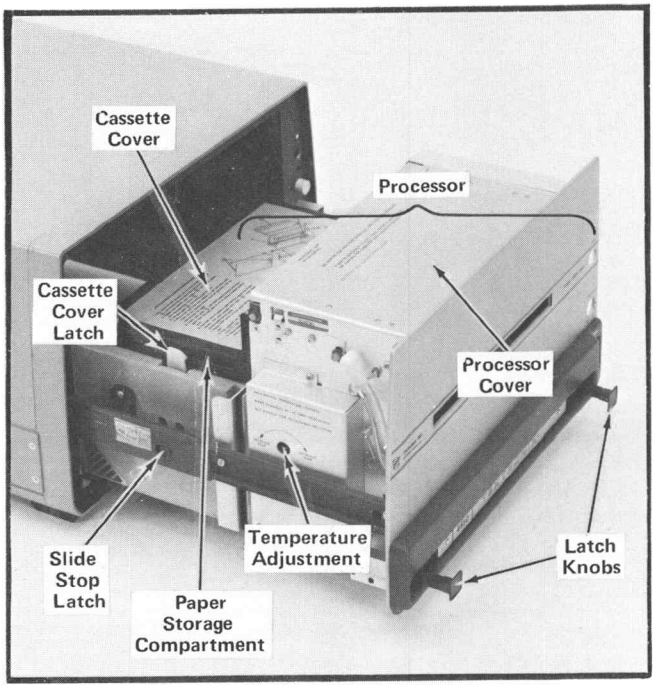


Fig. 3-2. Processor in fully extended position (left-side view).

Paper Characteristics

3M Type 777 dry silver direct print paper, which the 4610 is designed to use, has the image stability normally associated with wet-process photosensitive papers and the convenience of a dry-print paper. The paper may be written upon with pen or pencil. Information written with a pencil is erasable.

The light-exposed image on the 3M Type 777 paper is developed with heat. The image will remain stable in normal environmental conditions. Temperatures above about 55°C (130°F) and high humidity tend to darken the background of the paper, but the image remains readable. 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 inch
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 room temperature. Paper life can be extended somewhat by reduced storage temperature.

Exposed paper. No special precautions need be taken. It should be remembered that temperatures above about 55°C (130°F) and high humidity levels will tend to darken the background.

Processor Cleaning

Inspect the processor after each roll of paper is replaced and clean if necessary. Chemical powder, from the paper, builds up on the interior surfaces and in the plastic tubing, which ducts much of the powder to the fan in the lower part of the processor. A vacuum cleaner and a soft paint brush are the recommended cleaning tools.

WARNING

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

Cover Removal

The top cover of the instrument is held in place by four slotted fasteners, while the bottom cover is held in place by six slotted fasteners. To remove the covers, turn the fasteners approximately one-half turn and lift the cover off the instrument. The covers protect against dust in the interior of the instrument and provide proper airflow for cooling.

Rear-Panel Connectors

Remote Program Connector. A 15-pin connector (see "MUX Option Connections") enables the 4610 to be connected to more than one 4010-1. Make Copy and Copy Gate also appear here (see Fig. 3-3).

Make Copy. A copy command can be introduced from a remote location via pin 11, J701.

Copy Gate Command. The logic level of the Copy Gate signal at pin 13 indicates when the paper is being exposed to make a copy (see Fig. 3-5).

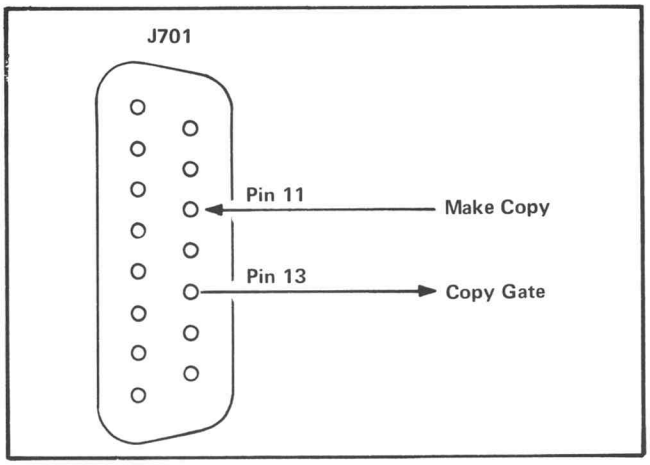


Fig. 3-3. Connections to J705 (15-pin rear-panel connector).

An alternative method is to connect pin 11 and pin 13 of the 15-pin rear-panel connector through a switch. If this switch is On, multiple copies will be produced until the switch is set to Off.

Instrument Option

MUX Option

The MUX (multiplexing) Option enables the 4610 to be remotely triggered by from one to four TEKTRONIX 4010-1 Computer Display Terminals either in an automatic sequence or individually.

MUX Option Connections

The MUX Option is built into the 4610 at the factory. It includes four rear-panel 15-pin female connectors (J701, J702, J703, and J704; see Fig. 3-4). Connect a 10-foot cable between the 15-pin female connector (J525) on the rear of a 4010-1 pedestal and one of the connectors on the 4610 rear panel. Using the preceding method, connect from one to three more 4010-1's to the 4610 utilizing any combination (or all) of the MUX connectors.

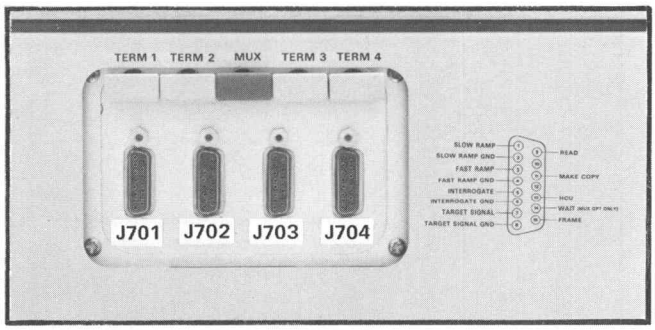


Fig. 3-4. Rear-panel connectors for the factory-wired MUX option.

The cables to be used (TEKTRONIX Part No. 012-0343-00) are specially designed for 4010-1/4610 interfacing.

MUX Option Operation

When the MUX button is pushed in, the COPY button on the 4610 front panel is automatically disengaged. In this state the 4610 scans all four channels sequentially (in a 1, 3, 4, 2 series), stopping to make a copy on request and then continuing on. (Example: If an operating 4010-1 is connected to channel 1 and another to channel 2: the 4610 will scan channel 1, read the request for copy, and service that request; scan channel 3, find no request, and move on; scan channel 4, find no request, and move on; scan channel 2, read the request for copy, and service that request; scan channel 1, etc.) This cycling will continue until one of the other option buttons (1 through 2—whether connected to a 4010-1 or not) is pushed in.

The 4610 can now be operated either by pushing in one of the option buttons (i.e., 1 or 2 using the previous example), and then the front-panel COPY button; or by pushing in the required option button (i.e., 1 or 2), and then triggering the 4610 remotely from the 4010-1 keyboard.

Optional Accessory

4610 Copy Catcher

The copy catcher (TEKTRONIX Part No. 016-0298-00) is a helpful accessory when the 4610 is operated remotely or with the MUX Option. It collects the hard copy as it comes out of the 4610 front-panel slot and guides it to an attached holding tray.

The copy catcher is an extra cost accessory (see Tektronix, Inc. Catalog for the part number and ordering information). It is easily attached to the 4610 front panel without the use of special tools or equipment.

Instrument Characteristics

Deflection System

Total Horizontal Deflection—6.3 inches (16 cm) or less to at least 7.9 inches (20 cm) at 3500 V cathode voltage.

Horizontal Position Range—at least + and −0.8 inch (2.0 cm) from electrical center.

Copy Program Lines

Make Copy Command—TTL levels: Copy is made at +2.4 V to +5 V level; Copy command is initiated at +0.8 V or less (3.2 mA maximum) level; Duration of copy command at least 200 μs. See Fig. 3-5.

Copy Gate—Initiated by manual or remote copy command. Duration is equal to the copy exposure time plus one or two seconds. See Fig. 3-5. High level is +2.4 V to +5 V. Low level is +0.8 V or less.

Copy Command Repeat Interval—200 μs upon completion of copy gate.

Copy Dimensions

Exposed Area—Width is 6.75 inches, within 0.25 inch. Length is 9 inches, within 0.25 inch. Aspect ratio W/L is 3/4.

Paper—Width is 8.5 inches. Length is 11 inches within 0.25 inch.

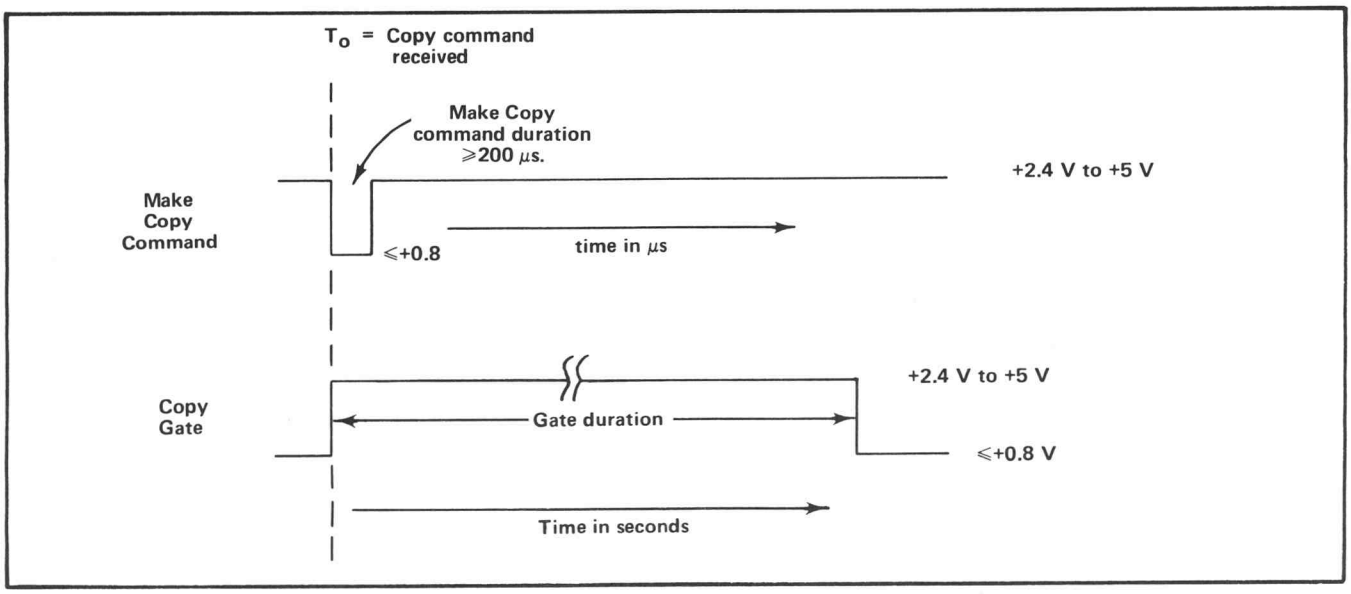


Fig. 3-5. Time relationships and required voltage levels of Copy Gate and Make Copy command.

SERVICING

Introduction

This section of the manual contains maintenance information for use in preventive and corrective maintenance.

Cover Removal

The top cover of the instrument is held in place by four slotted fasteners while the bottom cover is held in place by six slotted fasteners. To remove the covers, turn the fasteners approximately one-half turn and lift the cover off the instrument. The covers protect the instrument from getting dust in the interior, and provide proper airflow for cooling.

WARNING

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

PREVENTIVE MAINTENANCE

General

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

Mainframe Cleaning

General. The 4610 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket and prevents efficient heat dissipation. It also provides an electrical conduction path which may result in instrument failure.

The top and bottom covers provides protection against dust in the interior of the instrument. Operation without covers in place necessitates more frequent cleaning.

CAUTION

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

Exterior. Loose dust accumulated on the outside of the instrument can be removed with a soft cloth or small paint brush. The paint brush is particularly useful for dislodging dirt on and around controls. Dirt which remains can be removed with a soft cloth dampened in mild detergent and water solution. Abrasive cleaners should not be used.

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

The high-voltage circuits, particularly parts located in the high-voltage compartment and the area surrounding the post-acceleration anode connector, should receive special attention. Excessive dirt in these areas may cause high-voltage arcing and result in improper instrument operation.

Processor Cleaning and Lubrication

Cleaning. Inspect after each roll of paper and clean if necessary. Chemical powder, from the paper, builds up on the interior surfaces and in the plastic tubing, which ducts much of the powder to the fan in the lower part of the processor. A vacuum cleaner and a soft paint brush are the recommended cleaning tools.

WARNING

Do not clean the interior of the processor with compressed air, as this may cause the chemical powder to be blown into the eyes.

Lubrication. Approximately every 250 hours of operation, several drops of machine oil should be added to the felt reserviors on the processor drive motor. Use an oil such as Mobil DTE HM 290-300 SSU 100°F, Chevron OC

Turbine 15 oil 300-320 SSU 100°F, Shell Turbo 33 or Shell Tellus 33.

Approximately every 1500 hours of operation, a small amount (1 tablespoon) of oil should be added to the felt reservoir of the processor gearbox. To do this, remove the processor bottom cover and the screw in the side of the processor gearbox. The oil will be best absorbed if the processor is placed on its front-panel and the oil added slowly to the felt. Use an oil such as those described above.

NOTE

Since both the drive motor and gearbox require periodic lubrication, a small amount of oil leakage may occur. Excessive oil leakage indicates over-oiling.

After every 10 rolls of paper, the solenoid-actuated escapement mechanism should be lubricated with either a good grade of grease, or a dry lubricant such as graphite or molybdenum disulfide (both are available in either dry stick or liquid suspension).

For maximum life of the paper cutter, a lubricant such as graphite or molybdenum disulfide should be applied to the mating edges and the leg of the lower blade of the cutter blades, with particular attention given to lubricating the leg of the lower blade, at intervals not exceeding 10,000 operations.

Wherever possible, self lubricating or prelubricated materials have been used for bearings or moving parts, therefore, additional lubrication will not normally be required. In time, however, the accumulation of dust and debris may cause noise, which can usually be eliminated by the use of a small amount of light machine oil.

Processor Safety Clutch

The coupling between the drive motor and the gearbox is also a safety clutch, which will trip if the torque load on the gearbox exceeds a safe level.

The clutch will automatically reset when the processor is turned off and the cause of the excessive torque load is removed.

Visual Inspection

The Hard Copy Unit should be inspected occasionally for such defects as broken connections, improperly seated transistors, damaged circuit boards, heat-damaged parts and small pieces of paper inside the processor.

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

Transistor Checks

Periodic checks of the transistors are not recommended. The best check of transistor performance is actual operation in the instrument.

Re-adjustment

To assure accurate reproductions, check the adjustments of this instrument whenever copy quality deteriorates. Any time components are replaced, re-adjustment of the affected circuits may be necessary. Complete adjustment instructions are given in the Electrical Adjustments section.

The adjustment procedure can also be helpful in localizing certain troubles in the instrument. In some cases, minor troubles may be revealed and/or corrected by the adjustment procedure.

CORRECTIVE MAINTENANCE

General

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

Obtaining Replacement Parts

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

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a component may affect its performance in the instrument, particularly at high frequencies. All replacement parts should be direct replacements, unless it is known that a different component will not adversely affect instrument performance.

Special Parts. In addition to the standard electronic components, some special components are used. These components are manufactured or selected by Tektronix, Inc. to meet specific performance requirements, or are manufactured for Tektronix, Inc. in accordance with our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Component Replacement

WARNING

Disconnect the instrument from the power source before replacing components.

Circuit Card or Board Replacement. If a circuit card or board is damaged beyond repair, either the entire assembly including all soldered-on components, or the card or board only, can be replaced. Part numbers are given in the Mechanical Parts List for either the completely wired or the unwired card or board. The cards are plug-in type cards which can be removed by firmly pulling straight out. To replace the cards, reverse the order of removal. Insert the card in the edge guide and firmly press straight in.

Transistor and Integrated Circuit Replacement. Transistors and Integrated Circuits should not be replaced unless actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement of transistors or ICs may affect the calibration of this instrument. When transistors or ICs are replaced, check the operation of the part of the instrument which may be affected.

Replacement transistors or ICs should be of the original type or a direct replacement. Fig. 4-1 shows the lead configuration of the transistors and ICs used in this instrument. If a transistor is replaced by a transistor made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. Transistors, which have heat radiators or are mounted on the chassis, use silicone grease to increase heat transfer. Replace the silicone grease when replacing these transistors.

WARNING

Handle silicone grease with care. Avoid getting silicone grease in the eyes. Wash hands thoroughly after use.

Cathode-Ray Tube Replacement

WARNING

The CRT may implode if it is scratched or struck severely enough. Wear protective clothing and a face shield when replacing the CRT.

To remove the Cathode Ray Tube, use the following procedure:

1. Disconnect the signal cable and power cord from the instrument.

2. Remove the top and bottom covers and the processor unit.

3. Disconnect the CRT base socket by pulling the socket straight back.

4. Loosen the yoke "O" ring retaining clamp and CRT neck clamp bracket (see Fig. 4-2) to relieve the strain on the neck of the CRT for the steps that follow.

5. Remove the CRT front shield cover by pulling forward on it.

6. Remove the CRT anode connector by pulling outward.

7. With the instrument in the normal position, loosen the two upper CRT clamp bracket screws; see Fig. 4-2.

8. Begin pulling the CRT straight forward through the front opening of the CRT shield. As soon as the CRT is far enough forward, put one hand into the CRT shield to support the tube neck.

9. Protect the CRT from damage while it is out of the instrument, by placing it face down on a soft mat inside a box or (preferably) by placing it in the CRT shipping carton.

To install a CRT, use the following procedure:

1. Support the CRT neck with one hand and guide it into the plastic liner of the yoke. Push the CRT fully into the shield.

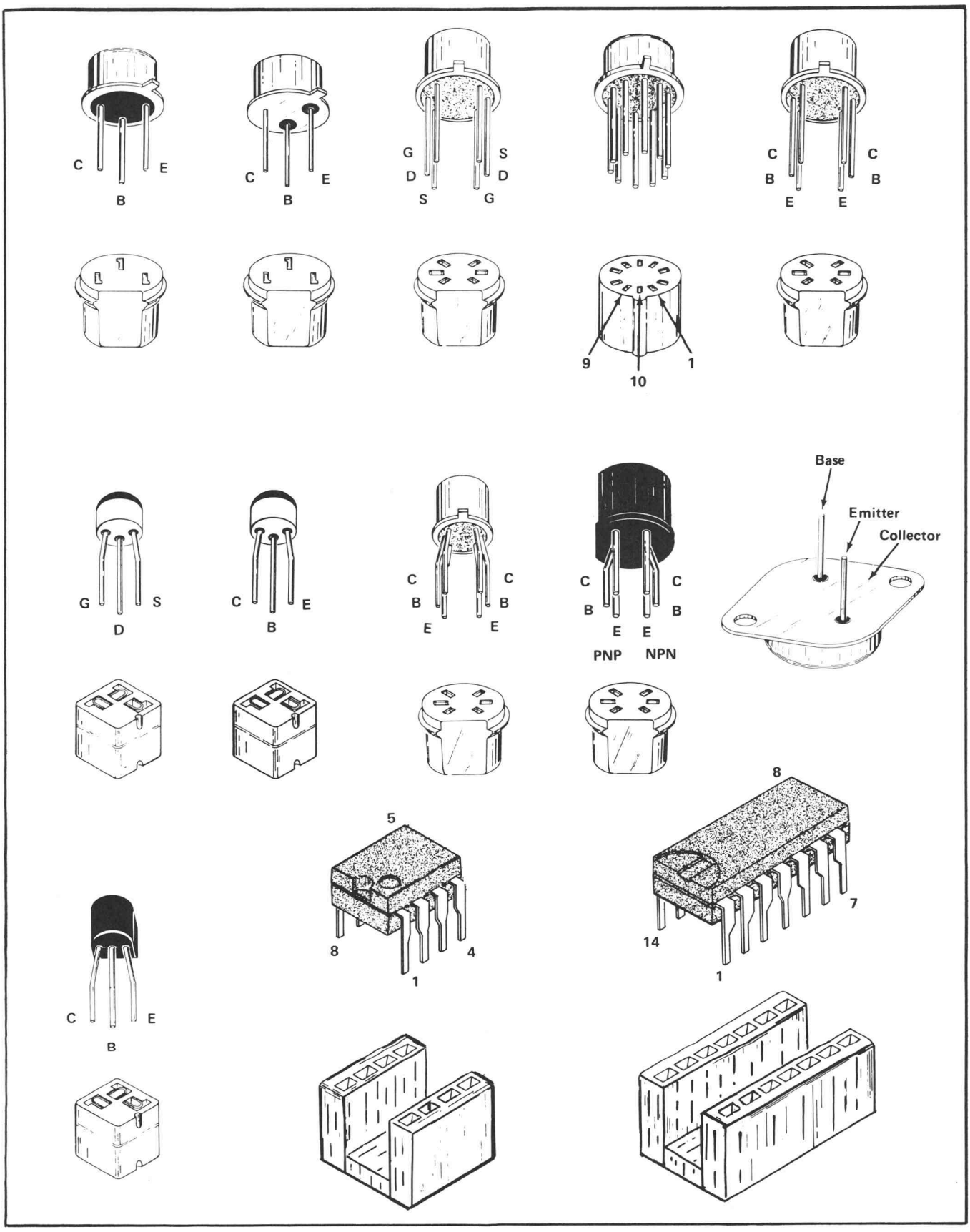


Fig. 4-1. Lead configuration of transistors and integrated circuits used in this instrument.

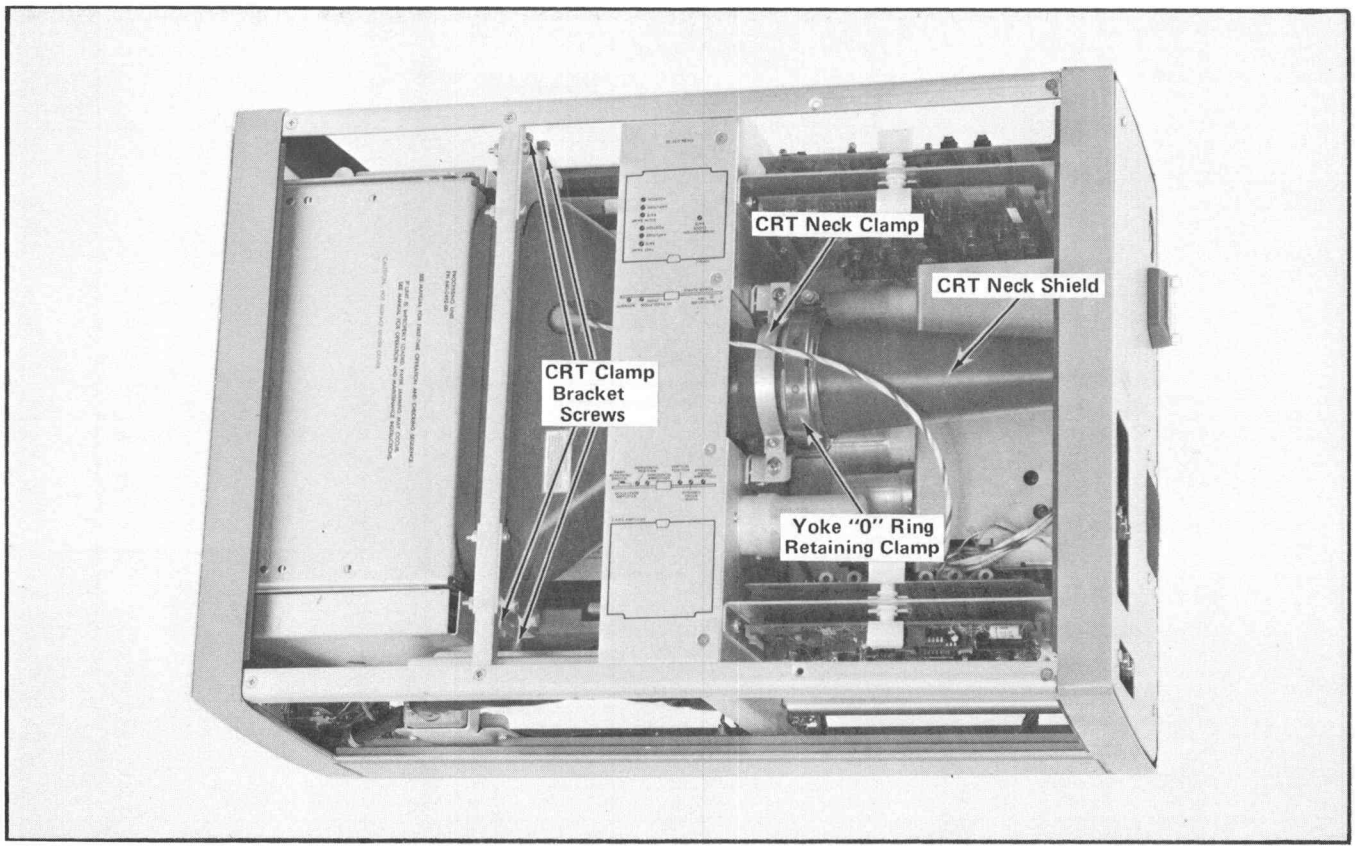


Fig. 4-2. Illustration showing location of CRT alignment adjustments.

2. Push the CRT forward so the fiber optic faceplate just touches the processor drive roller.

3. Use the four CRT clamp bracket screws, by loosening and tightening them, to align and hold the CRT so its horizontal centerline is mechanically parallel with the bottom or top of the instrument.

4. Install the CRT front shield cover. It may be necessary to readjust the four CRT clamp bracket screws if the fiber-optic faceplate will not fit through the slot in the front shield cover.

5. Tighten the "O" ring retaining clamp. As the clamp is tightened, the neck shield will be pulled forward snugly against the yoke "O" ring. Tighten the CRT neck clamp bracket.

6. Connect the CRT base socket and anode connector.

7. After the installation of a CRT, it may be necessary to re-adjust the instrument and reposition the trace and CRT. These procedures are given in Section 6 of this manual.

NOTE

The CRT shield and CRT neck shield are fabricated from a metal that protects the CRT yoke and electron trajectories from external magnetic interference. Since a sharp blow may cause the shield to lose some of its protective properties, handle it carefully. If the shield is damaged and a loss of shielding occurs, contact your local Tektronix, Inc. Application Engineer.

CHARACTERISTICS

The following performance characteristics are only valid under the conditions listed below.

The instrument must have been calibrated at an ambient temperature between +20°C and +30°C.

The instrument must be in an environment whose limits are described in Table 4-5.

The instrument must have a warmup period of at least 20 minutes.

TABLE 4-1

TIMING CHARACTERISTICS

Characteristics		Supplemental
Outputs		
Interrogation Control Pulse		
Nominal Width	85 μs	
Width Limits	60 μs to 100 μs	
Copy Gate (4610 Only)	T^2L. Gate low (ready to copy). Gate high (busy).	
Read	T^2L. Low during copy time	
HCU (4610 Option 1 Only)	T^2L. Low when 4610 Option 1 connected	Open collector output
Wait (4610 Option 1 Only)	T^2L open collector output low from Remote copy command until completion from unit which gave copy command. 4010-1 disabled. Output high, 4010-1 ready for operation	
Inputs		
Make Copy	T^2L with a low having a width of >200 μs initiating copy	
Target Signal	T^2L negative-going pulses with a width of approximately 400 ns	

TABLE 4-2

CRT CHARACTERISTICS

Characteristics		Supplemental
Type	T4601	P31 phosphor

TABLE 4-3

COPY CHARACTERISTICS

Characteristics		Supplemental
System Resolution	4010-1 essential resolution 2500 characters	For character format see 4010 manual
Transport Speed		
60 Hz		1.38 inches/second Gear ratio 74:1
50 Hz		1.15 inches/second Gear ratio 74:1

TABLE 4-4

POWER SOURCE CHARACTERISTICS

Characteristics		Supplemental
Line Voltage Range and Frequency (Factory Wired Options)		
115 VAC (4610)	90 to 136 VAC; 50-60 Hz	If line frequency rate is changed, instrument timing adjustments must be checked.
220 VAC (4610-1)	185 to 255 VAC; 50 Hz	
Maximum Power Consumption at 115 VAC, 60 Hz		1450 W for first 40 s after turn on. Normal Operation: 220 to 520 W. Excludes warm-up. Standby: 100 W.

TABLE 4-5

ENVIRONMENTAL CHARACTERISTICS

Characteristics		Supplemental
Temperature		
Operating	0°C to +35°C	
Non-Operating (Without Paper)		−15°C to +55°C
Non-Operating (With Paper)		−15°C to +35°C
Altitude		
Non-Operating		To 50,000 feet
Operating		To 15,000 feet. Maximum allowable ambient temperature decreased by 1°C/1000 feet from 5,000 feet to 15,000 feet.
Humidity		Operating Humidity performance limits are determined by the recording paper used.
Storage (Without Paper)		5 cycles (120 hours) to 95% relative humidity reference to MIL-E-16400F (Par. 4.5.9 through 4.5.9.5.1, Class 4)
Storage (With Paper)		At 100°F and 80% humidity edge deterioration will slowly start to take place within 2 days.

TABLE 4-5 (cont)

Characteristics		Supplemental
Vibration		
Non-Operating		15 minutes along each of the 3 major axes at a total displacement of 0.015 inch (2.3 g's at 55 Hz) with frequency varied from 10 to 55 Hz with frequency varied from 10 to 55 to 10 Hz in 1-minute sweeps. Hold for 3 minutes at 55 Hz. All major resonances must be above 55 Hz.
Shock		
Non-Operating		30 g's 1/2 sine, 11 ms duration, 2 guillotine-type shocks per axis each direction for a total of 12 shocks

TABLE 4-6

PHYSICAL CHARACTERISTICS

Characteristics		Supplemental
Finish	Anodized front panel on processor unit: Vinyl painted mainframe with anodized front and rear panels.	
Dimensions		
Cabinet Model (Overall)		
Height	11 inches (27.9 cm)	
Length	24.4 inches (62.0 cm)	
Width	16.8 inches (42.7 cm)	

TABLE 4-7

FUSES

Circuit No.	Purpose	Location	Size	
			115 VAC	220 VAC
F300	Line	Rear panel	15 A Fast-Blow	8 A Fast-Blow
F301	Electronics Unit	Rear panel	1 A Slow-Blow	0.5 A Slow-Blow
F303	Thermoelectric Cooling Unit	Main-frame underneath right-side rear	1.6 A Slow-Blow	0.8 A Slow-Blow
F307	Drive Motor	Processor left-side bottom	0.7 A Slow-Blow	0.4 A Slow-Blow
F28	Solenoid	Timing card near bottom	0.2 A Fast-Blow	
None	Thermal Heater	Inside processor, see Users Manual	Opens at 333°F	

ELECTRICAL ADJUSTMENT

Introduction

Complete electrical and mechanical adjustment information for the Hard Copy Unit is given in this section. The Hard Copy Unit can be returned to original performance by completion of each step in this procedure. Limits, tolerances, and waveforms in this procedure are given as adjustment guides, and are not instrument specifications. To touch up the adjustments, perform only those steps entitled "ADJUST". A short form adjustment procedure is also provided in this section for the convenience of the experienced calibrator.

The Hard Copy Unit should be checked and readjusted if necessary whenever copy quality deteriorates.

TEST EQUIPMENT REQUIRED

General

The following test equipment or its equivalent is required for the complete adjustment procedure. Specifications given for the test equipment are the minimum necessary for accurate adjustment of this instrument. All test equipment is assumed to be correctly calibrated, and operating within the given specifications. If equipment is substituted, it must meet or exceed specifications of the recommended equipment.

1. Precision DC Voltmeter. Accuracy; Within ±0.5%. Range: 0 to 5 kilovolts. For example, Fluke Model 825A Differential DC Voltmeter. Use a Fluke Model 80E-5 Voltage Divider with the voltmeter to measure voltage above 500 volts.

2. Test Oscilloscope. Bandwidth DC to at least 15 megahertz, minimum Deflection Factor; 0.005 volt per division, must have both alternate vertical channel display and differential comparator capabilities. For example, TEKTRONIX 7403N with 7A18, 7A13, and 7B52 plug-in units with three 1X probes and two 10X probes.

3. Storage Display Unit. Must be modified to operate with the 4610 and be calibrated. For example, TEKTRONIX 4010-1 Computer Display Terminal.

4. Variable Auto Transformer. Must be capable of supplying at least 1500 watts for the first 40 seconds, and 520 watts thereafter over a range of 99 to 132 volts AC (198 to 264 volts for 230 volt AC operation). If auto transformer does not have an AC voltmeter to indicate output voltage and a wattmeter to indicate wattage, monitor output with an AC voltmeter (RMS) with a range of at least 132 volts (264 volts for 230 volt AC operation), and with a wattmeter having a range of at least 1500 watts. For example, General Radio W10MT3W Metered Variac Auto Transformer.

5. Ruler. Must have inch scale and be at least eleven inches long.

6. Recording Paper. Minnesota Mining and Manufacturing Co. Type 777 Dry Silver Paper recommended. May be ordered from Tektronix, Inc., using TEKTRONIX Part No. 006-1603-00.

7. Special Rear Panel Plug. (Only for use when adjusting Hard Copy Unit.) Use 15-pin male Cinch or Cannon, DA15P or DAM15P connector, TEKTRONIX Part No. 131-0459-00 and construct according to diagram shown below.

8. Adjustment Tools

Description	TEKTRONIX Part No.
a. Insulated Screw Driver, 1-1/2 in. shaft, non-metalic	003-0000-00
b. Screw Driver, 3 in. shaft	003-0192-00

SHORT FORM ADJUSTMENT PROCEDURE and INDEX

This short form adjustment procedure is provided to aid in checking the operation of the Hard Copy Unit. It may be used as an adjustment guide by the experienced calibrator, or it may be used as a record of adjustment. Since the step numbers and titles used here correspond to those used in the complete procedure, this procedure also serves as an index to locate a step in the complete adjustment pro-

cedure. Performance requirements correspond to those given in the characteristics tables.

Hard Copy Unit _____

Hard Copy, Serial No. _____

Adjustment Date _____

Adjustment Technician _____

1. Check or Adjust +15 Volt Supply (R344) Page 5-3

   +15 volts, ±1% (±0.15 V)

2. Check Low-Voltage Power Supplies Page 5-5

Supply	Testpoint Location	Accuracy	Ripple
+15 V	TP345	±1% (+14.85 to +15.15 volts)	50 mV
−15 V	TP363	±3% (−14.55 to −15.45 volts)	80 mV
−40 V	TP395	±3% (−38.8 to −41.2 volts)	Not measured at this time
+100 V	TP331	±3% (+97 to +103 volts)	200 mV
+350 V	TP473 on Deflection Amp and Dynamic Focus Card	±15% (+297 to +402 volts)	3 V
25 V	Junction of C334 and Collector of Q334 on the Hard Copy Unit mainframe	±20% (+20 to +30 volts)	2.5 V

3. Check Voltage Range Selector Operation Page 5-5

   Repeat step 2 with the voltage range selector set to each of the two remaining voltage ranges.

4. Check or Adjust High Voltage Regulator (R366) Page 5-5

   R366–Voltmeter reading of −3500 volts

   −40 V Ripple– ≤300 mV

5. Check or Adjust Interrogation Pulse Period, Width, and Blanking (R122) Page 5-5

   Pulse Period–Between 1.5 and 4 μs

   Pulse Width–Approximately 200 ns

   Unblanking Pulse Width–Approximately 3.6 ms

6. Check or Adjust Fast Ramp (R92, R111, and R115) Page 5-6

   R92 Fast Ramp Time–Adjustable <4 ms to > 6 ms Set at 4 ms for procedure.

   R115 Fast Ramp Position–See Fig. 5-3.

   R111 Fast Ramp Amplitude–See Fig. 5-4

7. Check or Adjust Slow Ramp (R102 and R106) Page 5-8

   See complete procedure

8. Check or Adjust Horizontal Deflection (R401 and R405) Page 5-9

   R401 Horiz Amp–1.2 volts signal at TP434

   R405 Horiz Pos–Center waveform about 0 volt DC reference at TP434.

9. Check or Adjust Dynamic Focus (R453 and R458) Page 5-10

   NOTE

   Fast ramp time must be 4 ms for this step to be accurately checked or adjusted.

   R453–2.66 ms between 50% points on waveform at TP472

   R458–Waveform amplitude approximately 215 volts.

10. Check or Adjust Z Axis Protection and Intensity (R382) Page 5-10

    Shorting TP472 to ground should extinguish trace.

    R382 Intensity–With CONTRAST at 9 o'clock position, trace should just be invisible.

11. Check or Adjust Horizontal Position and Length (R401 and R405) Page 5-11

    R401 Horizontal Amplitude–Trace length 7.5 inches (19 centimeters).

    R405 Horizontal Position–Trace centered in horizontal scan area of CRT.

12. Check or Adjust Cathode Ray Tube Page 5-11

CRT Alignment–Parallel to top of processor.

Trace Alignment–Parallel to the flat surface of the processor using yoke for adjusting.

CRT to processor Alignment–With power disconnected, CRT fiber optic faceplate should just touch lower drive roller when drive rollers are together.

13. Check or Adjust Vertical Position (R482) Page 5-12

R482 Vertical Position–Center average trace position in vertical center of CRT.

14. Check or Adjust Cam Timing Page 5-12

Leading and trailing edges of T_{mech} waveform should occur approximately midway in the negative-going solenoid waveform.

15. Check Copy Making Page 5-12

Readable display copy from each terminal connected to Hard Copy Unit.

16. Check or Adjust Processor Temperature Page 5-13

Unexposed areas of copy should have a very light grey background.

ADJUSTMENT PROCEDURE

General

Any needed maintenance should be performed before proceding with adjustments. Troubles which become apparent during the procedure should be corrected immediately.

To prevent readjustment of other circuits when performing a partial procedure, readjust only if the listed tolerance is not met. However, when performing a complete procedure, best overall performance will be provided if each adjustment is made to the exact setting, even if the (CHECK) is within the allowable tolerance.

The following procedure uses equipment listed under Equipment Required. If equipment is substituted, control settings or test equipment setup may need to be altered to meet the requirements of the test equipment used.

NOTE

All waveforms shown in this procedure are actual waveform copies taken with either a TEKTRONIX oscilloscope camera system, or a Hard Copy Unit.

Preliminary Procedure

1. Remove the top and bottom covers from the Hard Copy Unit.

2. Set the Hard Copy Unit upright and remove the processor.

3. Connect the autotransformer to a suitable power source.

4. Connect the Hard Copy Unit to the autotransformer output.

5. Set the autotransformer output voltage to the nominal center voltage for which the voltage range selector has been set.

6. Set the front panel controls of the Hard Copy Unit as described below.

7. Set the Hard Copy Unit POWER SWITCH to ON. Allow at least 20 minutes warmup at 25°C ±5°C for checking the instrument to the given accuracies.

PROCEDURE

Control Settings

	Hard Copy Unit
COPY	As Is
CONTRAST	Fully Counterclockwise
POWER	ON

1. Check or Adjust +15 Volt Supply (R344)

a. Connect the precision DC voltmeter between the +15 volt test point (TP345) and ground (Fig. 5-1).

b. CHECK–The output voltage should be between +14.85 and +15.15 volts.

c. ADJUST–R344 +15 Volts (Fig. 5-1) for a voltmeter reading of +15 volts ±1%.

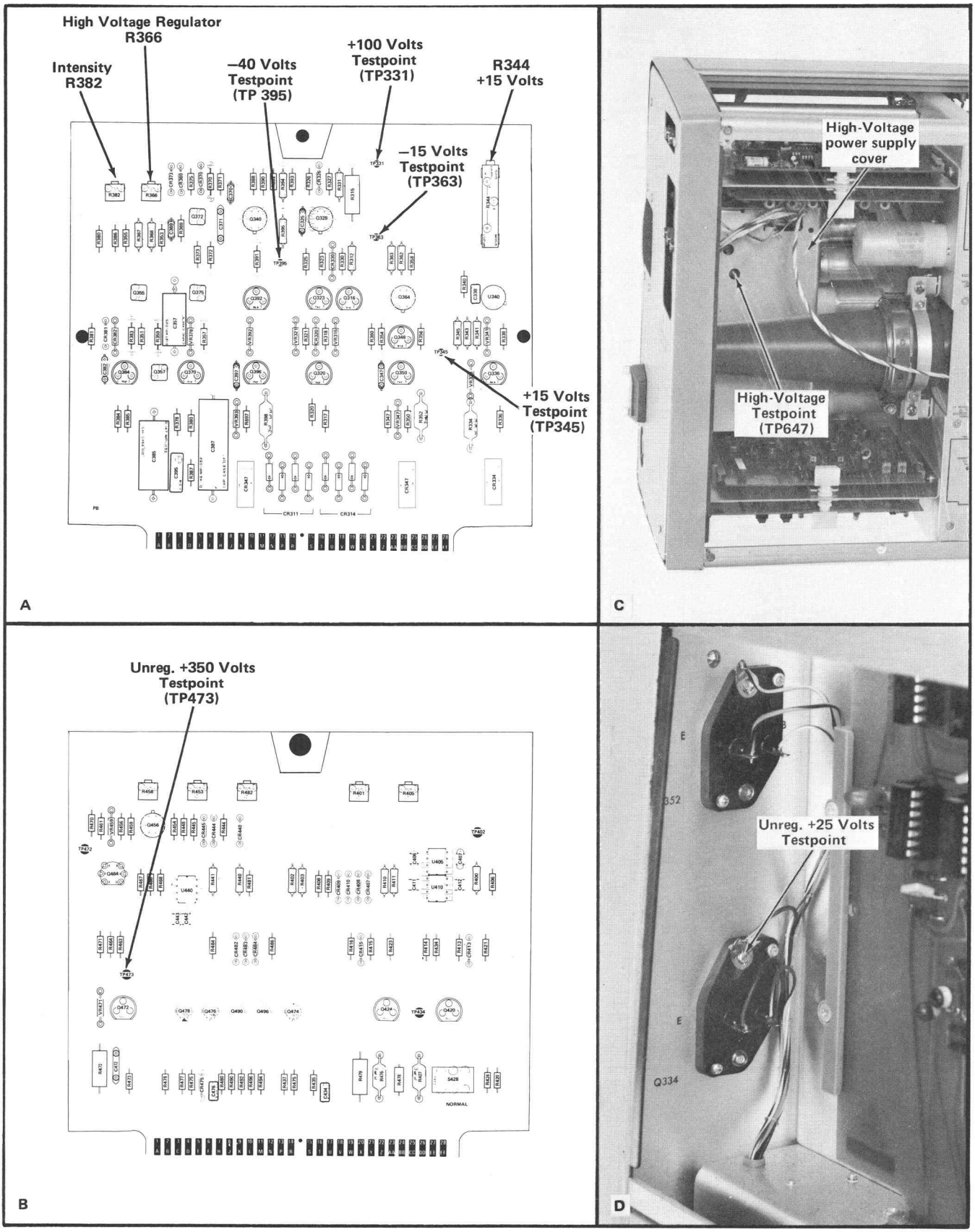


Fig. 5-1. (A) Location of Power Supply and High Voltage Regulator circuit card adjustments and testpoints. (B) Location of +350 V unregulated testpoint. (C) Location of high voltage testpoint. (D) Location of +25 V unregulated testpoint.

d. INTERACTION—Operation of all circuits within the Hard Copy Unit may be affected by the +15 volt supply.

2. Check Low Voltage Power Supplies

a. Connect the precision DC voltmeter successively between the output of each low voltage power supply and ground. See Fig. 5-1 for test point locations.

b. CHECK—Each supply is within the accuracy tolerance listed in Column 3 of Table 5-1.

c. Set the test oscilloscope for a vertical deflection factor of 0.005 volt per division; Channel 1, AC coupled; sweep rate of 5 milliseconds per division with negative slope; external automatic triggered sweep.

d. Connect a 1X probe from the test oscilloscope external trigger connector to TP434 on the deflection amplifier and dynamic focus circuit card; see Fig. 5-1. Connect a 1X probe from the test oscilloscope Channel 1 input consecutively to each power supply test point (Fig. 5-1).

e. CHECK—As the autotransformer output voltage is varied from the lower through the upper line voltage operating range, each supply voltage remains within the accuracy tolerance and the peak to peak ripple voltage amplitude (−40 V supply ripple is not measured at this time).

TABLE 5-1

Supply	Testpoint Location	Accuracy	Ripple
+15 V	TP345	±1% (+14.85 to +15.15 volts)	50 mV
−15 V	TP363	±3% (−14.55 to −15.45 volts)	80 mV
−40 V	TP395	±3% (−38.8 to −41.2 volts)	Not measured at this time
+100 V	TP331	±3% (+97 to +103 volts)	200 mV
+350 V	TP473 on Deflection Amp and Dynamic Focus Card	±15% (+297 to +402 volts)	3 V
25 V	Junction of C334 and Collector of Q334 on the Hard Copy Unit mainframe	±20% (+20 to +30 volts)	2.5 V

3. Check Voltage Range Selector Operation

a. Repeat Step 2 with the voltage range selector set to each of the remaining two voltage ranges.

b. Set the autotransformer output voltage to the nominal center voltage for which the voltage range selector has been set (i.e., line voltage range on which the Hard Copy Unit will be used).

c. Disconnect the test oscilloscope and the precision DC voltmeter.

4, Check or Adjust High Voltage Regulator (R366)

a. Connect the precision DC voltmeter between the high voltage test point TP647 and ground (−3500 V). See Fig. 5-1.

b. CHECK—DC voltmeter for a reading of −3500 volts ±5%.

c. ADJUST—R366 High Voltage Regulator (Fig. 5-1) to obtain a voltmeter reading of −3500 volts.

d. Disconnect the voltmeter.

e. Set the test oscilloscope for a vertical deflection factor of 0.05 volt per division; Channel 1, AC coupled; sweep rate 5 milliseconds per division with positive slope; source, line frequency; automatic trigger sweep.

f. Connect the 1X probe from the test oscilloscope Channel 1 input to TP395 −40 volt power supply test point (Fig. 5-1).

g. CHECK— −40 volt power supply ripple remains less than or equal to 300 millivolts as the autotransformer output voltage is varied from the lower through the upper voltage operating range.

h. Disconnect the test oscilloscope.

5. Check or Adjust Interrogation Pulse Period, Width, and Blanking (R122)

a. Set the test oscilloscope for a vertical deflection factor of 2 volts per division; Channel 1, DC coupled; sweep rate of 1 microsecond; negative slope; internal source; automatic triggered sweep.

b. Connect a 1X probe from the test oscilloscope Channel 1 input to TP125 on the timing circuit card. See Fig. 5-2.

c. Press COPY button.

d. CHECK—Test oscilloscope for a pulse period between 1.5 and 4 microseconds and a pulse width of approximately 200 nanoseconds at the 50% point of the waveform.

e. ADJUST—R122 Pulse Period (Fig. 5-2) fully clockwise and fully counterclockwise, and check for an adjustment range ≥1.5 microseconds to ≤4 microseconds. Adjust R122 for a pulse period of between 1.5 to 4 microseconds.

f. Set the test oscilloscope for a sweep rate of 1 millisecond per division.

g. Push COPY button.

h. CHECK—Test oscilloscope for an unblanking pulse approximately 3.6 milliseconds in width, negative-going.

i. Disconnect the test oscilloscope.

6. Check or Adjust Fast Ramp (R92, R111, and R115)

a. Set each channel of the dual-trace vertical unit of the test oscilloscope for a vertical deflection factor of 2 V/division. Both channels DC coupled; positive deflection up; alternate display modes; trigger source, Channel 1. Set the sweep unit of the test oscilloscope for a sweep rate of 1 ms/division with negative slope; internal source; AC coupled; automatic triggered sweep; display mode, main sweep.

b. Connect a 1X probe from the test oscilloscope Channel 1 input connector to the junction of U81, Pin 6 and R85, on the timing circuit card. See Fig. 5-2.

c. Connect a 1X probe from the test oscilloscope Channel 2 input connector to TP125 on the timing circuit card. See Fig. 5-2.

d. CHECK—Test oscilloscope display while varying R92 Fast Ramp Time (Fig. 5-2) fully clockwise, and then fully

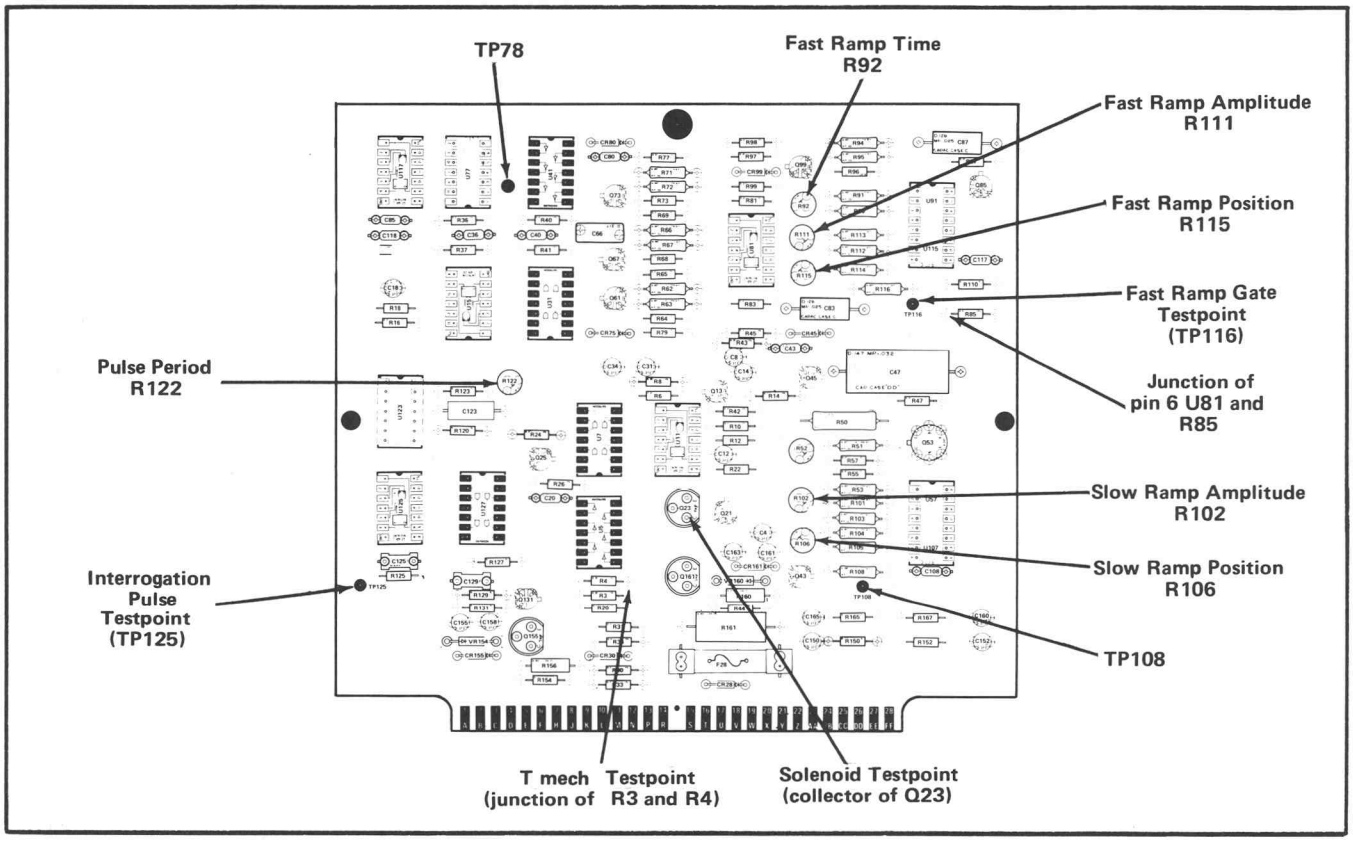


Fig. 5-2. Location of Timing circuit card adjustments and testpoints.

counterclockwise. Observe a ramp time greater than 6 milliseconds in the clockwise direction of the control and a time less than 4 milliseconds in the counterclockwise position of the control.

e. ADJUST—R92 Fast Ramp Time (Fig. 5-2) for a ramp time of 4 milliseconds.

f. Set the differential comparator unit of the test oscilloscope for a vertical deflection factor of 2 V/division; DC coupling; positive input; negative input grounded. The controls of the sweep unit remain the same as indicated in part a above. Set the test oscilloscope vertical mode controls to display only the output of the differential comparator unit.

g. Connect a 1X probe from the +input connector on the differential unit in the test oscilloscope to TP116 on the timing circuit card. See Fig. 5-2. Do not disconnect the other two probes at this time.

h. CHECK—Test oscilloscope display as R111 (Fig. 5-2) is rotated from its fully counterclockwise position to its fully clockwise position. The signal amplitude should be less than 10 volts when the control is fully counterclockwise, and greater than 10 volts when the control is fully clockwise. Observe the test oscilloscope display as R115 (Fig. 5-2) is varied from its fully counterclockwise position to its fully clockwise position. Note that the center of the 10 volt ramp is varied about a 0 volt level.

i. Set the test oscilloscope vertical mode controls to chop between vertical units. Set the differential comparator unit of the test oscilloscope for a vertical deflection factor of 50 mV/division; volts control, 5.000 volts; polarity, +; plus input, DC coupling; negative input, V_C coupling. Set the sweep unit of the test oscilloscope for a sweep rate of 0.1 millisecond; display mode, intensity; delayed sweep rate, 0.1 ms/division; slope, positive; delayed time multiplier, 4.20.

j. Push in the V_C reference button on the differential comparator and using the differential comparator position control, center the trace on the CRT of the test oscilloscope.

k. Push the COPY pushbutton.

l. CHECK—Test oscilloscope display for a waveform which appears similar to that waveform shown in Fig. 5-3.

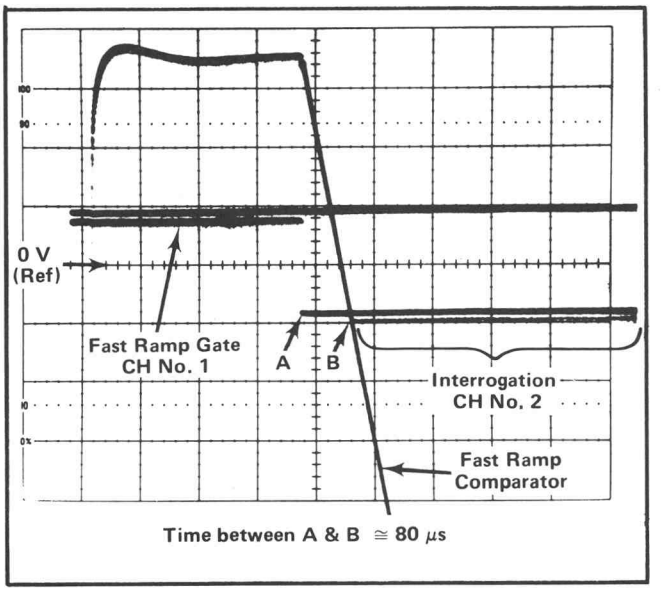


Fig. 5-3. Illustration showing correct test oscilloscope display when R115 Fast Ramp Position is properly adjusted

m. ADJUST—R115 (Fig. 5-2) Fast Ramp Position so that the fast ramp passes through the null point (center of test oscilloscope CRT) where the interrogate pulse train touches the reference line as shown in Fig. 5-3.

n. Set the volts control of the differential plug-in to 5.00 and the polarity to —. Set the time-base unit delayed time multiplier control, to 3.80; main and delayed sweep rates, 0.5 ms/division.

o. Check the V_C reference point on the test oscilloscope. The trace should be centered on the test oscilloscope CRT.

p. CHECK—Test oscilloscope display should show that the bottom tip of the ramp falls on the center of the CRT. See Fig. 5-4.

q. ADJUST—R111 Fast Ramp Amplitude (Fig. 5-2) so that the bottom tip of the ramp falls on the center of the test oscilloscope CRT. See Fig. 5-4.

r. Repeat parts i through q to remove interaction between the two adjustments.

s. Disconnect the test oscilloscope.

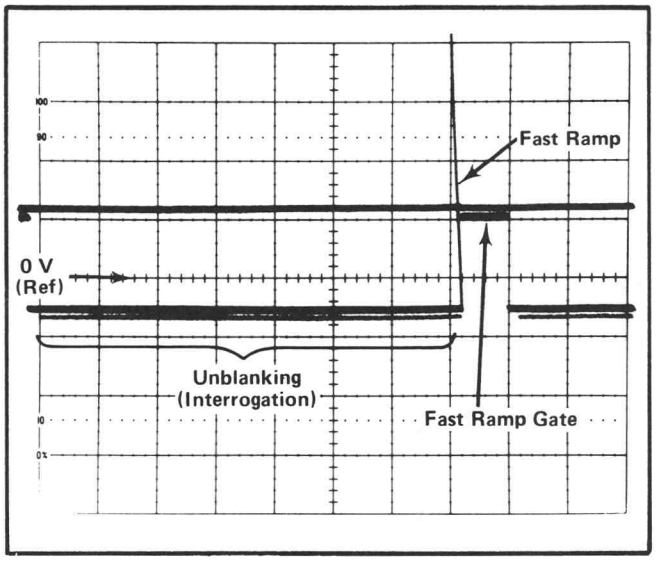


Fig. 5-4. Illustration showing correct test oscilloscope display when R111 Fast Ramp Amplitude is properly adjusted.

7. Check or Adjust Slow Ramp (R102 and R106)

a. Set the alternate trace unit of the test oscilloscope vertical deflection factor, 2 V/division; channel 2, DC coupled; mode switch, channel 2; trigger source, channel 2; channel 2 polarity, plus up; channel 1, grounded. Set the differential comparator unit of the test oscilloscope volts control, 5.000; polarity, +; + input, DC; – input, V_C; bandwidth control, 5 megahertz; vertical deflection factor, 50 mV/division. Set the sweep plug-in unit of the test oscilloscope for a sweep rate, of 20 ms/division; magnifier, off; display mode, main sweep; trigger source, internal; trigger coupling, AC; triggering mode, automatic. Set the test oscilloscope display controls: vertical mode, chopped; triggering source, alternate trace unit.

b. Connect a 1X probe from the test oscilloscope Channel 2 input connector to TP78 and a 1X probe from the + input connector of the differential unit to TP108 on the timing circuit card. See Fig. 5-2.

c. Push in the V_C reference control on the differential comparator unit in the test oscilloscope and position the trace to the test oscilloscope display center line.

d. Push the COPY pushbutton.

e. CHECK–Test oscilloscope display to see that the slow ramp starts down the CRT then the READ switch goes high.

f. Change the sweep unit trigger mode switch in the test oscilloscope to normal.

g. Push COPY pushbutton.

h. CHECK–Test oscilloscope display to see that the ramp starts at the reference line established (+5.000 volts) ±1 major division (±50 millivolts). Note that the COPY pushbutton will have to be pushed a number of times to see the start of the slow ramp. See Fig. 5-5.

i. ADJUST–R106 Slow Ramp Position (Fig. 5-2) until the start of the slow ramp is at the reference line (+5.000 volts) ±1 major division (±50 millivolts).

j. Set the alternate trace unit of the test oscilloscope for inverted signal. Set the differential comparator unit in the

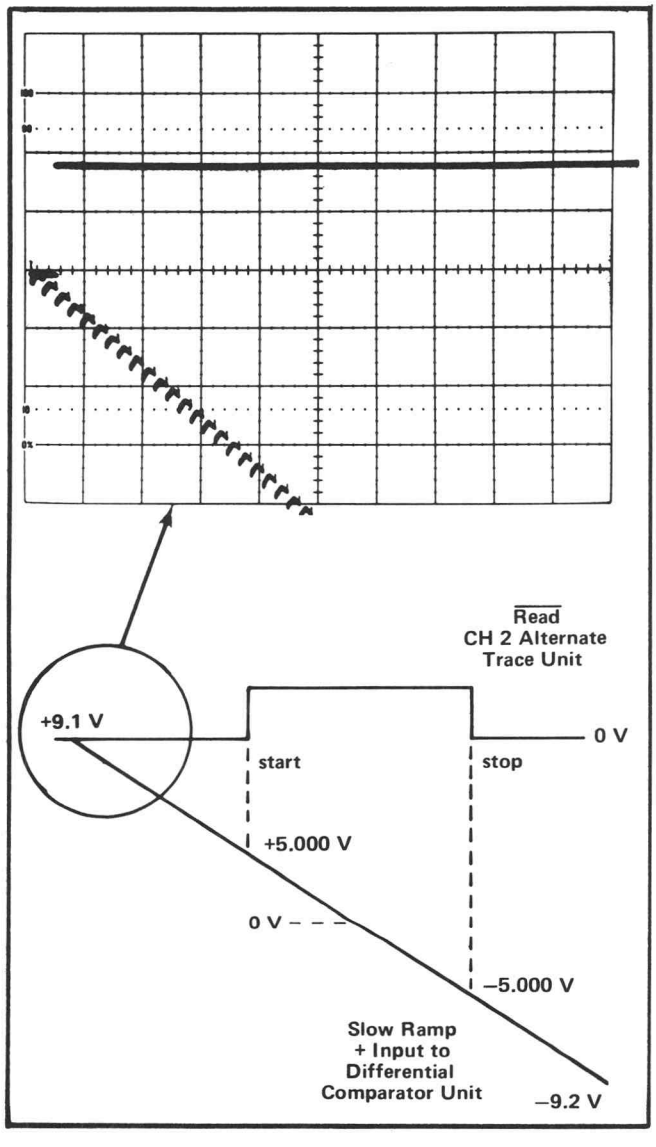


Fig. 5-5. Illustration showing (A) Correct test oscilloscope display when R106 Slow Ramp Position is properly adjusted (B) Overall waveform relationship of slow ramp and read signals.

test oscilloscope volts control, 5.000; polarity, −; vertical deflection factor, 50 millivolts per division. The remaining test oscilloscope controls stay the same.

k. CHECK—Test oscilloscope display while pushing COPY pushbutton and check that the slow ramp starts at the established reference line at the center of the test oscilloscope CRT within one major division.

l. ADJUST—R102 Slow Ramp Amplitude (Fig. 5-2) until the start of the slow ramp is at the center reference line of the test oscilloscope CRT within ±1 major division.

m. Repeat the parts above until the interaction between R106 and R102 has been removed.

n. Disconnect the test oscilloscope.

8. Check or Adjust Horizontal Deflection (R401 and R405)

a. Set the test oscilloscope for alternate trace unit vertical deflection factor, 20 mV/division; display mode, channel 1; channel 1, DC coupled; trigger source, channel 1; sweep rate, 1 ms/division; slope, positive; source, internal; coupled, AC automatic triggered sweep.

b. Connect a 10X probe from a test oscilloscope Channel 1 connector to TP434 on the vertical amp and dynamic focus circuit card. See Fig. 5-6.

c. Establish a ground reference point in the center of the test oscilloscope CRT.

d. CHECK—Test oscilloscope display for waveform having approximately 1.2 volts amplitude and the waveform being centered about zero DC reference point.

e. ADJUST—R401 Horiz Amp (Fig. 5-6) for a test oscilloscope waveform amplitude of approximately 1.2 volts. Adjust R405 Horiz Pos (Fig. 5-6) so that the test oscilloscope waveform is centered about the test oscilloscope zero volt DC reference point.

f. Disconnect the test oscilloscope.

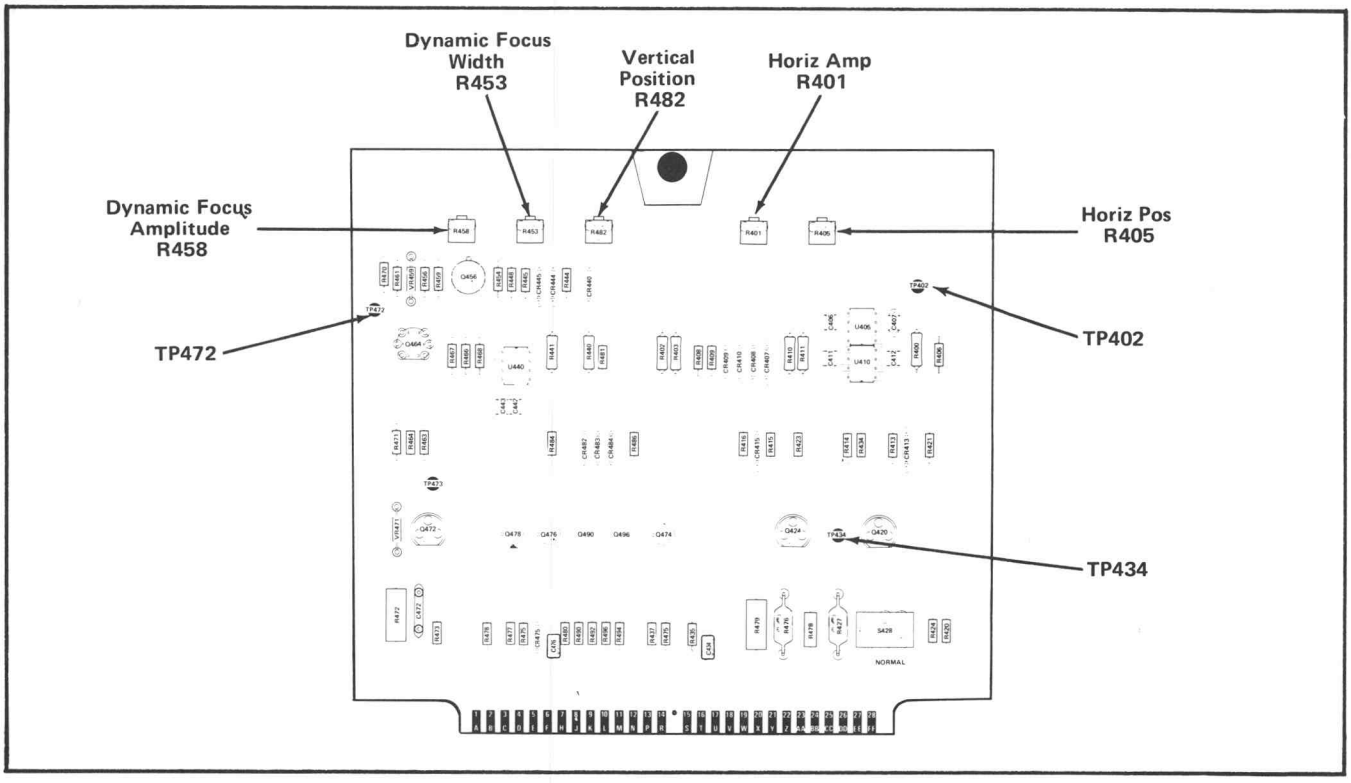


Fig. 5-6. Location of Deflection Amplifier and Dynamic Focus circuit card adjustments and testpoints.

9. Check or Adjust Dynamic Focus (R453 and R458)

a. Set the test oscilloscope for vertical deflection factor, 5 V/division, channel 1, DC coupled; trigger source, channel 1; display mode, channel 1; sweep rate, 1 ms/division; slope, positive; source, internal; coupling, AC; automatic triggered sweep.

NOTE

For this step to be done accurately, the fast ramp must be set to 4 milliseconds.

b. Connect a 10X probe from a test oscilloscope, channel 1 connector to TP472 on the deflection amp and dynamic focus circuit card. See Fig. 5-6.

c. CHECK–Test oscilloscope display for a waveform which has an amplitude of approximately 215 volts and a width at its 50% point of 2.66 milliseconds. See Fig. 5-7.

d. ADJUST–R453 dynamic focus width and R458 dynamic focus amplitude (see Fig. 5-6) for waveform amplitude of approximately 215 volts with a width at the waveform 50% points of 2.66 milliseconds.

e. Disconnect test oscilloscope.

10. Check or Adjust Z Axis Protection and Intensity (R382)

a. Install 15-pin male connector to J701 on the rear panel of the Hard Copy Unit.

b. If the Hard Copy Unit has a MUX option, push terminal 1 pushbutton in.

c. Push COPY pushbutton.

d. Turn CONTRAST control clockwise until a horizontal line is displayed on the hard copy CRT.

e. Set the test oscilloscope for vertical deflection factor, 20 mV/division; channel 1, DC coupled; sweep rate, 1 ms/division; slope, positive; source, internal; coupling, AC; automatic triggered sweep.

f. Connect a 10X probe from the test oscilloscope channel 1 input connector to TP434 (Fig. 5-6).

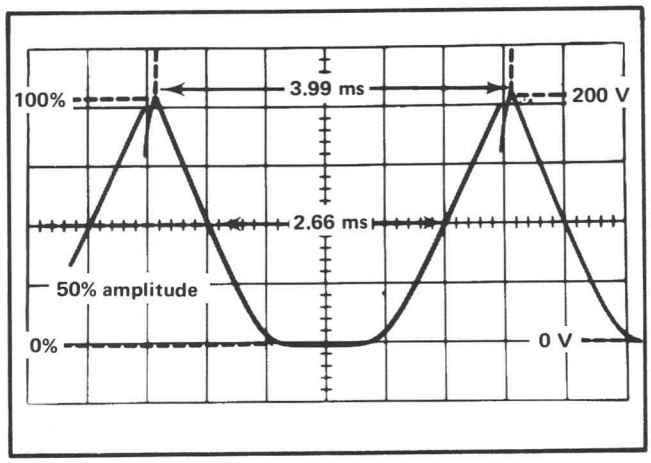


Fig. 5-7. Dynamic focus waveform.

g. Note test oscilloscope waveform.

h. Connect a shorting strap between TP402 (Fig. 5-6) and ground.

i. CHECK–Test oscilloscope waveform should appear as a sawtooth.

j. Push COPY pushbutton and observe that no trace is displayed on the Hard Copy Unit CRT.

k. Remove the ground strap from TP402.

l. Push the COPY pushbutton and note that a trace appears on the Hard Copy Unit CRT. Momentarily, short TP402 to ground while the trace is running on the Hard Copy Unit CRT, and note that the trace will disappear for the time that TP402 is shorted to ground.

m. Disconnect the test oscilloscope and the ground strap.

n. Turn the CONTRAST control to its 9 o'clock position.

o. ADJUST–R382 Intensity (Fig. 5-1) until the trace is visible, then back off on the adjustment until the trace is just invisible.

p. Disconnect 15-pin male connector.

11. Check or Adjust Horizontal Position and Length (R401 and R405)

a. Set CONTRAST control to its 12 o'clock position.

b. Push COPY pushbutton.

c. Rotate R405 horizontal position (Fig. 5-6) throughout its range.

d. CHECK—Hard Copy Unit CRT display for a trace movement of at least 0.8 inch (2 centimeters) on each side of a trace centered position.

e. CHECK—Hard Copy Unit CRT display for a trace length of 7.5 inches (19 centimeters).

f. ADJUST—R401 Horizontal Amplitude and R405 Horizontal Position for a trace length of 7.5 inches (19 centimeters) and a trace position in the horizontal center of the Hard Copy Unit CRT.

12. Check or Adjust Cathode Ray Tube (CRT)

a. Install the processor into the Hard Copy Unit mainframe. Check slide-out track adjustment and extend it from the mainframe. If the processor does not install easily into the mainframe, the slide-out tracks may need adjustment. To adjust slide-out tracks, loosen the screws holding the mainframe part of the tracks, and allow the tracks to position themselves. Then retighten the screws.

b. Load paper into the processor with the processor remaining extended from the mainframe after paper loading.

c. CHECK—CRT should be mechanically level with a flat surface on the top of the processor.

d. ADJUST—Using the four CRT clamp bracket screws, (see Fig. 5-8) mechanically adjust the CRT until it is parallel to a top flat surface on the processor, and the CRT is mechanically centered in the CRT shield opening.

e. Press COPY pushbutton.

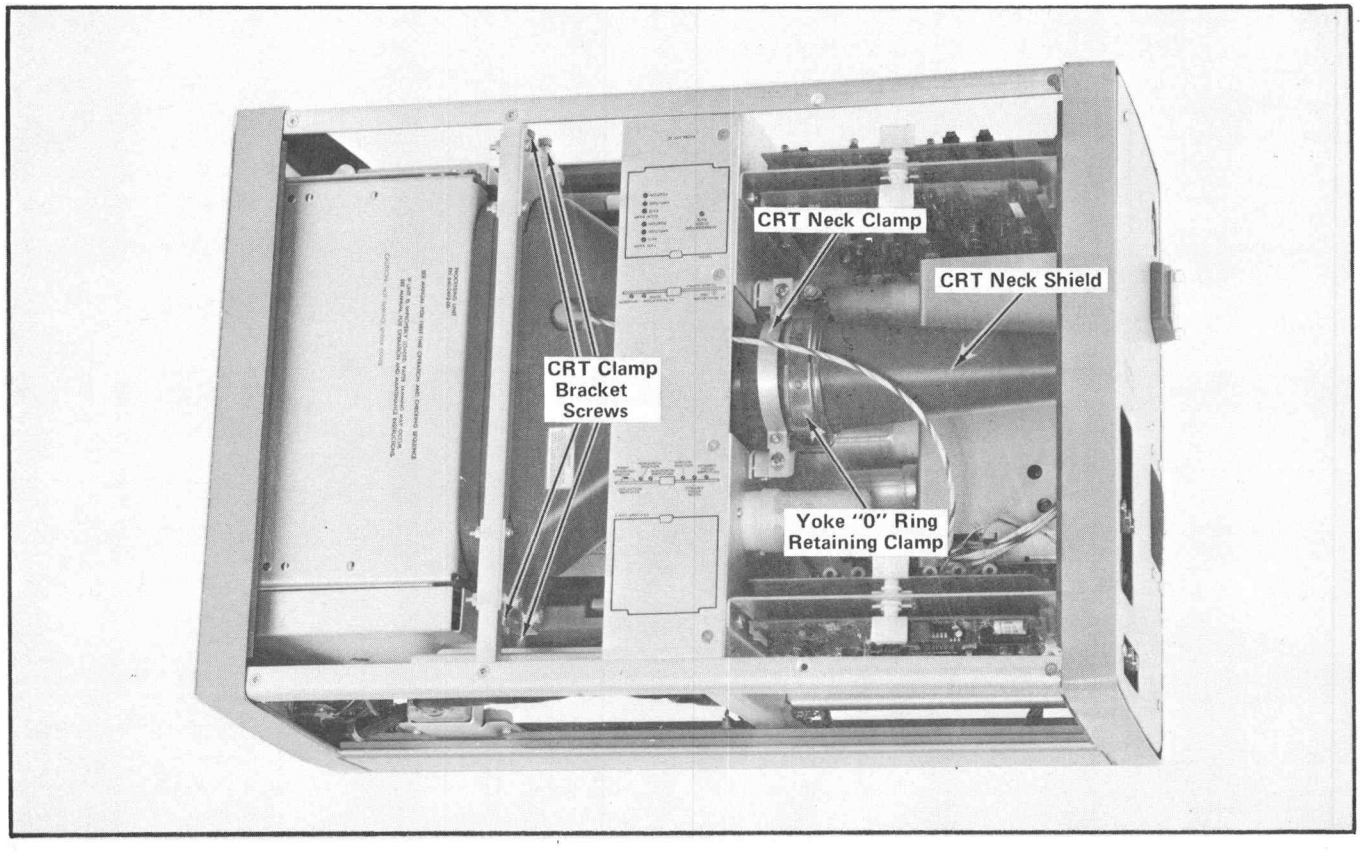


Fig. 5-8. Illustration showing location of CRT alignment adjustments.

f. CHECK–CRT display trace is parallel to the flat surface of the processor.

g. ADJUST–Trace alignment by loosening the yoke "O" ring retaining clamp and rotating the CRT neck shield assembly (see Fig. 5-8) until the trace is parallel to the top flat surface of the processor. Make sure the CRT neck shield is as far forward as possible and tighten the yoke "O" ring retaining clamp when adjustment has been completed.

h. Install the processor fully into the mainframe using the processor latches to lock the processor into position.

i. Press the COPY pushbutton.

j. Unplug the Hard Copy Unit from its power source when drive rollers come together.

k. CHECK–Hard Copy Unit CRT fiber optic faceplate should just touch the processor lower drive roller when the drive rollers are together, that is, in the position to drive paper.

l. ADJUST–Using the four CRT clamp bracket screws and the CRT neck clamp, mechanically adjust the CRT until its fiber optic faceplate just touches the lower processor drive roller.

13. Check or Adjust Vertical Position (R482)

a. Reconnect the Hard Copy Unit to its power source and allow the processor to complete the cycle started in the above step.

b. Slide processor out from mainframe.

c. Press COPY pushbutton.

d. Rotate R482 Vertical Position (Fig. 5-6) throughout its range.

e. CHECK–Hard Copy Unit CRT display to see that the trace can be moved off the scanning area in both directions.

f. ADJUST–R482 Vertical Position to center the average position of the trace in the center of the CRT.

NOTE

The trace moves slightly vertically while the unit is scanning. It may take several copy cycles to determine that the sweep is centered vertically on the Hard Copy Unit CRT.

g. Install the processor fully into the mainframe.

14. Check or Adjust Cam Timing

a. Set the test oscilloscope for a vertical deflection factor, 0.5 V/division; (channel 1) and 0.1 V/division (channel 2); both channels, DC coupled; channel 2 polarity, + up; both channels, chopped; sweep rate, 50 ms/div; slope, negative; channel 2 trigger source, internal; normal triggered sweep.

b. Connect 10X probe from the test oscilloscope channel 1 input to the collector of Q23; see Fig. 5-2.

c. Connect a 10X probe from the test oscilloscope channel 2 input to the junction of R3 and R4 on the Timing Circuit card, see Fig. 5-2.

d. Push the COPY pushbutton.

e. CHECK–Test oscilloscope waveform, for the T_{mech} leading and trailing waveform edges occurring approximately midway in the solenoid negative-going waveform time; see Fig. 5-9.

f. ADJUST–The T_{mech} shaft can be adjusted to position the T_{mech} waveform edges midway in the solenoid pulse. Contact your local Tektronix, Inc. Applications Engineer for further information.

g. Disconnect the test oscilloscope.

15. Check Copy Making

a. Remove the special 15-pin connector from J701.

b. Connect 4610 Hard Copy Unit to the 4010-1 Computer Display Terminal. If the 4610 has Option 1 Multiplexer, connect the 4010-1 to Terminal 1 and depress Terminal 1 pushbutton on rear panel of Hard Copy Unit.

c. Press Hard Copy Unit COPY pushbutton.

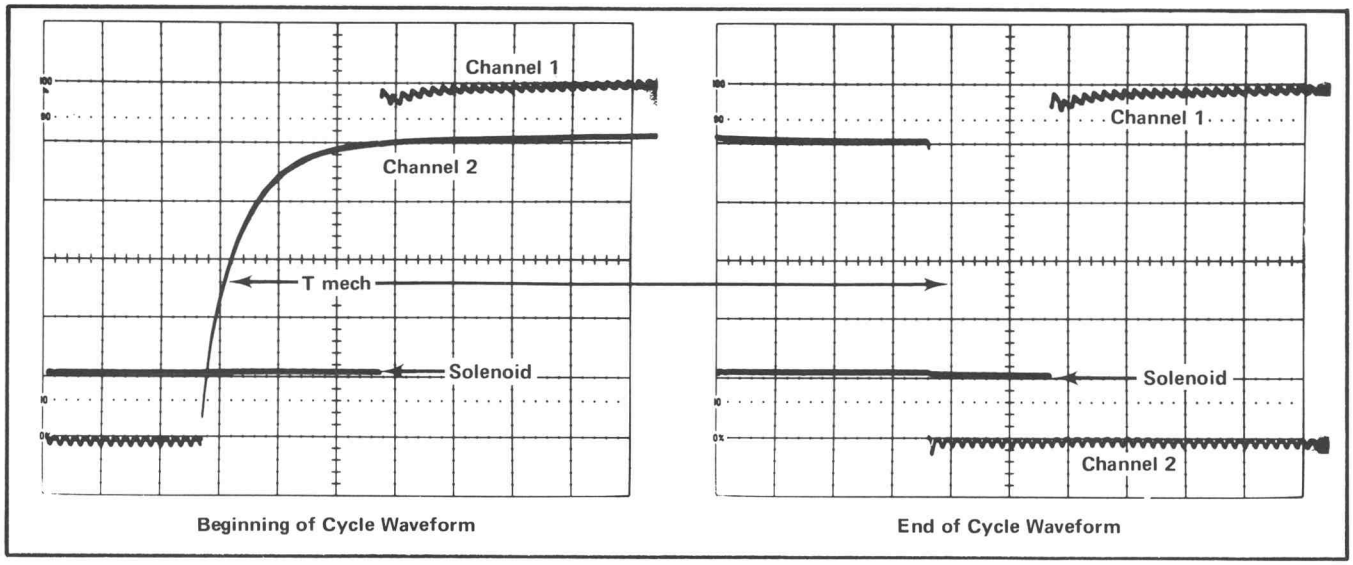


Fig. 5-9. Cam timing waveform of beginning and end of copy cycle.

d. CHECK–Paper copy for a readable display copy.

e. If 4610 has Option 1 Multiplexer, connect a 4010-1 to each of the other terminal positions and depress the MUX pushbutton.

f. Initiate a copy command from each 4010-1.

g. Repeat the above check for each 4010-1.

NOTE

The 15-pin connector removed in part a can be used to observe the signals required for proper multiplexer operation.

16. Check or Adjust Processor Temperature

a. With the 4610 connected to the 4010-1, push the COPY pushbutton to obtain a paper copy.

b. CHECK–Copy should have a very light gray background in the unexposed areas of the copy.

c. ADJUST–The processor temperature adjustment (Fig. 5-10) in small increments until the unexposed areas of the paper have a very light gray background.

This completes the electrical adjustment procedure. Replace the instrument covers.

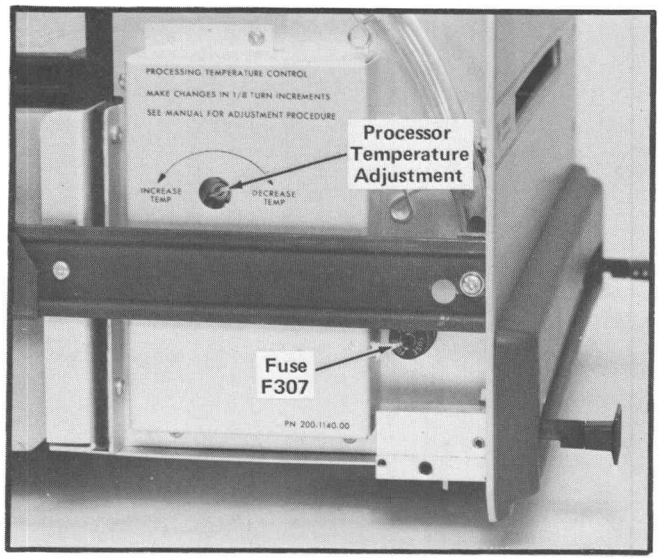


Fig. 5-10. Location of processor Processing Temperature Control.

SECTION 6

DIAGRAMS, CIRCUIT DESCRIPTIONS, AND PART LISTS

The Electrical Parts List and the Circuit Description for each circuit diagram is located on the pages preceeding that diagram.

Symbols and Reference Designators

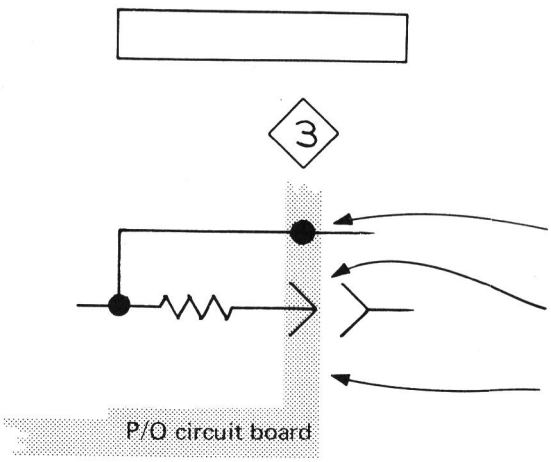
Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μF).
Resistors = Ohms (Ω)

Symbols used on the diagrams are based on USA Standard Y32.2-1967.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



External control or connector.

Refer to diagram number indicated in diamond.

Connection soldered to circuit board.

Connection made to circuit board with interconnecting pin.

Blue tint encloses components located on circuit board.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
Q	Transistor or silicon-controlled rectifier
P	Connector, movable portion
R	Resistor, fixed or variable
RT	Thermistor
S	Switch
T	Transformer
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal

Ⓐ

MECHANICAL DESCRIPTION

Processor Operation

General. All actions of the processor unit are electronically controlled by the mainframe. When a copy is desired, the timing cycle is initiated. Initiating the timing cycle causes a 600 ms pulse to be sent from the mainframe circuitry to the processor. The pulse energizes a solenoid, which actuates the escapement mechanism that separates the upper and lower cutter blades, and forces the paper drive rollers together. The paper drive rollers coming together causes the recording paper to be pulled past the fiber optic CRT at a constant rate of about 0.5 inch per second. The exposed paper is then fed into the development section of the processor.

When the scanning of the Storage Display Unit has been completed, there is a delay of about three seconds to allow the last of the recorded information (exposed paper) to be pulled through the cutter blades. At the end of the approximate three-second delay, another pulse is sent to the solenoid, from the mainframe, which again actuates the escapement mechanism, this time causing the drive rollers to separate and the cutter blades to shear the paper. The cut off paper continues through the development section of the processor, and emerges from the slot in the front-panel.

Drive System. Mechanical power to drive the processor is provided by an 1800 RPM, 1/50 hp synchronous reluctance motor. (A synchronous motor is necessary to maintain a constant paper feed rate, regardless of the line voltage and load variations.) The synchronous motor drives a gear box having a reduction ratio through a safety coupling (clutch). The safety clutch disengages the motor from the gearbox when the torque load exceeds the normal load by a factor of two, minimizing the possibility of damage. The safety clutch will not re-engage until the power switch has been turned off and the motor RPM has slowed down. If the line voltage is now re-applied to the 4610, but the torque load stalls the motor without disengaging the safety clutch, fuse F307 will blow in about 20 seconds.

Timing belts distribute the mechanical power from the output of the gear box to the necessary points. One belt drives the drum in the developer section, while a second belt drives the paper feed rollers and cutter blade mechanism.

The paper feed rollers have been coated to provide a more positive grip on the recording paper. Only the upper paper roller is driven directly, while the lower paper roller is driven by contact with the upper roller near the ends when the two rollers are forced together. The upper paper feed roller is crowned to account for a shaft deflection and for other design criteria.

The modified timing belt pulley is on the lower shaft near the solenoid. It normally runs freely, with the rocker at the end of the shaft normally held out of engagement with the teeth of the star wheel section by the sear attached to the solenoid plunger. When the solenoid is pulsed, the rocker is pulled into engagement with the star wheel section for a half-revolution of the modified pulley, after which it is disengaged. This half-revolution action causes eccentrics on the rocker shaft to raise the upper cutter blade and lift the lower paper feed roller into contact with the upper paper roller. A second pulse to the solenoid causes another half-revolution of the rocker shaft, which separates the upper and lower paper feed rollers and lowers the upper cutter blade to shear the recording paper.

Development. The development section of the processor consists of a urethane-coated drum and a blanket heater which covers about 240° of the drum's circumference. The blanket heater itself is a two-element resistance wire array, imbedded in a fiberglass-silicone rubber sheet which is vulcanized to a metal wrap-around.

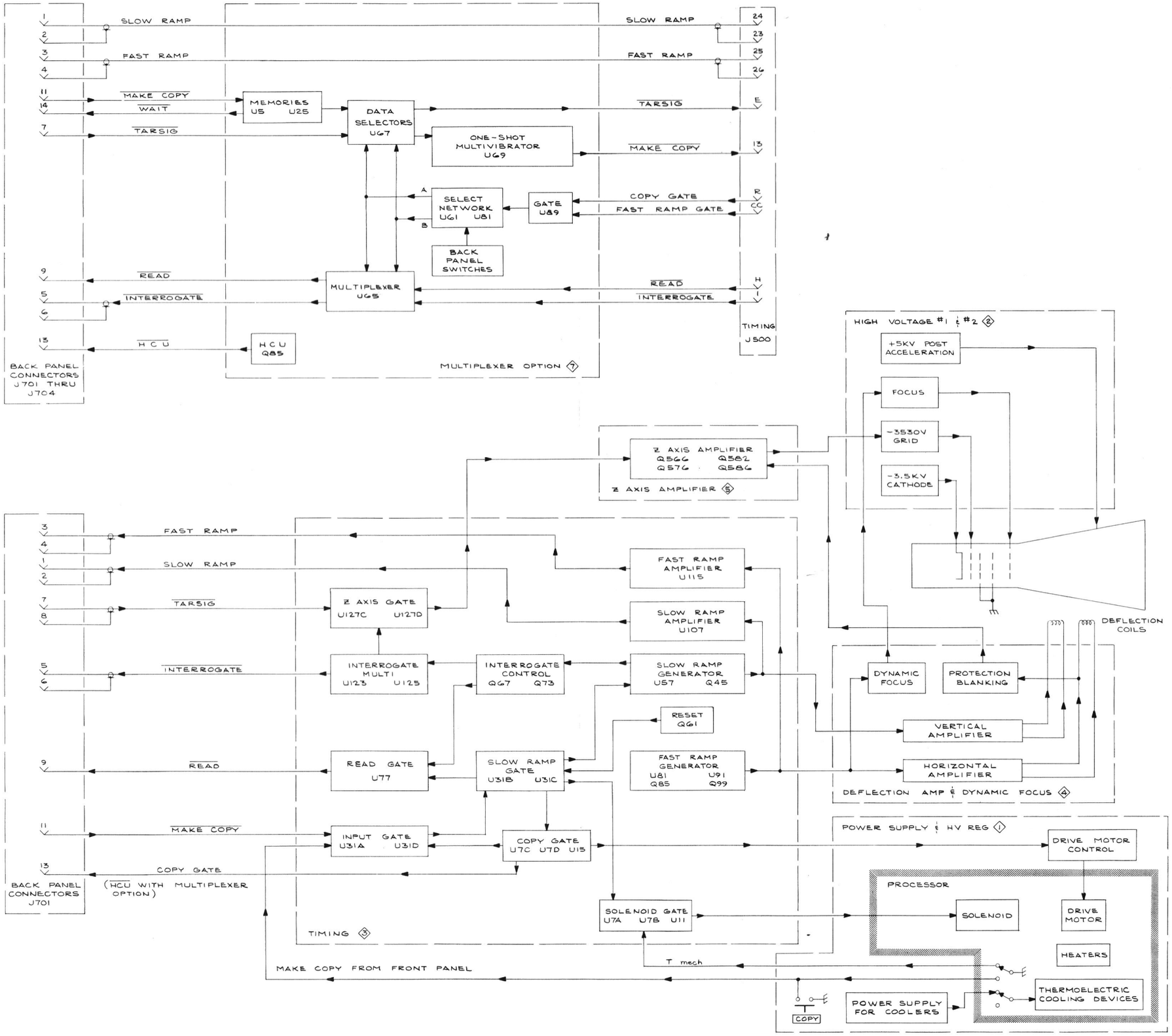
The development-section temperature is controlled by two microswitches which are actuated by the expansion of the heater blanket itself. A rod, made from a material having a low thermal expansion coefficient, goes across the back of the heater blanket to provide a reference for the 900 and 300 watt heater element microswitches. The microswitches controlling the 900 watt heater element has a relatively wide hysteresis, while the microswitch controlling the 300 watt heater element has a very narrow hysteresis. On initial (cold) turn-on, both heater elements are on, to bring the development section up to operating temperature as quickly as possible. Both heater elements then turn off almost simultaneously, with the 300 watt heater normally turning off just ahead of the 900 watt heater. The 300 watt heater element will now cycle by itself, because of its narrow microswitch hysteresis, as the

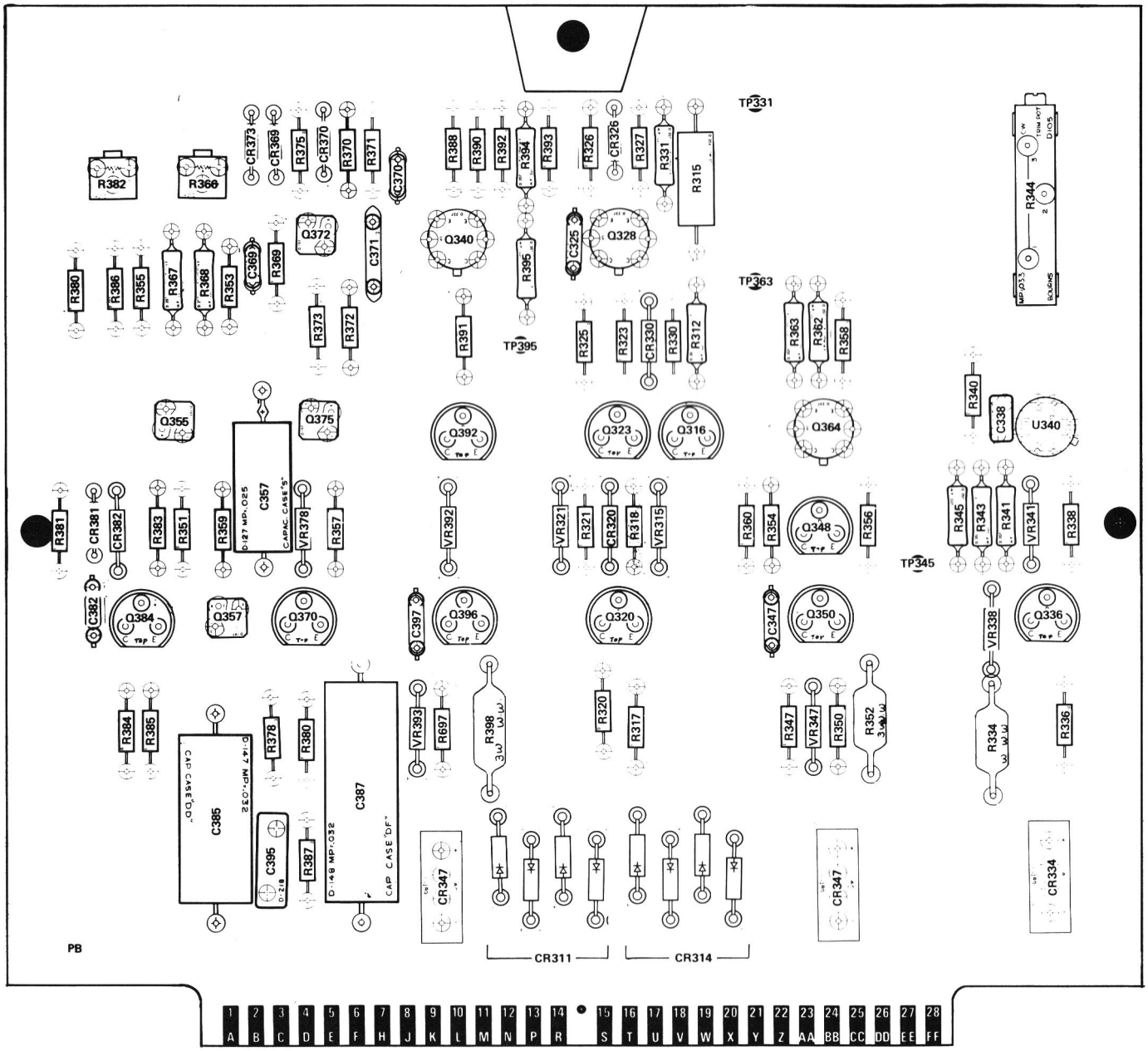
heater blanket contracts and expands, controlling the development section temperature within ±2°F of its required temperature. To protect the heater elements in the event of microswitch failure or temperature-setting error, a non-resetting thermal fuse rated at 333°F is mounted on the heater blanket.

The exposed recording paper is guided into the development section between the heater blanket and the drum by a curved shoe in the top cover of the processor. The coeffieient of friction between the recording paper and the urethane on the drum is higher than that between the recording paper and the coated metal surface of the heater blanket, to ensure that the recording paper will be carried through. The rate at which the paper feed rollers pull the recording paper past the fiber optic faceplate of the CRT, and the take-up rate of the development section, have been carefully matched to avoid excessive paper buckle or tension between the take-up and feed sections of the processor.

Thermal Considerations. The development section heater blanket is insulated with a half-inch layer of fiberglass, and the ends of the drum are closed to reduce heat conversion losses. Additional thermal barriers have been inserted between parts of the processor to reduce thermal losses and to reduce heat conduction to the recording paper supply box. The paper supply box thermal barriers consist of an expanded material top cover and a foamed in-place urethane box. On the lower rear surface of the paper supply box are two thermoelectric cooling devices which are clamped between the box itself, which serves as the cold sink, and an aluminum extrusion, which is the hot sink. The thermoelectric devices' hot sink is cooled by a mainframe-mounted centrifugal blower which provides forced cooling air. Power to the thermoelectric cooling devices and to the mainframe-mounted centrifugal blower is interrupted when the processor is extended from the mainframe, and during the time that a paper copy is being made.

Cleaning Considerations. When the dry silver recording paper is heat processed, a material is given off in a vapor form. This vapor will condense on any relatively cool surface, causing a build-up of white- or tan-colored powdery material. To reduce the build-up of this powdery material in critical areas of the development section of the processor, vacuum ducts and hoses have been provided to remove most of the material. The fan which provides the vacuum for the ducts and hoses is located on the bottom of the processor; it and the ducts and hoses must be periodically cleaned to prevent the powdery buildup in critical areas of the processor.


SLOW RAMP
FAST RAMP
MAKE COPY
WAIT
TARSIG
MEMORIES U5 U25
DATA SELECTORS U67
ONE-SHOT MULTIVIBRATOR U69
SELECT NETWORK U61 U81
GATE U89
BACK PANEL SWITCHES
COPY GATE
FAST RAMP GATE
READ
INTERROGATE
MULTIPLEXER U65
HCU Q85
BACK PANEL CONNECTORS J701 THRU J704
TIMING J500
MULTIPLEXER OPTION 7
HIGH VOLTAGE #1 & #2 2
+5KV POST ACCELERATION
FOCUS
-3530V GRID
-3.5KV CATHODE
Z AXIS AMPLIFIER Q566 Q582 Q576 Q586
Z AXIS AMPLIFIER 5
FAST RAMP AMPLIFIER U115
SLOW RAMP AMPLIFIER U107
Z AXIS GATE U127C U127D
INTERROGATE MULTI U123 U125
INTERROGATE CONTROL Q67 Q73
SLOW RAMP GENERATOR U57 Q45
RESET Q61
READ GATE U77
SLOW RAMP GATE U31B U31C
FAST RAMP GENERATOR U81 U91 Q85 Q99
INPUT GATE U31A U31D
COPY GATE U7C U7D U15
SOLENOID GATE U7A U7B U11
(HCU WITH MULTIPLEXER OPTION)
BACK PANEL CONNECTORS J701
TIMING 3
DEFLECTION COILS
DYNAMIC FOCUS
PROTECTION BLANKING
VERTICAL AMPLIFIER
HORIZONTAL AMPLIFIER
DEFLECTION AMP & DYNAMIC FOCUS 4
POWER SUPPLY & HV REG 1
DRIVE MOTOR CONTROL
PROCESSOR
SOLENOID
DRIVE MOTOR
HEATERS
THERMOELECTRIC COOLING DEVICES
POWER SUPPLY FOR COOLERS
COPY
T mech
MAKE COPY FROM FRONT PANEL



Power Supply & HV Regulator (1)

(A)

ELECTRICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

POWER SUPPLY & HV REGULATOR ◈1

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
MOTORS				
B305[1]	147-0031-00			Motor, AC, 115 V
B305[1]	147-0031-01			Motor, AC, 330 V
B308[1]	147-0032-00			Motor, AC, 115 V
B308[1]	147-0032-01			Motor, AC, 230 V
B309[1]	119-0215-01			Fan, axial, 115 V
B309[1]	119-0215-03			Fan, axial, 230 V
CAPACITORS				
C306	290-0321-00			11,000 µF, Elect., 15 V, +100%-10%
C307	283-0189-01			0.1 µF, Cer, 400 V, 20%
C308[1]	285-0907-00			4 µF, Oil Imp., 370 V, 10%
C308[1]	285-0553-00			1 µF, PMC, 600 V
C311A,B	290-0150-00			2 x 10 µF, Elect., 500 V
C314	290-0018-00			150 µF, Elect., 150 V
C334	290-0320-00			4500 µF, Elect., 40 V, +100%-10%
C345	290-0278-00			550 µF, Elect., 50 V
C347	290-0320-00			4500 µF, Elect., 40 V, +100%-10%
C363	290-0278-00			550 µF, Elect., 50 V
C365	290-0322-00			550 µF, Elect., 100 V, +75%-10%
DIODES				
CR305	152-0274-00			Silicon, selected from 1N1200
CR306	152-0274-00			Silicon, selected from 1N1200
CR307	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
FUSES				
F300[1]	159-0038-00			Cartridge, 15 A, 3 AG, slo-blo
F300[1]	159-0046-00			Cartridge, 8 A, 3 AG, fast-blo
F301[1]	159-0019-00			Cartridge, 1 A, 3 AG, slo-blo
F301[1]	159-0032-00			Cartridge, 0.5 A, 3 AG, slo-blo
F303[1]	159-0034-00			Cartridge, 1.6 A, 3 AG, slo-blo
F303[1]	159-0018-00			Cartridge, 0.8 A, 3 AG, slo-blo

[1] 4610-1 only.

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POWER SUPPLY & HV REGULATOR ⟨1⟩ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
FUSES (cont)				
F307[1]	159-0040-00			Cartridge, 0.7 A, 3 AG, slo-blo
F307[1]	159-0031-00			Cartridge, 0.4 A, 3 AG, slo-blo
F308	159-0101-00			Thermal, 333°F open, 1200 V, AC
HEATERS				
HR309[1]	119-0241-00			Heater, paper
HR309[1]	119-0241-02			Heater, paper
TC305	119-0255-00			Heat exchange unit, cooling
TC306	119-0255-00			Heat exchange unit, cooling
RELAY				
K307	148-0074-00			Armature, 240 V, DC, 700 Ω coil, 5A
INDUCTORS				
L306	119-0254-00			Solenoid, 24 V
TRANSISTORS				
Q334	151-0140-00			Silicon, NPN, selected from 2N3055
Q352	151-0140-00			Silicon, NPN, selected from 2N3055
Q398	151-0140-00			Silicon, NPN, selected from 2N3055
RESISTORS				
R311	301-0103-00			10 kΩ, 1/2 W, 5%
R312	301-0474-00			470 Ω, 1/2 W, 5%
SWITCHES				
S300	260-1198-00			Rocker, DPST, POWER ON
S301[2]	260-0413-00			Thermostatic, open 79.4° C, close 68.3°C
S302[2]				
S304	260-1107-00			Push, DPDT
S305	260-0677-00			Thermostatic, open 70°C, close 53.3°C
S306	260-0574-00			Push, COPY
S307	260-0976-00			Sensitive, DP, dual
S308	260-1181-00			Sensitive, SPDT
S309	260-1180-00			Sensitive, SPST
TRANSFORMERS				
T305[1]	120-0679-00			Thermo electric cooling
T305[1]	120-0728-00			Thermo electric cooling
T311[1]	120-0782-00			LV Power
T311[1]	120-0786-00			LV Power
ASSEMBLY				
A1	**670-1898-00**			**POWER SUPPLY & HV REGULATOR Circuit Card Assembly**
CAPACITORS				
C325	283-0110-00			0.005 µF, Cer, 150 V
C338	283-0178-00			0.1 µF, Cer, 100 V, +80%-20%
C348	283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C357	290-0316-00			47 µF, Elect., 35 V, 20%
C369	283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C370	283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C371	283-0010-00			0.05 µF, Cer, 50 V
C382	283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C385	290-0285-00			4 µF, Elect., 200 V, +50%-10%
C387	290-0149-00			5 µF, Elect., 150 V
C395	283-0134-00			0.47 µF, Cer, 50 V, +80%-20%
C397	283-0003-00			0.01 µF, Cer, 150 V, +80%-20%

[1] 4601-1 only.
[2] See Mechanical Parts List (Line Voltage Selector).

POWER SUPPLY & HV REGULATOR ⟨1⟩ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
DIODES				
CR311A,B,C,D	152-0107-00			Silicon, replaceable by TI60 or 1N647
CR314A,B,C,D	152-0107-00			Silicon, replaceable by TI60 or 1N647
CR320	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
CR326	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR330	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
CR334	152-0488-00			Silicon, rectifier bridge
CR347	152-0488-00			Silicon, rectifier bridge
CR365	152-0488-00			Silicon, rectifier bridge
CR369	152-0400-00			Silicon, replaceable by 1N4936
CR370	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR373	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR381	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR382	152-0061-00			Silicon, replaceable by CD8393 or FDH2161
VR315	152-0280-00			Zener, replaceable by 1N753A, 0.4 W, 6.2 V, 5%
VR321	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%
VR338	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%
VR341	152-0212-00			Zener, selected from 1N936, 0.5 W, 9 V, 5%
VR347	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%
VR378	152-0241-00			Zener, replaceable by 1N973B, 0.4 W, 33 V, 5%
VR392	152-0241-00			Zener, replaceable by 1N973B, 0.4 W, 33 V, 5%
VR397	152-0278-00			Zener, replaceable by 1N4372A, 0.4 W, 3 V, 5%
TRANSISTORS				
Q316	151-0228-00			Silicon, PNP, selected from 2N4888
Q320	151-0150-00			Silicon, NPN, replaceable by 2N3440
Q323	151-0150-00			Silicon, NPN, replaceable by 2N3440
Q328A,B	151-0261-00			Silicon, PNP, replaceable by NS7406, dual
Q336	151-0136-00			Silicon, NPN, replaceable by 2N3053
Q348	151-0134-00			Silicon, PNP, selected from 2N2905
Q350	151-0136-00			Silicon, NPN, replaceable by 2N3053
Q355	151-0188-00			Silicon, PNP, replaceable by 2N3906
Q357	151-0254-00			Silicon, NPN, replaceable by 2N5308
Q364A,B	151-0261-00			Silicon, PNP, replaceable by NS7406, dual
Q372	151-1005-00			Silicon, FET, selected from 2N4303 or replaceable by U1490
Q375	151-0188-00			Silicon, PNP, replaceable by 2N3906
Q378	151-0150-00			Silicon, NPN, replaceable by 2N3440
Q384	151-0150-00			Silicon, NPN, replaceable by 2N3440
Q390 A,B	151-0232-00			Silicon, NPN, replaceable by NS7348 or selected from 2N2919, dual
Q392	151-0208-00			Silicon, PNP, replaceable by 2N4036
Q396	151-0150-00			Silicon, NPN, replaceable by 2N3440
RESISTORS				
R315	303-0223-00			22 kΩ, 1 W, 5%
R317	315-0301-00			300 Ω, 1/4 W, 5%
R318	315-0272-00			2.7 kΩ, 1/4 W, 5%
R320	315-0151-00			150 Ω, 1/4 W, 5%
R321	315-0102-00			1 kΩ, 1/4 W, 5%
R323	315-0272-00			2.7 kΩ, 1/4 W, 5%
R325	315-0822-00			8.2 kΩ, 1/4 W, 5%
R326	315-0103-00			10 kΩ, 1/4 W, 5%
R327	315-0473-00			47 kΩ, 1/4 W, 5%
R330	315-0102-00			1 kΩ, 1/4 W, 5%

POWER SUPPLY & HV REGULATOR ⟨1⟩ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R331	321-0367-00			64.9 kΩ, 1/8 W, 1%
R332	321-0295-00			11.5 kΩ, 1/8 W, 1%
R334	308-0441-00			3 Ω, 3 W, WW, 5%
R336	315-0220-00			22 Ω, 1/4 W, 5%
R338	315-0101-00			100 Ω, 1/4 W, 5%
R340	315-0182-00			1.8 kΩ, 1/4 W, 5%
R341	321-0185-00			825 Ω, 1/8 W, 1%
R343	321-0231-00			2.49 kΩ, 1/8 W, 1%
R344	311-0409-00			1 kΩ, Var
R345	321-0251-00			4.02 kΩ, 1/8 W, 1%
R347	315-0103-00			10 kΩ, 1/4 W, 5%
R350	315-0220-00			22 Ω, 1/4 W, 5%
R351	315-0103-00			10 kΩ, 1/4 W, 5%
R352	308-0441-00			3 Ω, 3 W, WW, 5%
R353	315-0103-00			10 kΩ, 1/4 W, 5%
R354	315-0152-00			1.5 kΩ, 1/4 W, 5%
R355	315-0472-00			4.7 kΩ, 1/4 W, 5%
R356	315-0752-00			7.5 kΩ, 1/4 W, 5%
R357	315-0155-00			1.5 MΩ, 1/4 W, 5%
R358	315-0152-00			1.5 kΩ, 1/4 W, 5%
R359	315-0105-00			1 MΩ, 1/4 W, 5%
R360	315-0152-00			1.5 kΩ, 1/4 W, 5%
R362	321-0306-00			15 kΩ, 1/8 W, 1%
R363	321-0306-00			15 kΩ, 1/8 W, 1%
R366	311-1282-00			5 kΩ, Var
R367	321-0306-00			15 kΩ, 1/8 W, 1%
R368	321-0377-00			82.5 kΩ, 1/8 W, 1%
R369	315-0104-00			100 kΩ, 1/4 W, 5%
R370	315-0105-00			1 MΩ, 1/4 W, 5%
R371	315-0103-00			10 kΩ, 1/4 W, 5%
R372	315-0104-00			100 kΩ, 1/4 W, 5%
R373	315-0102-00			1 kΩ, 1/4 W, 5%
R375	315-0103-00			10 kΩ, 1/4 W, 5%
R378	315-0102-00			1 kΩ, 1/4 W, 5%
R380	315-0203-00			20 kΩ, 1/4 W, 5%
R381	315-0473-00			47 kΩ, 1/4 W, 5%
R382	311-1285-00			25 kΩ, Var
R383	315-0101-00			100 Ω, 1/4 W, 5%
R384	315-0473-00			47 kΩ, 1/4 W, 5%
R385	315-0102-00			1 kΩ, 1/4 W, 5%
R386	315-0223-00			22 kΩ, 1/4 W, 5%
R387	315-0223-00			22 kΩ, 1/4 W, 5%
R388	315-0123-00			12 kΩ, 1/4 W, 5%
R390	315-0222-00			2.2 kΩ, 1/4 W, 5%
R391	315-0512-00			5.1 kΩ, 1/4 W, 5%
R392	315-0122-00			1.2 kΩ, 1/4 W, 5%
R393	315-0222-00			2.2 kΩ, 1/4 W, 5%
R394	321-0306-00			15 kΩ, 1/4 W, 1%
R395	321-0347-00			40.2 kΩ, 1/8 W, 1%
R396	307-0106-00			4.7 Ω, 1/4 W, 5%
R397	315-0681-00			680 Ω, 1/4 W, 5%
R398	308-0240-00			2 Ω, 3 W, WW, 5%
INTEGRATED CIRCUIT				
U340	156-0049-00			Operational amplifier, replaceable by UA741C

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POWER SUPPLY

General

Power for the processor drive moter B308, processor fan B309, and processor heater HR309 is applied through connector J308 pins 14 and 15. Processor heater (HR309) power is subject to the action of microswitches S308 and S309 and thermal fuse F308. S308 and S309 are set up to sense heater expansion. When initially turned on, both S308 and S309 are closed, energizing the entire 1200 W heater. When the heater has warmed to operating temperature, S309 opens. Current through S308 continues until it, too, is opened by expansion of the heater. The correct processor operating temperature is maintained by the 300 W section of HR309 controlled by the thermostatic action of S308. F308 is a special thermal fuse which is heat sensitive and will open if processor temperature exceeds a safe value (333°F). The processor drive motor (B308) power application is determined by the copy gate signal, which goes high during the copy making cycle, being inverted on the timing circuit card and then applied to the control circuitry where it causes K307 to be energized since it is now connected between +25 V and ground. The drive motor will run during copy making time and for a period after the last copy (after the copy gate signal has gone low), which is determined by the time constant of C357, R357 and R359.

Power for the thermoelectric cooler transformer, T305, is connected to switch S307 (closed except when the instrument is making a copy) and switch S304 (closed whenever processor unit is pushed all the way in; open otherwise). Fan B305 runs whenever the cooler transformer, T305 is energized.

The thermoelectric cooler system is used to keep the paper supply cool and thereby extend its life. The cooler is not switched by the POWER ON switch but operates whenever the processor is installed (S304 closed) and the Hard Copy Unit is plugged in. The thermoelectric coolers are mounted on the back of the paper storage unit and serve as a heat exchanger, transferring heat to a finned aluminum heat sink. Fan B304 blows air over the heat sink to remove the heat. The thermoelectric coolers (TC305, TC306) are driven by the full-wave rectified voltage from the secondary winding of T305.

The low voltage power supply circuits supply the power for the Hard Copy Unit from four regulated supplies and two unregulated supplies. Each regulated supply is current limited to prevent damage.

The primary winding of the power transformer, T311, has taps above and below the 115 V (220 V) nominal point. The Voltage Range Selector switch taps allow the instrument to regulate correctly on lower or higher than, or normal, line voltages. As the Voltage Range Selector switch is switched from LO to M to HI, more turns are connected to the primary winding, thus reducing the turns ratio. This serves to maintain the secondary voltage at a nearly constant value.

+15 Volt

The +15 V supply provides the reference voltage for the other regulated supplies. The output from the secondary of T311 is rectified by bridge rectifier CR334. The unregulated voltage across filter capacitor C334 is applied to the +15 V Series Regulator stage.

The +15 V Series regulator is made up of Q334, a series pass transistor; U340, an operational amplifier (the compa rator and error amplifier); Q336, the current amplifier; VR338, the current-limiting diode; and VR341, the reference zener diode.

The unregulated side of the regulated +15 V supply (+25 V) is used for the solenoid drive.

−15 V Supply

The −15 V supply is referenced to the +15 V supply and consists of Q364, the comparator; Q348, the error amplifier; Q350, a current amplifier; and Q352, the series pass transistor. VR347 serves as the current limiting diode.

−40 V Supply

The −40 V regulator consists of Q390, the comparator; Q392, the error amplifier; VR392, the level-shifting diode; Q396, a current amplifier; and Q398, the series pass transistor. VR397 is the current limiting element.

+100 V Supply

The +100 V supply consists of Q328, the error sensing transistor; Q323, the error amplifier; Q316, a constant-current transistor; VR315, which sets the current in Q316; and Q320, the series pass transistor. VR321 is the current limiting element.

A +350 V unregulated supply is provided from the output of bridge rectifier CR311 through a pi-filter.

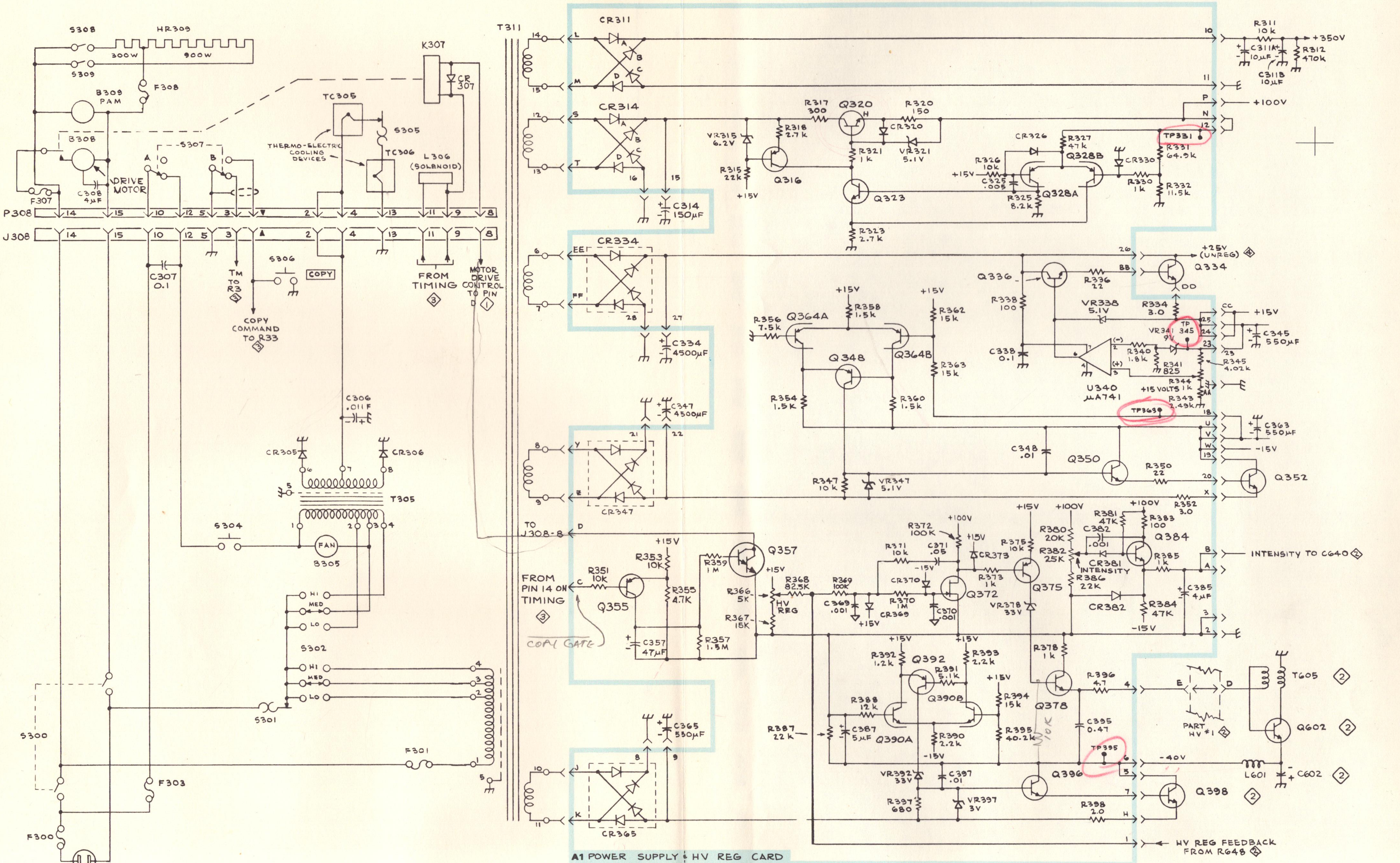
H.V. Regulator

The +15 V volt supply is reference for the H.V. regulator circuit.

The −3500 V from the cathode is applied through six 3.32 MΩ resistors to the summing junction of the regulator amplifier Q372, Q375 and Q378. The other input to the summing junction is applied from the arm of R366 (H.V. regulator).

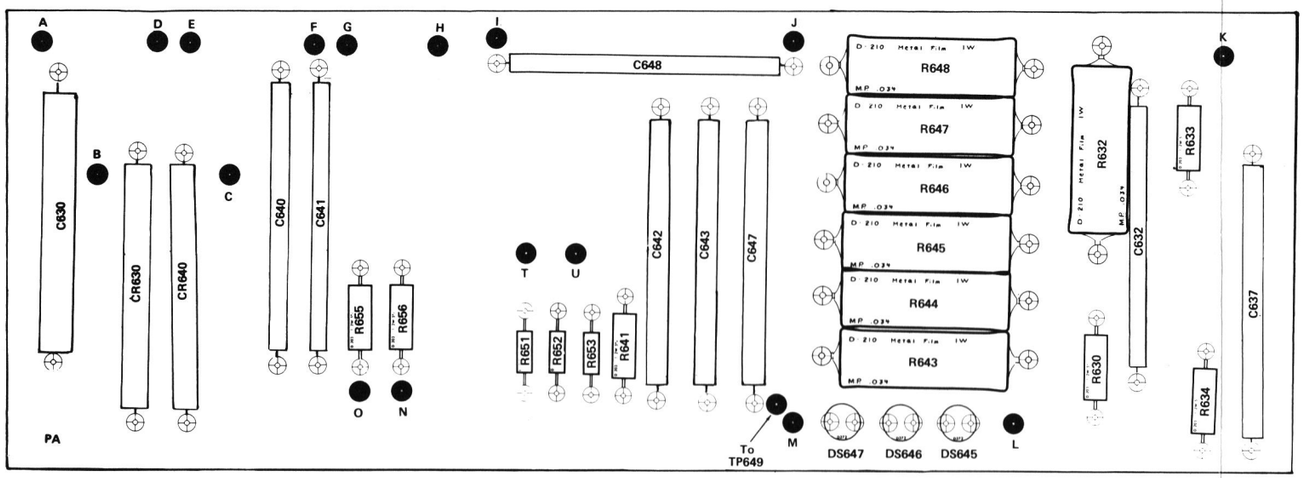
Intensity Control

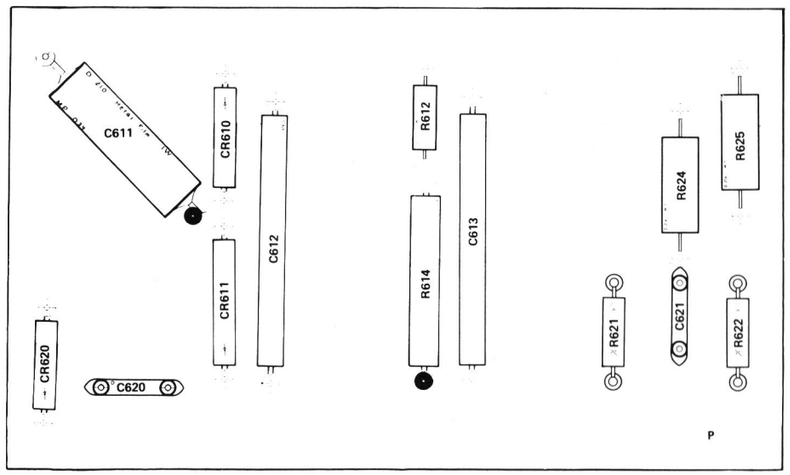
Q384, R382, and their associated circuitry set the reference DC level for the cathode H.V. supply. This establishes a nominal value of beam current.



POWER SUPPLY & HV REGULATOR

TYPE 4610 HARD COPY UNIT





High Voltage No. 1 & No. 2 (2)

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ELECTRICAL PARTS LIST

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ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

HIGH VOLTAGE #1 & #2 ◇2

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CAPACITOR				
C602	290-0226-00			20 µF, Elect., 100 V
INDUCTOR				
L601	108-0205-00			1 mH
TRANSISTOR				
Q602	151-0218-00			Silicon, NPN, replaceable by 2N4348
RESISTORS				
R626	311-0505-01			10 MΩ, Var
R649	301-0104-00			100 kΩ, 1/2 W, 5%
TRANSFORMER				
T605	120-0680-00			HV Power
ELECTRON TUBE				
V660	154-0629-00			CRT
ASSEMBLY				
A2	**670-2045-00**			**HIGH VOLTAGE #1 Circuit Board Assembly**
CAPACITORS				
C630	283-0071-00			0.0068 µF, Cer, 5000 V, +80%-30%
C632	283-0082-00			0.01 µF, Cer, 4000 V, +80%-20%
C637	283-0082-00			0.01 µF, Cer, 4000 V, +80%-20%
C640	283-0071-00			0.0068 µF, Cer, 5000 V, +80%-20%
C641	283-0071-00			0.0068 µF, Cer, 5000 V, +80%-20%
C642	283-0082-00			0.01 µF, Cer, 4000 V, +80%-20%
C643	283-0082-00			0.01 µF, Cer, 4000 V, +80%-20%
C647	283-0082-00			0.01 µF, Cer, 4000 V, +80%-20%
C648	283-0082-00			0.01 µF, Cer, 4000 V, +80%-20%

HIGH VOLTAGE #1 & # 2 ◇2◇ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
DIODES				
CR630	152-0408-00			Silicon, replaceable by VF5-12X
CR640	152-0408-00			Silicon, replaceable by VF5-12X
BULBS				
DS645	150-0030-00			Neon, NE 2 V
DS646	150-0030-00			Neon, NE 2 V
DS647	150-0030-00			Neon, NE 2 V
RESISTORS				
R630	301-0333-00			33 kΩ, 1/2 W, 5%
R632	325-0094-00			100 MΩ, 1.5 W, 5%
R633	301-0302-00			3 kΩ, 1/2 W, 5%
R634	301-0334-00			330 kΩ, 1/2 W, 5%
R641	301-0223-00			22 kΩ, 1/2 W, 5%
R643	324-0531-00			3.32 MΩ, 1 W, 1%
R644	324-0531-00			3.32 MΩ, 1 W, 1%
R645	324-0531-00			3.32 MΩ, 1 W, 1%
R646	324-0531-00			3.32 MΩ, 1 W, 1%
R647	324-0531-00			3.32 MΩ, 1 W, 1%
R648	324-0531-00			3.32 MΩ, 1 W, 1%
R650	315-0101-00			100 Ω, 1/4 W, 5%
R651	315-0101-00			100 Ω, 1/4 W, 5%
R653	315-0104-00			100 kΩ, 1/4 W, 5%
R655	307-0093-00			1.2 Ω, 1/2 W, 5%
R656	307-0051-00			2.7 Ω, 1/2 W, 5%
ASSEMBLY				
A3	**670-0378-01**			**HIGH VOLTAGE #2 Circuit Board Assembly**
CAPACITORS				
C611	283-0043-00			0.0068 µF, Cer, 3000 V
C612	283-0101-00			4700 pF, Cer, 6000 V, +80%-20%
C613	283-0101-00			4700 pF, Cer, 6000 V, +80%-20%
C620	283-0105-00			0.01 µF, Cer, 2000 V, +80%-20%
C621	283-0105-00			0.01 µF, Cer, 2000 V, +80%-20%
DIODES				
CR510	152-0429-00			Silicon, replaceable by VG-5X
CR611	152-0429-00			Silicon, replaceable by VG-5X
CR620	152-0429-00			Silicon, replaceable by VG-5X
RESISTORS				
R612	301-0225-00			2.2 MΩ, 1/2 W, 5%
R614	325-0094-00			100 MΩ, 1.5 W, 5%
R621	301-0105-00			1 MΩ, 1/2 W, 5%
R622	301-0395-00			3.9 MΩ, 1/2 W, 5%
R624	303-0475-00			4.7 MΩ, 1 W, 5%
R625	303-0475-00			4.7 MΩ, 1 W, 5%

CRT CIRCUITS

General

The CRT circuit provides the voltages necessary for operation of the cathode-ray tube (CRT). Intensity and Focus controls are provided to adjust the CRT for proper display.

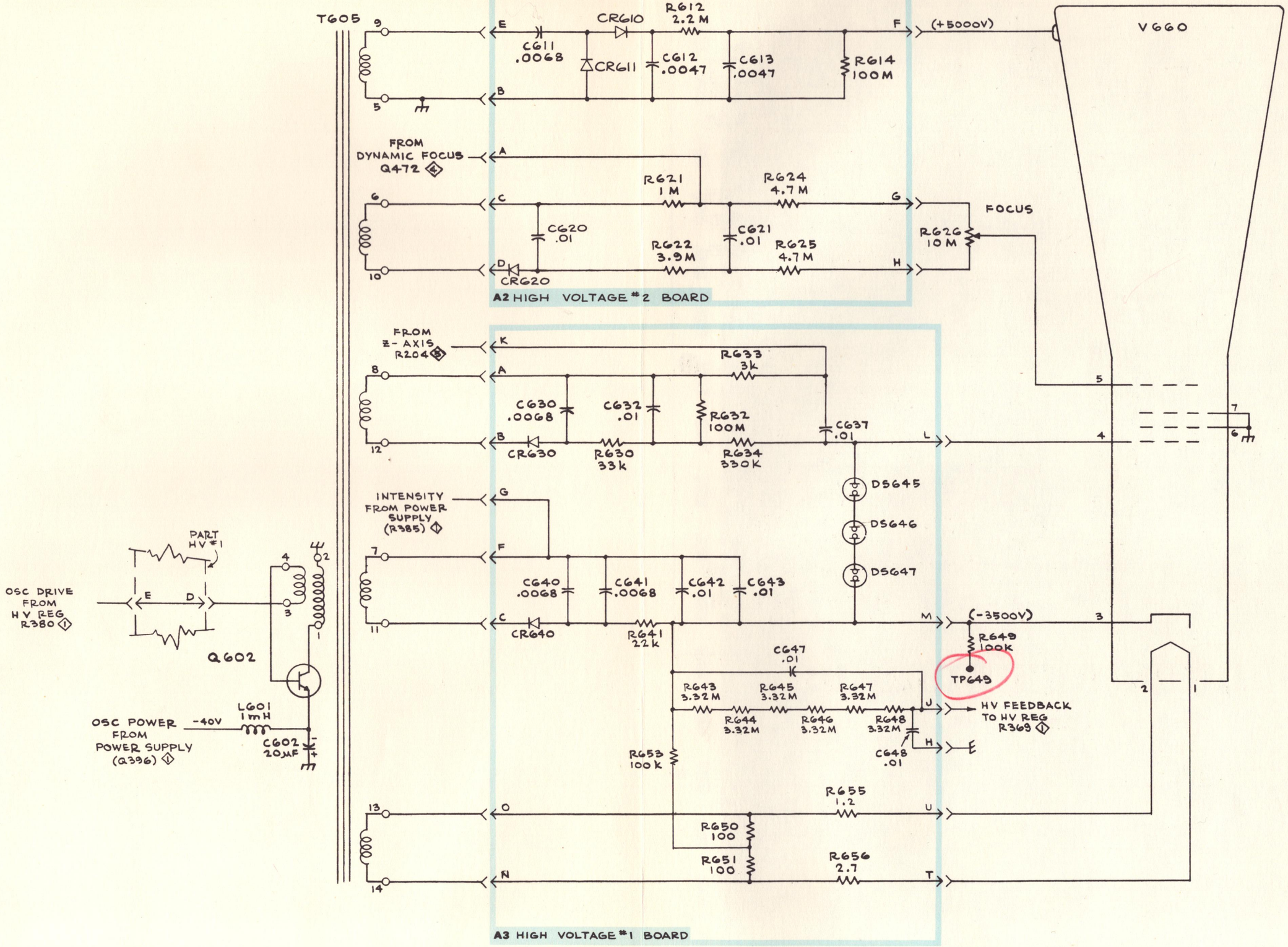
The CRT circuit consists of the CRT and its regulated high-voltage supply.

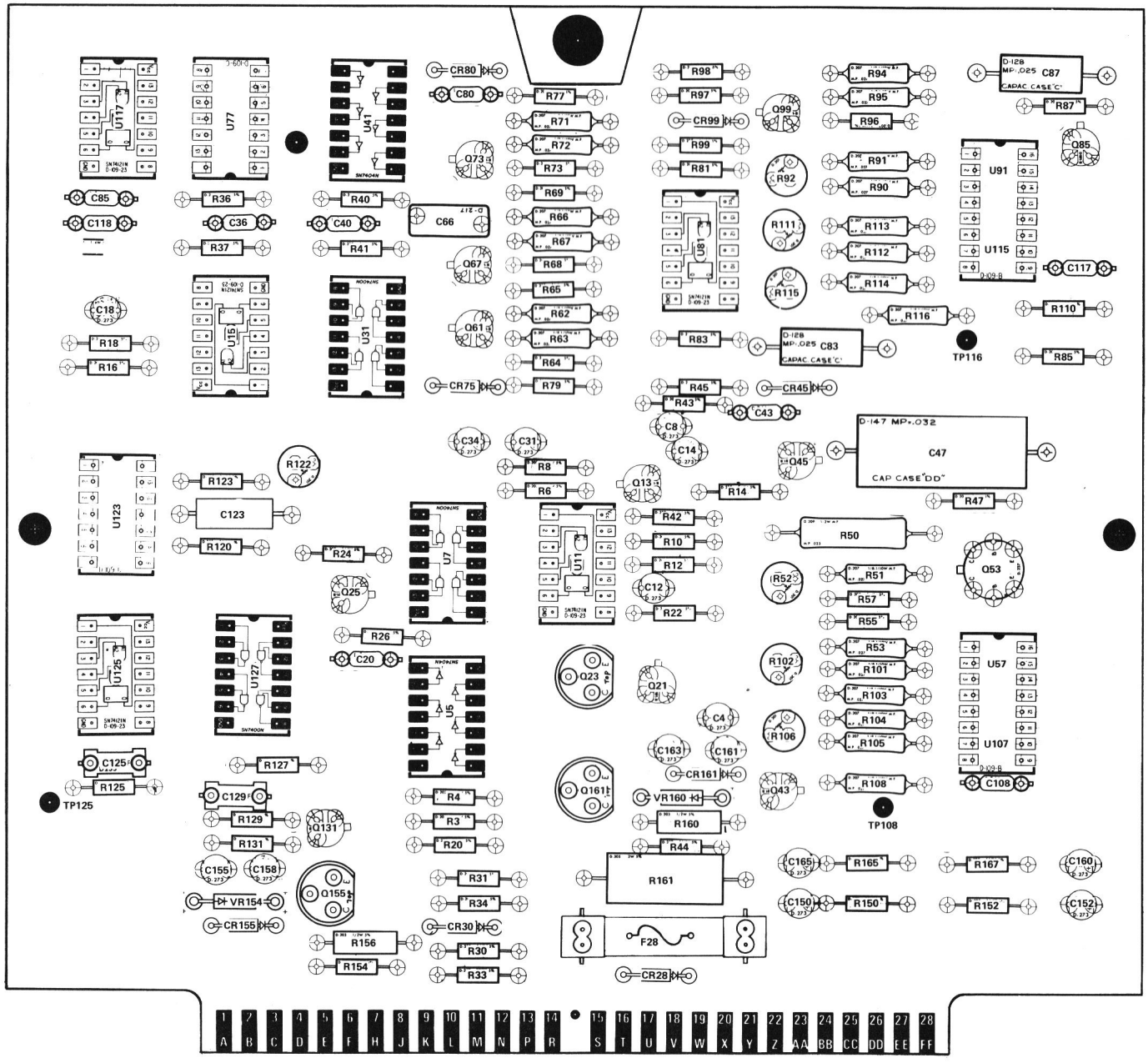
High Voltage Oscillator

The High-Voltage (H.V.) oscillator consists of Q602 and its associated circuitry. The primary winding (pins 1 and 2) of T605 and the reflected capacitance of the secondaries comprise the tuned collector tank circuit; pins 3 and 4 connect the winding which supplies feedback to the base of Q602, the oscillator transistor. The oscillator runs at about 24 kHz.

H.V. Rectifiers

The high voltage generated by the oscillator is induced in secondary windings, pins 11 and 7, which supply the CRT cathode; pins 6 and 10, which supply the focus voltage; pins 9 and 5, which supply the CRT anode; pins 8 and 12, which supply the CRT grid; and pins 13 and 14, which drive the CRT filament.


T605
9
5
E
B
CRG10
R612
2.2 M
F
(+5000V)
V660
C611
.0068
CRG11
C612
.0047
C613
.0047
R614
100M
FROM
DYNAMIC FOCUS
Q472 4
A
6
10
C
D
CRG20
R621
1 M
R624
4.7 M
G
FOCUS
C620
.01
R622
3.9M
C621
.01
R625
4.7 M
H
R626
10 M
A2 HIGH VOLTAGE #2 BOARD
FROM
Z-AXIS
R204 3
K
8
12
A
B
CRG30
R633
3k
C630
.0068
C632
.01
R632
100M
R630
33k
R634
330K
C637
.01
L
5
4
7
6
D5645
D5646
D5647
INTENSITY
FROM POWER
SUPPLY
(R385) 1
G
7
11
F
C
CRG40
C640
.0068
C641
.0068
C642
.01
C643
.01
R641
22k
M
(-3500V)
3
R649
100K
TP649
C647
.01
R643
3.32M
R644
3.32M
R645
3.32M
R646
3.32M
R647
3.32M
R648
3.32M
J
HV FEEDBACK
TO HV REG
R369 1
H
E
C648
.01
R653
100 k
2
1
R655
1.2
13
14
O
N
U
T
R650
100
R651
100
R656
2.7
A3 HIGH VOLTAGE #1 BOARD
PART
HV #1
4
2
3
E
D
OSC DRIVE
FROM
HV REG
R380 1
Q602
-
OSC POWER
FROM
POWER SUPPLY
(Q396) 1
-40V
L601
1mH
C602
20μF


U117
U77
U41
SN7404N
C85
C118
R36
C36
R37
R40
C40
R41
C66
CR80
C80
R77
R71
R72
R73
R69
R66
R67
R68
R65
R62
R63
R64
R79
CR75
Q73
Q67
Q61
R98
R97
CR99
R99
R81
Q99
R92
R111
R115
U81
R94
R95
R96
R91
R90
R113
R112
R114
R116
R83
C83
D-128 MP-.025
CAPAC CASE'C'
C87
R87
Q85
U91
U115
C117
R110
R85
TP116
C18
R18
R16
U15
U31
R45
CR45
R43
C43
C8
C14
Q45
C47
D-147 MP-.032
CAP CASE'DD'
R47
C34
C31
R8
R6
Q13
R14
U123
R123
R122
C123
R120
R24
Q25
U7
U11
R42
R10
R12
C12
R22
R50
R52
R51
R57
R55
Q53
U125
U127
R26
C20
Q23
Q21
R53
R101
R103
R104
R105
R102
R106
R108
U57
U107
C108
C4
C163
C161
CR161
Q43
TP108
C125
R125
TP125
R127
C129
R129
R131
Q131
R4
R3
R20
VR160
R160
R44
R161
C155
C158
VR154
CR155
Q155
R156
R154
R31
R34
CR30
R30
R33
F28
CR28
C165
R165
R167
C160
C150
R150
R152
C152
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
A B C D E F H J K L M N P R S T U V W X Y Z AA BB CC DD EE FF

Timing ◇3

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B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

TIMING ◈3

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
ASSEMBLY				
A4	**670-1909-00**	**B010100**	**B010159**	**TIMING Circuit Board Assembly**
A4	**670-1909-01**	**B010160**		**TIMING Circuit Card Assembly**
CAPACITORS				
C4	290-0527-00			15 µF, Elect., 20 V, 20%
C8	290-0523-00			2.2 µF, Elect., 20 V, 20%
C12	290-0535-00			33 µF, Elect., 10 V, 20%
C14	290-0523-00			2.2 µF, Elect., 20 V, 20%
C18	290-0530-00			68 µF, Elect., 6 V, 20%
C21	283-0110-00			0.005 µF, Cer, 150 V
C31	290-0534-00			1 µF, Elect., 35 V, 20%
C34	290-0523-00			2.2 µF, Elect., 20 V, 20%
C36	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C40	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C43	283-0110-00			0.005 µF, Cer, 150 V
C47	285-0894-00			5 µF, PTM, 50 V, 5%
C66	283-0164-00			2.2 µF, Cer, 25 V, 20%
C80	283-0000-00			0.001 µF, Cer, 500 V, +100%-0%
C83	285-0808-00			0.1 µF, PTM, 50 V, 10%
C85	283-0110-00			0.005 µF, Cer, 150 V
C87	285-0808-00			0.1 µF, PTM, 50 V, 10%
C97	281-0580-00	XB010160		470 pF, Cer, 500 V, 10%
C801	283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C117	283-0003-00			0.01 µF, Cer, 150 V, +80%-20%
C118	283-0080-00			0.022 µF, Cer, 25 V, +80%-20%

TIMING ③ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CAPACITORS (cont)				
C123	285-0626-00			0.0015 µF, PTM, 100 V, 10%
C125	281-0523-00			100 pF, Cer, 350 V, 20%
C129	281-0546-00			330 pF, Cer, 500 V, 10%
C150	290-0527-00			15 µF, Elect., 20 V, 20%
C152	290-0523-00			2.2 µF, Elect., 20 V, 20%
C155	290-0523-00			2.2 µF, Elect., 20 V, 20%
C157	290-0530-00			68 µF, Elect., 6 V, 20%
C161	290-0523-00			2.2 µF, Elect., 20 V, 20%
C163	290-0530-00			68 µF, Elect., 6 V, 20%
C165	290-0527-00			15 µF, Elect., 20 V, 20%
C167	290-0523-00			2.2 µF, Elect., 20 V, 20%
DIODES				
CR28	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR30	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR45	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR75	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR80	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR99	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR155	152-0185-00			Silicon, selected form 1N4152 or 1N3605
CR161	152-0185-00			Silicon, selected from 1N4152 or 1N3605
VR154	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%
VR160	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%
FUSE				
F28	159-0044-00			Cartridge, 0.2 A, 3 AG, slo-blo
TRANSISTORS				
Q13	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q21	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q23	151-0136-00			Silicon, NPN, replaceable by 2N3053
Q25	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q43	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q45	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q53A,B	151-1036-00			Silicon, FET, selected from D/2N4393 or replaceable by FD1551, dual
Q61	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q67	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q73	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q85	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q99	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q131	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q155	151-0136-00			Silicon, NPN, replaceable by 2N3053
Q161	151-0136-00			Silicon, NPN, replaceable by 2N3053
RESISTORS				
R3	315-0202-00			2 kΩ, 1/4 W, 5%
R4	315-0101-00			100 Ω, 1/4 W, 5%
R6	315-0101-00			100 Ω, 1/4 W, 5%
R8	315-0101-00			100 Ω, 1/4 W, 5%
R10	315-0512-00			5.1 kΩ, 1/4 W, 5%
R12	315-0123-00			12 kΩ, 1/4 W, 5%
R14	315-0273-00			27 kΩ, 1/4 W, 5%
R16	315-0202-00			2 kΩ, 1/4 W, 5%
R18	315-0223-00			22 kΩ, 1/4 W, 5%
R20	315-0202-00			2 kΩ, 1/4 W, 5%

TIMING ③ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R22	315-0472-00			4.7 kΩ, 1/4 W, 5%
R24	315-0103-00			10 kΩ, 1/4 W, 5%
R26	315-0512-00			5.1 kΩ, 1/4 W, 5%
R30	315-0202-00			2 kΩ, 1/4 W, 5%
R31	315-0101-00			100 Ω, 1/4 W, 5%
R33	315-0202-00			2 kΩ, 1/4 W, 5%
R34	315-0101-00			100 Ω, 1/4 W, 5%
R36	315-0202-00			2 kΩ, 1/4 W, 5%
R37	315-0202-00			2 kΩ, 1/4 W, 5%
R40	315-0202-00			2 kΩ, 1/4 W, 5%
R41	315-0202-00			2 kΩ, 1/4 W, 5%
R42	315-0202-00			2 kΩ, 1/4 W, 5%
R43	315-0105-00			1 MΩ, 1/4 W, 5%
R44	315-0104-00			100 kΩ, 1/4 W, 5%
R45	315-0223-00			22 kΩ, 1/4 W, 5%
R47	315-0101-00			100 Ω, 1/4 W, 5%
R50	323-0481-00			1 MΩ, 1/2 W, 1%
R51	321-0269-00			6.19 kΩ, 1/8 W, 1%
R52	311-0607-00			10 kΩ, Var
R53	321-0248-00			3.74 kΩ, 1/8 W, 1%
R55	315-0822-00			8.2 kΩ, 1/4 W, 5%
R57	315-0822-00			8.2 kΩ, 1/4 W, 5%
R60	315-0472-00			4.7 kΩ, 1/4 W, 5%
R62	321-0318-00			20 kΩ, 1/8 W, 1%
R63	321-0335-00			30.1 kΩ, 1/8 W, 1%
R64	315-0472-00			4.7 kΩ, 1/4 W, 5%
R66	321-0304-00			14.3 kΩ, 1/8 W, 1%
R67	321-0335-00			30.1 kΩ, 1/8 W, 1%
R68	315-0472-00			4.7 kΩ, 1/4 W, 5%
R69	315-0472-00			4.7 kΩ, 1/4 W, 5%
R71	321-0256-00			4.53 kΩ, 1/8 W, 1%
R72	321-0335-00			30.1 kΩ, 1/8 W, 1%
R73	315-0472-00			4.7 kΩ, 1/4 W, 5%
R77	315-0472-00			4.7 kΩ, 1/4 W, 5%
R79	315-0102-00			1 kΩ, 1/4 W, 5%
R81	315-0202-00			2 kΩ, 1/4 W, 5%
R83	315-0562-00			5.6 kΩ, 1/4 W, 5%
R85	315-0223-00			22 kΩ, 1/4 W, 5%
R87	315-0100-00			10 Ω, 1/4 W, 5%
R90	321-0373-00			75 kΩ, 1/8 W, 1%
R91	321-0233-00			2.61 kΩ, 1/8 W, 1%
R92	311-0633-00			5 kΩ, Var
R94	321-0289-00			10 kΩ, 1/8 W, 1%
R95	321-0335-00			30.1 kΩ, 1/8 W, 1%
R96	315-0472-00			4.7 kΩ, 1/4 W, 5%
R97	315-0472-00			4.7 kΩ, 1/4 W, 5%
R98	315-0103-00			10 kΩ, 1/4 W, 5%
R99	315-0332-00			3.3 kΩ, 1/4 W, 5%
R101	321-0255-00			4.42 kΩ, 1/8 W, 1%

TIMING ③ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R102	311-0635-00			1 kΩ, Var
R103	321-0268-00			6.04 kΩ, 1/8 W, 1%
R104	321-0306-00			15 kΩ, 1/8 W, 1%
R105	321-0377-00			82.5 kΩ, 1/8 W, 1%
R106	311-0614-00			30 kΩ, Var
R108	321-0364-00			60.4 kΩ, 1/8 W, 1%
R110	315-0471-00			470 Ω, 1/4 W, 5%
R111	311-0635-00			1 kΩ, Var
R112	321-0285-00			9.09 kΩ, 1/8 W, 1%
R113	321-0306-00			15 kΩ, 1/8 W, 1%
R114	321-0375-00			78.7 kΩ, 1/8 W, 1%
R115	311-0614-00			30 kΩ, Var
R116	321-0337-00			31.6 kΩ, 1/8 W, 1%
R118	315-0432-00			4.3 kΩ, 1/4 W, 5%
R120	315-0202-00			2 kΩ, 1/4 W, 5%
R122	311-0633-00			5 kΩ, Var
R123	315-0152-00			1.5 kΩ, 1/4 W, 5%
R125	315-0512-00	B010100	B010139	5.1 kΩ, 1/4 W, 5%
R125	315-0222-00	B010140		2.2 kΩ, 1/4 W, 5%
R127	315-0202-00			2 kΩ, 1/4 W, 5%
R129	315-0102-00			1 kΩ, 1/4 W, 5%
R131	315-0911-00			910 Ω, 1/4 W, 5%
R150	307-0103-00			2.7 Ω, 1/4 W, 5%
R152	315-0100-00			10 Ω, 1/4 W, 5%
R154	315-0122-00			1.2 kΩ, 1/4 W, 5%
R156	301-0101-00			100 Ω, 1/2 W, 5%
R160	301-0821-00			820 Ω, 1/2 W, 5%
R161	305-0560-00			56 Ω, 2 W, 5%
R165	307-0103-00			2.7 Ω, 1/4 W, 5%
R167	315-0100-00			10 Ω, 1/4 W, 5%
INTEGRATED CIRCUITS				
U5	156-0058-00			Hex. inverter, replaceable by SN7404N
U7	156-0030-00			Quad 2-input positive nand gate, replaceable by SN7400N
U11	156-0072-00			Single monostable multivibrator-one shot, replaceable by SN74121N
U15	156-0072-00			Single monostable multivibrator-one shot, replaceable by SN74121N
U31	156-0030-00			Quad 2-input positive nand gate, replaceable by SN7400N
U41	156-0058-00			Hex. inverter, replaceable by SN7404N
U57	156-0067-00			Operational amplifier, replaceable by UA741C
U77	156-0129-00			Quad 2-input positive and gate, replaceable by SN7408N
U81	156-0072-00			Single monostable multivibrator-one shot, replaceable by SN74121N
U91	156-0067-00			Operational amplifier, replaceable by UA741C
U107	156-0067-00			Operational amplifier, replaceable by UA741C
U115	156-0067-00			Operational amplifier, replaceable by UA741C
U117	156-0072-00			Single, monostable multivibrator-one shot, replaceable by SN74121N
U123	156-0143-00			Single retriggerable monostable multivibrator, replaceable by SN74122N
U125	156-0072-00			Single monostable multivibrator-one shot, replaceable by SN74121N
U127	156-0030-00			Quad 2-input positive nand gate, replaceable by SN7400N

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TIMING CIRCUITS

General

The Timing Circuits are located on the timing card. The circuits are Fast Ramp, Slow Ramp, Read, Interrogate, Z Axis Signal, Solenoid, and Copy Gate.

Fast Ramp

The Fast Ramp is generated by a Miller Integrator (U91), a sweep gating multivibrator (U81) and the associated circuitry. When power is applied, C87 begins to charge and the ramp runs up (Pin 6 or U91). When the ramp reaches an amplitude of 5 volts (set by R94 and R95), Q99 turns on and produces a negative-going signal at its collector. This signal is fed back to the sweep gating multi, producing a positive pulse of 400 microseconds duration at its output (Pin 6). This positive pulse, called the Fast Ramp Gate, turns Q85 on to saturation and allows capacitor C87 to rapidly discharge through Q85 and R87, terminating the ramp. The output at Pin 6 of U91 is then held at zero for the rest of the 400 microsecond pulse (hold-off). At the end of the 400 microsecond pulse, Q85 turns off, C87 begins to charge, the ramp runs up and the cycle is repeated. R90 and R92 control the charging current for C87, and therefore control the slope and repetition rate of the ramp. The repetition rate is set to about 4 milliseconds. This fast ramp is fed to the deflection amplifier in the Hard Copy unit to provide the required horizontal sweep signal. It is also fed to an inverting operational amplifier (U115), where it is inverted, amplified and positioned (by R115) to produce a negative-going ramp centered at zero volts and running from +5 V to −5 V to provide the sweep signal for the Display Terminal. The fast ramp is free-running. Note that the fast ramp terminating pulse at the output of the fast ramp gate is also applied to pin CC and called the Fast Ramp Gate. This signal is not used in the standard unit, but is only used in conjunction with the Multiplexer.

Slow Ramp

The Slow Ramp is generated by a gating transistor Q45, a Miller Integrator Q53 and U57, and the associated circuitry.

Q45 is normally on, so no charging current is supplied to C47. Pin 13 of U31D is high; see Fig. 6-1. When a Copy Command is supplied to the input gate (U31A/U31D), either by pushing the COPY button on the Hard Copy Unit front panel or by a signal to the Make Copy input, a negative pulse is fed to the slow ramp gate flip-flop (U31B/U31C) to switch it and produce a high at Pin 8 of U31C (see waveform diagram, Fig. 6-1). This signal is fed to the base of Q45 as a low, turning Q45 off. With Q45 off, capacitor C47 begins to charge (slowly, because of the large capacitance of C47 and the large resistance of R50).

The charging of C47 produces the slow ramp at pin 6 of U57. The slope and repetition rate are set by R52. When this ramp reaches about +10 volts (set by R62 and R63), Q61 turns on, producing a negative-going signal at its collector. Passage of this signal thru inverters U41C and U41E converts the negative transition to a fast negative step to switch the Slow Ramp Gate. This signal turns Q45 on, allowing C47 to rapidly discharge and terminate the ramp.

This Slow Ramp is fed to the deflection amplifier of the Hard Copy Unit to provide vertical sweep. It is also fed into an inverting operational amplifier to produce the proper vertical scanning signal for the Display Terminal.

$\overline{\text{Read}}$

When the copy command is given, a signal called $\overline{\text{Read}}$ is sent to a switch in the Display Unit to couple the Display Unit to the Hard Copy Unit.

Pin 10 of U77C is normally high. When the copy command is given, Pin 9 of U77C also goes high. These two highs are fed to the And gate, causing the Read signal to go low. At a certain point on the Slow Ramp, the voltage at the base of Q67 becomes high enough to turn it on. The collector of $\overline{\text{Q67}}$ goes low, causing Pin 10 of U77C to go low and the $\overline{\text{Read}}$ signal goes high and stays high until the start of the next Slow Ramp.

$\overline{\text{Interrogate}}$

Interrogation pulses are generated by U117, U123, U125, and the associated circuitry. The interrogate control circuit consists of comparators Q73 and Q67. Q73 starts the pulses and Q67 terminates them.

As the Slow Ramp runs up, it reaches a voltage at which Q73 will turn on. When Q73 turns on, a negative step is generated at its collector, and therefore a high at Pin 13 of U77D. This high together with the high already existing at Pin 12 of U77D produces a high at Pin 2 of U77A. U117 is triggered on the trailing edge of the Fast Ramp Gate,

producing a negative pulse at Pin 1 of U77A. Also, while the Fast Ramp is running up, a high is produced at Pin 1 of U81, and therefore at Pin 5 of U77B. When all three of these signals are high, a high will appear at Pin 6 of U77B, allowing the Interrogation Multi to run and produce interrogation pulses at TP125. The rate of the pulses is determined by R122, R123 and C123. The pulse width is determined by R125 and C125.

Interrogation pulses are produced only when the fast ramp is running up and the slow ramp is in the central portion of its excursion. At the point on the slow ramp where comparator Q67 turns on, its collector goes low, causing the output of U77D to go low, and the Interrogation pulses are not produced. When the fast ramp reaches the point where Q99 turns on to terminate the ramp, Pin 1 of U81 goes low and the interrogation pulses are not produced.

Z Axis

A target signal is fed from the Display Unit back to the Hard Copy Unit whenever there is some information being displayed.

The $\overline{\text{Interrogate}}$ pulses, together with the $\overline{\text{Tarsig}}$, are fed to the cross-coupled Nand gates U127C and U127D in such a manner that the output at pin 8 of U127C goes low with an $\overline{\text{Interrogate}}$ signal, and goes high with a $\overline{\text{Tarsig}}$. When pin 6 of U127B is high, the $\overline{\text{Tarsig}}$ is coupled to Q131, and consequently to the Z Axis.

Solenoid

The Solenoid circuit consists of U11, U7A, U7B, and associated circuitry. The Solenoid, when actuated, initiates or terminates the mechanical cycle of the processor.

When the signal at Pin 8 of U31C goes high to start the Slow Ramp, Pin 6 of U31B goes low. These signals, together with the signal from Tmech, are fed into the Solenoid Gate and switch the one-shot (U11), producing a 250 millisecond pulse at its output. This pulse turns on Q21 and Q23 and provides current to trip the Solenoid and start the mechanical cycle of the Processor. At the end of the Slow Ramp, these same conditions occur and another 250 millisecond pulse is generated, to again trip the Solenoid and stop the mechanical cycle.

Copy Gate

The Copy Gate signal is sent from the Hard Copy Unit to the logic in the Display Terminal to inform it that a copy is being made.

The Copy Gate is developed by U15, U7C, U7D, U5D, and associated circuitry.

Pin 9 of U7C is normally high because of the condition of one-shot multi U15. Pin 10 of U7C is also high until a copy command is received. When the copy command turns pin 6 of U31B low and pin 8 of U31C high, to start the slow ramp, the output of U7C is switched from low to high. This switches U7D output from low to high and produces the required Copy Gate.

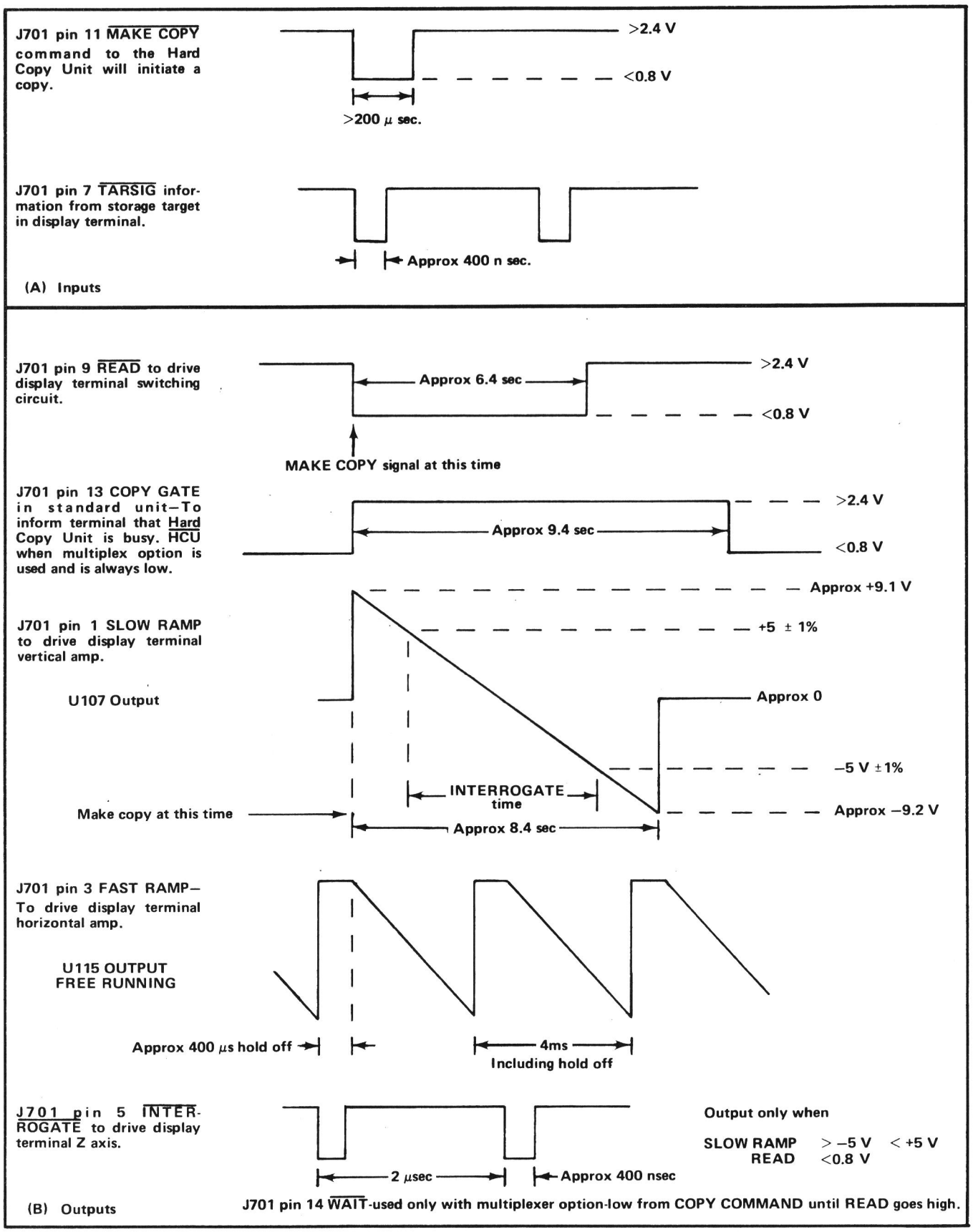


Fig. 6-1. (A) 4610 Inputs. (B) 4610 Outputs.

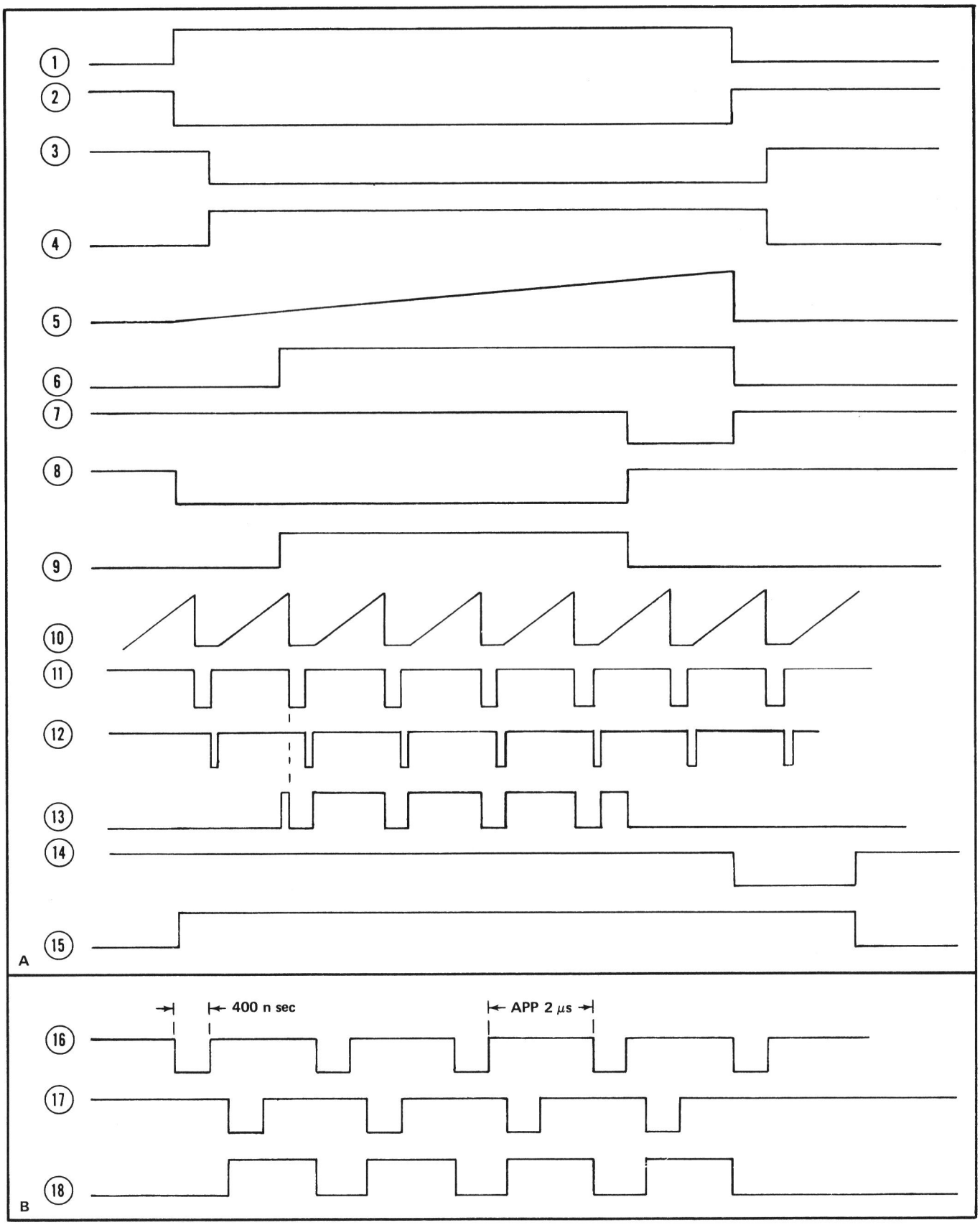


Fig. 6-2. Timing waveforms.

T mech FROM J308

MAKE COPY REMOTE FROM J701-11

FROM COPY FRONT PANEL

SLOW RAMP GATE

COPY GATE TO DRIVE MOTOR CONTROL

COPY GATE TO J701-13

FROM +25V UN REG

SOLENOID TO J308

READ TO J701-9

TP78

SLOW RAMP TO DFL AMP TO J701-1&2

SLOW RAMP TO 4010

TP108

FAST RAMP TO DFL AMP

FAST RAMP GATE

TP116

FAST RAMP TO 4010 TO J701-3&4

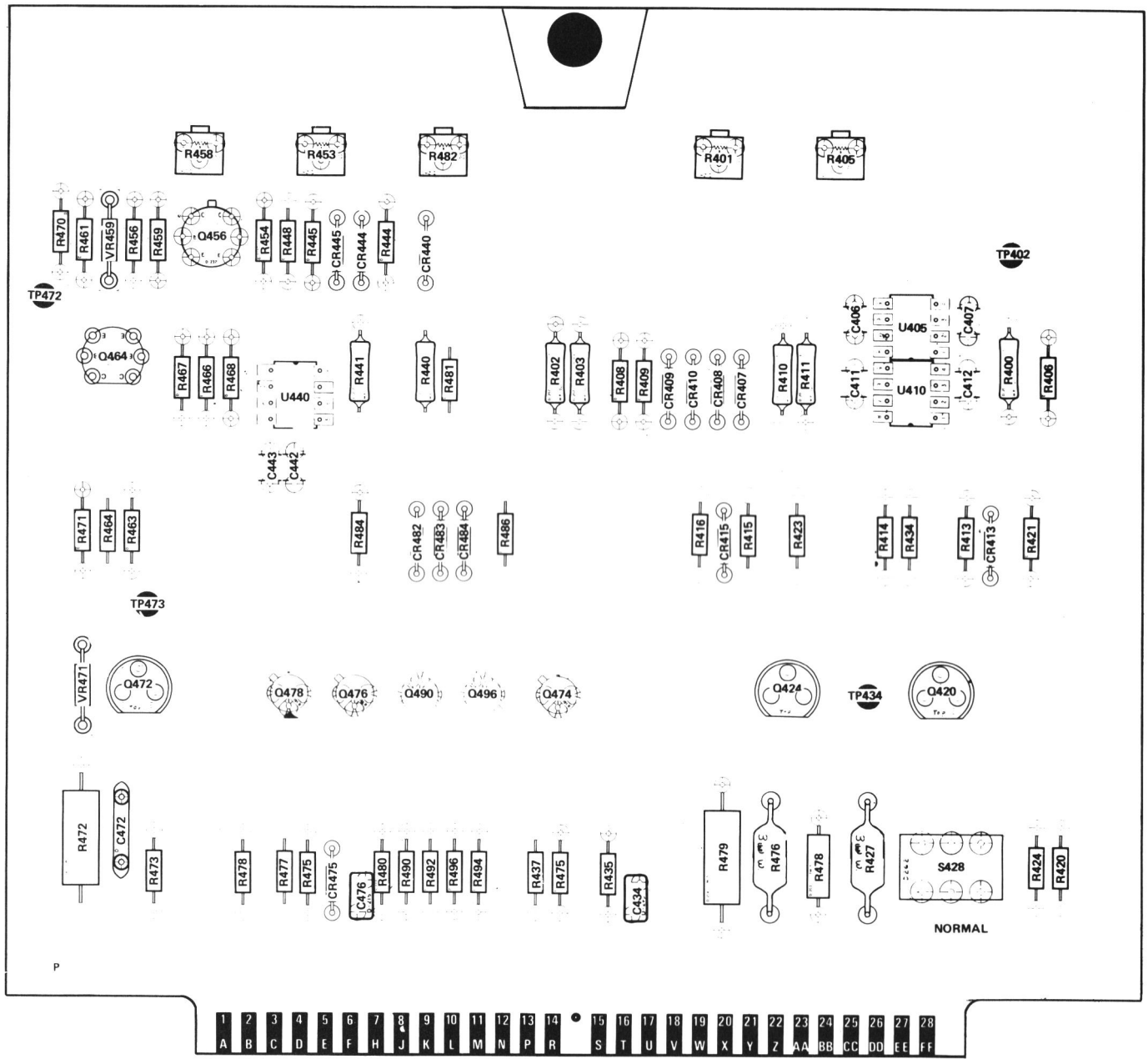
TP125

INTERROGATE TO 4010 TO J701-5&6

TO PIN 22 Z AXIS

TARSIG IN FROM J701-7&8

A4 TIMING BOARD



Deflection Amps & Dynamic Focus ◇4

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ELECTRICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

DEFLECTION AMPS. & DYNAMIC FOCUS ◈4

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
INDUCTOR				
L428A,B	108-0451-00			CRT deflection
TRANSISTORS				
Q426	151-0226-00			Silicon, NPN, replaceable by 2N3767
Q428	151-0227-00			Silicon, PNP, replaceable by 2N3741
ASSEMBLY				
A5	**670-1965-00**			**DEFLECTION AMPLIFIER & DYNAMIC FOCUS Circuit Card Assembly**
CAPACITORS				
C406	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C407	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C411	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C412	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C434	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C442	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C443	283-0177-00			1 µF, Cer, 25 V, +80%-20%
C472	283-0097-00			300 pF, Cer, 1000 V, 10%
C476	283-0177-00			1 µF, Cer, 25 V, +80%-20%
DIODES				
CR407	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR408	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR409	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR410	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR413	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR415	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR440	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR444	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR445	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR475	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR482	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR483	152-0185-00			Silicon, selected from 1N4152 or 1N3605
CR484	152-0185-00			Silicon, selected from 1N4152 or 1N3605

DEFLECTION AMPS. & DYNAMIC FOCUS ◈ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
DIODES (cont)				
VR459	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%
VR471	152-0243-00			Zener, replaceable by 1N965B, 0.4 W, 15 V, 5%
TRANSISTORS				
Q420	151-0136-00			Silicon, NPN, replaceable by 2N3053
Q424	151-0134-00			Silicon, PNP, selected from 2N2905
Q456A,B	151-0361-00			Silicon, NPN, replaceable by TD702, dual
Q464A,B	151-0232-00			Silicon, NPN, replaceable by NS7348 or selected from 2N2919, dual
Q472	151-0169-00			Silicon, NPN, replaceable by 2N3439
Q474	151-0192-00			Silicon, NPN, selected from MPS6521
Q476	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q478	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q490	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904
Q496	151-0188-00			Silicon, PNP, replaceable by 2N3906
RESISTORS				
R400	321-0193-00			1 kΩ, 1/8 W, 1%
R401	311-1279-00			500 Ω, Var
R402	321-0306-00			15 kΩ, 1/8 W, 1%
R403	321-0306-00			15 kΩ, 1/8 W, 1%
R405	311-1280-00			1 kΩ, Var
R406	315-0512-00	B010100	B010129	5.1 kΩ, 1/4 W, 5%
R406	315-0133-00	B010130		13 kΩ, 1/4 W, 5%
R408	315-0102-00			1 kΩ, 1/4 W, 5%
R409	315-0103-00			10 kΩ, 1/4 W, 5%
R410	321-0339-00			33.2 kΩ, 1/8 W, 1%
R411	321-0318-00			20 kΩ, 1/8 W, 1%
R413	315-0682-00			6.8 kΩ, 1/4 W, 5%
R414	315-0301-00			300 Ω, 1/4 W, 5%
R415	315-0301-00			300 Ω, 1/4 W, 5%
R416	315-0682-00			6.8 kΩ, 1/4 W, 5%
R420	315-0560-00			56 Ω, 1/4 W, 5%
R421	315-0102-00			1 kΩ, 1/4 W, 5%
R423	315-0102-00			1 kΩ, 1/4 W, 5%
R424	315-0560-00			56 Ω, 1/4 W, 5%
R426	308-0244-00			0.3 Ω, 2 W, WW, 10%
R427	308-0244-00			0.3 Ω, 2 W, WW, 10%
R428	301-0430-00			43 Ω, 1/2 W, 5%
R429	310-0535-00			1 Ω, 4 W, 1/2%
R434	315-0153-00			15 kΩ, 1/4 W, 5%
R435	315-0105-00			1 MΩ, 1/4 W, 5%
R437	315-0153-00			15 kΩ, 1/4 W, 5%
R440	321-0306-00			15 kΩ, 1/8 W, 1%
R441	321-0306-00			15 kΩ, 1/8 W, 1%
R444	315-0333-00			33 kΩ, 1/4 W, 5%
R445	315-0683-00			68 kΩ, 1/4 W, 5%
R448	315-0752-00			7.5 kΩ, 1/4 W, 5%
R453	311-1282-00			5 kΩ, Var
R454	315-0432-00			4.3 kΩ, 1/4 W, 5%
R456	315-0471-00			470 Ω, 1/4 W, 5%

DEFLECTION AMPS. & DYNAMIC FOCUS ◈ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R458	311-1281-00			2.5 kΩ, Var
R459	315-0202-00			2 kΩ, 1/4 W, 5%
R461	315-0102-00			1 kΩ, 1/4 W, 5%
R463	315-0472-00			4.7 kΩ, 1/4 W, 5%
R464	315-0102-00			1 kΩ, 1/4 W, 5%
R466	315-0182-00			1.8 kΩ, 1/4 W, 5%
R467	315-0101-00			100 Ω, 1/4 W, 5%
R468	315-0182-00			1.8 kΩ, 1/4 W, 5%
R470	315-0103-00			10 kΩ, 1/4 W, 5%
R471	315-0105-00			1 MΩ, 1/4 W, 5%
R472	303-0823-00			82 kΩ, 1 W, 5%
R473	315-0821-00			820 Ω, 1/4 W, 5%
R475	315-0153-00			15 kΩ, 1/4 W, 5%
R476	315-0103-00			10 kΩ, 1/4 W, 5%
R477	315-0153-00			15 kΩ, 1/4 W, 5%
R478	315-0472-00			4.7 kΩ, 1/4 W, 5%
R480	315-0563-00			56 kΩ, 1/4 W, 5%
R481	315-0333-00			33 kΩ, 1/4 W, 5%
R482	311-1283-00			10 kΩ, Var
R484	315-0473-00			47 kΩ, 1/4 W, 5%
R486	315-0473-00			47 kΩ, 1/4 W, 5%
R490	315-0101-00			100 Ω, 1/4 W, 5%
R492	315-0330-00			33 Ω, 1/4 W, 5%
R494	315-0330-00			33 Ω, 1/4 W, 5%
R496	315-0101-00			100 Ω, 1/4 W, 5%
SWITCH				
S428	260-0723-00			Slide, DPDT
INTEGRATED CIRCUITS				
U405	156-0067-00			Operational amplifier, replaceable by UA741C
U410	156-0067-00			Operational amplifier, replaceable by UA741C
U440	156-0067-00			Operational amplifier, replaceable by UA741C

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DEFLECTION AMPLIFIER AND DYNAMIC FOCUS

Dynamic Focus

The dynamic focus circuit includes U440, Q456, Q464 and Q472.

The Fast Ramp is applied through the Horiz Ampl control, R401 and 1X operational amplifier U405, which is adjusted to center the Fast Ramp about a 0 VDC level. 1X operation amplifier U440 receives its input from U405, inverts it with no gain or DC level shift. CR440 and CR444 detect the absolute value of the Fast Ramp. The Dyna Focus Range control in the emitter of Q456B determines the amount of the ramp that is below the turn-on voltage of Q456B. The output of Q456B is then applied to the Q464/Q472 amplifier, whose output forms the DC reference for the focus winding in the CRT circuit.

Vertical Amplifier

The vertical amplifier is a single stage, complementary current source that provides current gain for the slow ramp. A quiescent current level adjustment (R482) is provided. Q490 and Q496 are the amplifier transistors.

Horizontal Amplifier

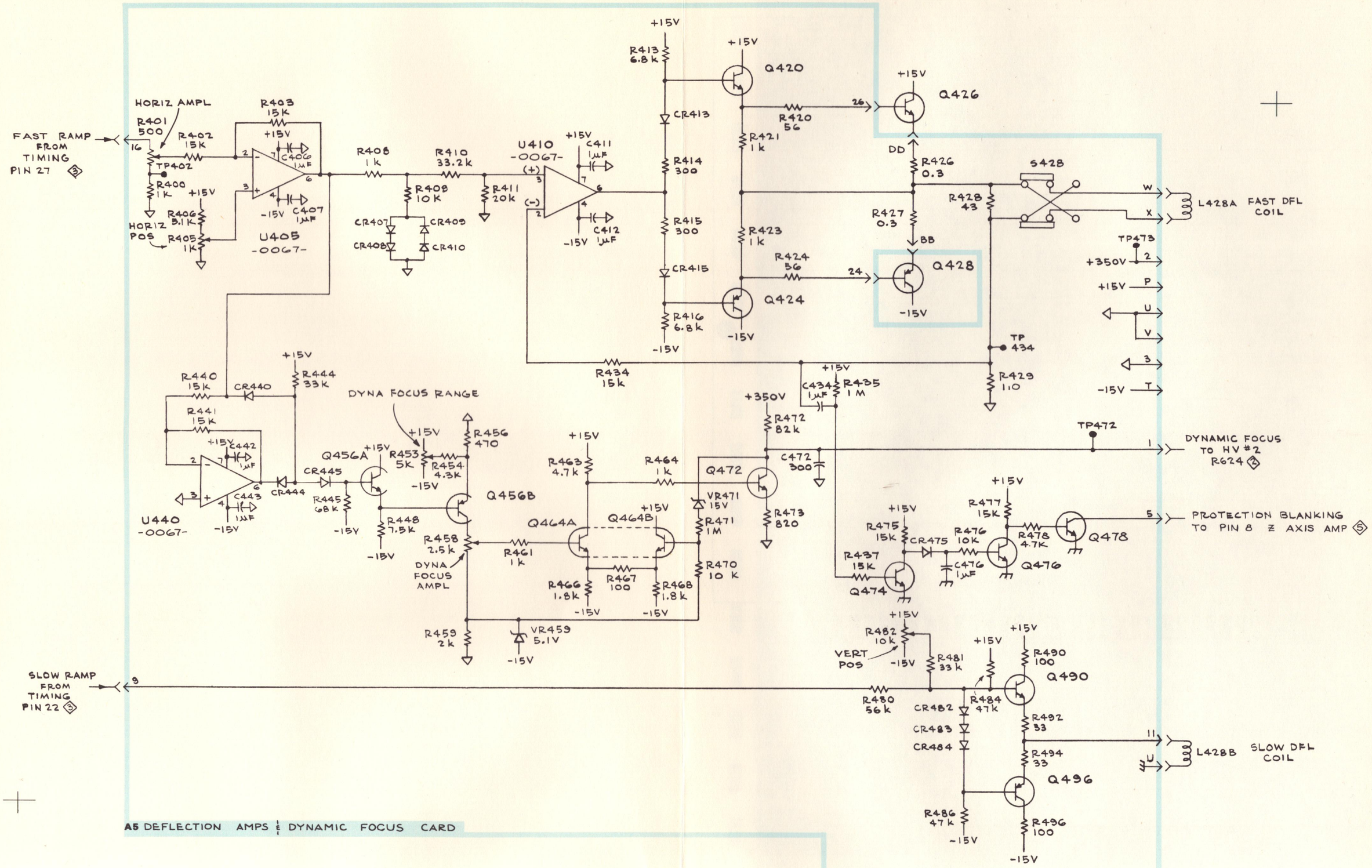
The horizontal amplifier is made up of U410, Q420, Q424, Q426 and Q428.

Linearity correction is accomplished by reducing the slopes of the input ramp at the + and – ends of the ramp. The slope is reduced at the + end by conduction of CR407 and CR408 through R409. This forms a voltage divider through R408, R409, and the impedance of CR407 and CR408 (dependent on the level of the ramp).

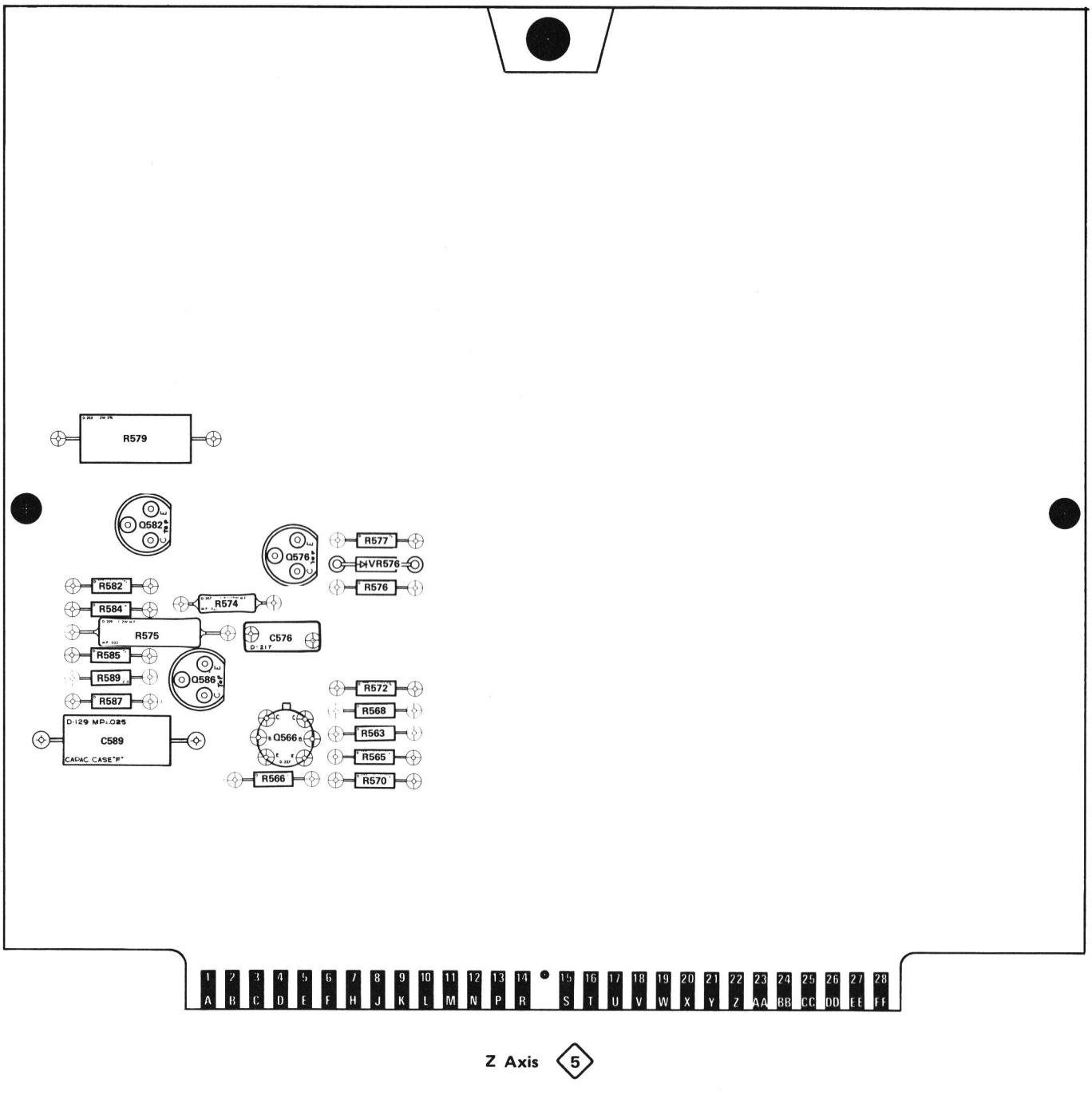
The reverse of this occurs on the – end of the ramp by conduction of CR409 and CR410. The linearity corrected ramp is then applied to U410, an integrated circuit operational amplifier, and then to a two-stage complementary current amplifier, which drives the horizontal deflection yoke. Feedback from the horizontal yoke is sensed across R429, and is fed back through R434 to the – input of R410. The polarity of output ramp may be reversed by changing S428.

Protection Blanking

The ramp from R429 is coupled to Q474. The pulse at the output of Q474 switches Q476 and Q478 depending upon whether the Fast Ramp is of sufficient amplitude.



A5 DEFLECTION AMPS & DYNAMIC FOCUS CARD


R579
Q582
Q576
R577
VR576
R576
R582
R584
R574
R575
C576
R585
R589
R587
Q586
D-129 MP-025
C589
CAPAC CASE "F"
Q566
R572
R568
R563
R565
R570
R566
1 A
2 B
3 C
4 D
5 E
6 F
7 H
8 J
9 K
10 L
11 M
12 N
13 P
14 R
15 S
16 T
17 U
18 V
19 W
20 X
21 Y
22 Z
23 AA
24 BB
25 CC
26 DD
27 EE
28 FF

Z Axis 5

Ⓐ

ELECTRICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

Z AXIS AMPLIFIER ⑤

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS				
R561	311-0091-00			1 kΩ, Var
R562	301-0181-00			180 Ω, 1/2 W, 5%
ASSEMBLY				
A6	**670-1910-00**			**Z AXIS AMPLIFIER Circuit Card Assembly**
CAPACITORS				
C576	283-0164-00			2.2 µF, Cer, 25 V, 20%
C589	290-0271-00			9 µF, Elect., 125 V, +20%-15%
DIODE				
VR576	152-0279-00			Zener, replaceable by 1N751A, 0.4 W, 5.1 V, 5%
TRANSISTORS				
Q566A,B	151-0261-00			Silicon, PNP, replaceable by NS7406, dual
Q576	151-0124-00			Silicon, NPN, selected from 2N3501 or 2N3119
Q582	151-0124-00			Silicon, NPN, selected from 2N3501 or 2N3119
Q586	151-0208-00			Silicon, PNP, replaceable by 2N4036
RESISTORS				
R563	315-0102-00			1 kΩ, 1/4 W, 5%
R565	315-0272-00			2.7 kΩ, 1/4 W, 5%
R566	315-0361-00			360 Ω, 1/4 W, 5%
R568	315-0182-00			1.8 kΩ, 1/4 W, 5%
R570	315-0272-00			2.7 kΩ, 1/4 W, 5%
R572	315-0182-00			1.8 kΩ, 1/4 W, 5%
R574	321-0193-00			1 kΩ, 1/8 W, 1%
R575	323-0328-00			25.5 kΩ, 1/2 W, 1%
R576	315-0100-00			10 Ω, 1/4 W, 5%
R577	315-0361-00			360 Ω, 1/4 W, 5%
R579	305-0103-00			10 kΩ, 2 W, 5%

Z AXIS AMPLIFIER ⑤ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R582	315-0101-00			100 Ω, 1/4 W, 5%
R584	315-0100-00			10 Ω, 1/4 W, 5%
R585	315-0100-00			10 Ω, 1/4 W, 5%
R587	315-0101-00			100 Ω, 1/4 W, 5%
R589	315-0510-00			51 Ω, 1/4 W, 5%

Z AXIS AMPLIFIER

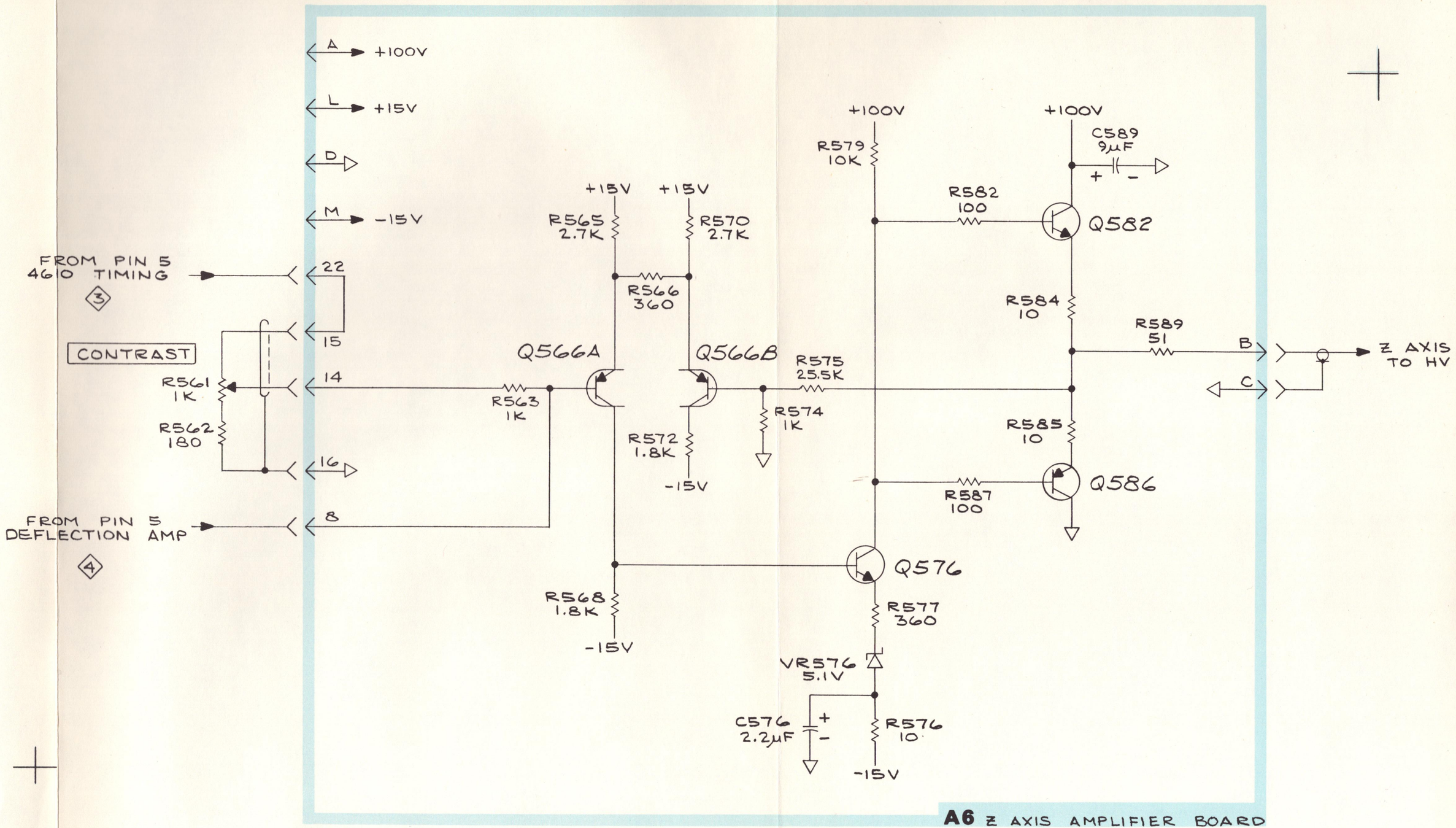
The Z axis amplifier output is used to intensity modulate the CRT beam current.

The Z axis amplifier consists of a differential amplifier, Q566; a voltage amplifier, Q576; and a complementary current amplifier, Q582/Q586.

If there are no Z axis signals coming from Terminal 5 on the timing board, the input to the differential amplifier is at zero volts, and therefore the Z axis output is also at zero because the collector of Q586 is grounded and cannot go below zero volts.

The Z axis output provides the reference voltage for the low voltage end of the CRT grid rectifiers; so when the Z axis input swings positive, as it does when a pulse arrives from the timing board, the Z axis output also swings positive, increasing the CRT beam current. The voltage swing of the Z output is controlled by adjusting the size of the input signal with Contrast Control R561.

An additional input to the Z axis amplifier is provided at Terminal 8. This signal comes from the Deflection Amplifier Board and is held at ground potential whenever the fast ramp is not running, or goes below its normal amplitude. This means that if, for any reason, deflection signals are not being sent to the CRT, any signals from Terminal 5 of the timing board are grounded and the intensity of the beam is not allowed to increase. This serves as a safety factor by preventing the beam from being intensified unless it is also being deflected, thus preventing burning of the CRT.



A6 Z AXIS AMPLIFIER BOARD

ELECTRICAL PARTS LIST

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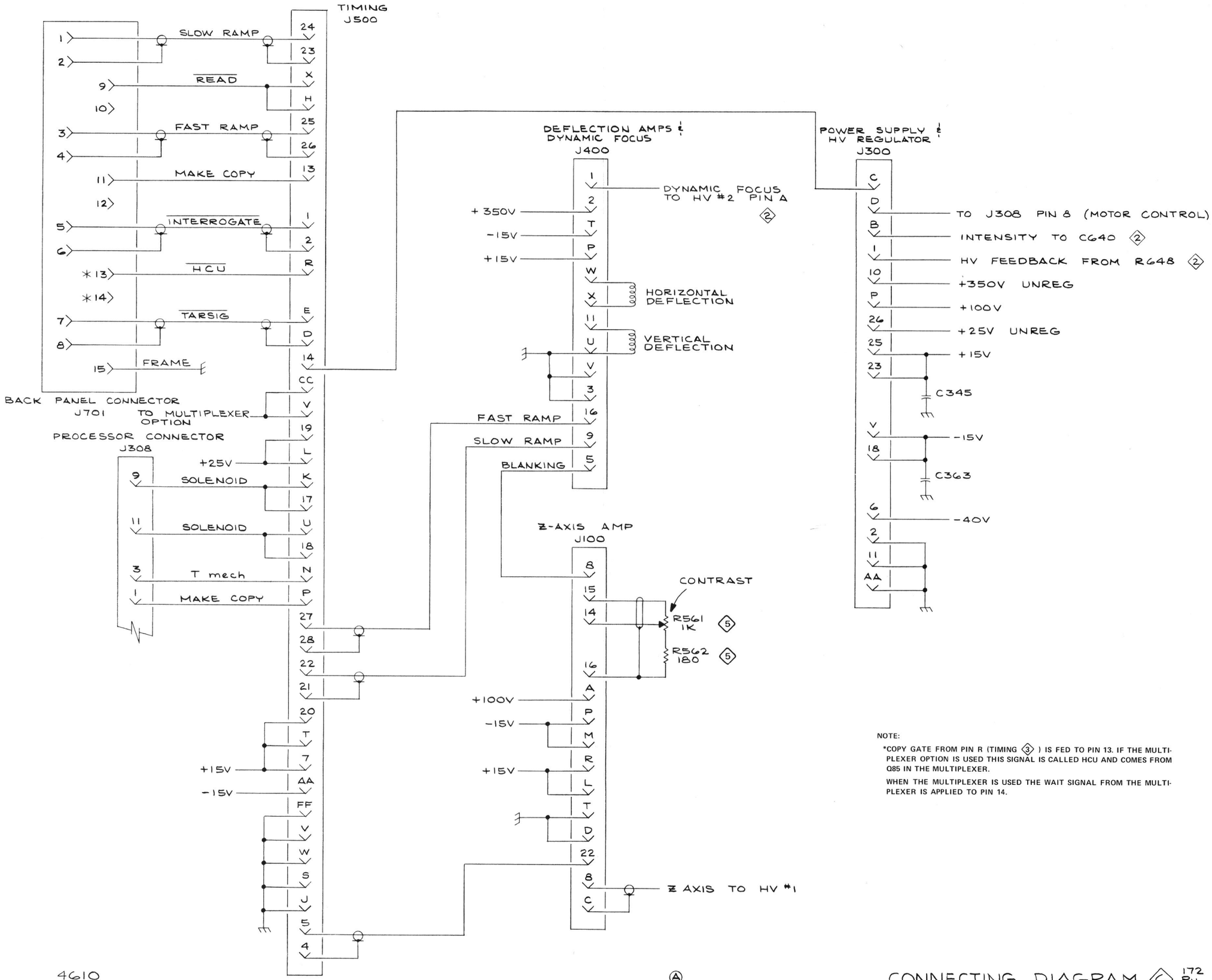
ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

CONNECTING DIAGRAM ◈6

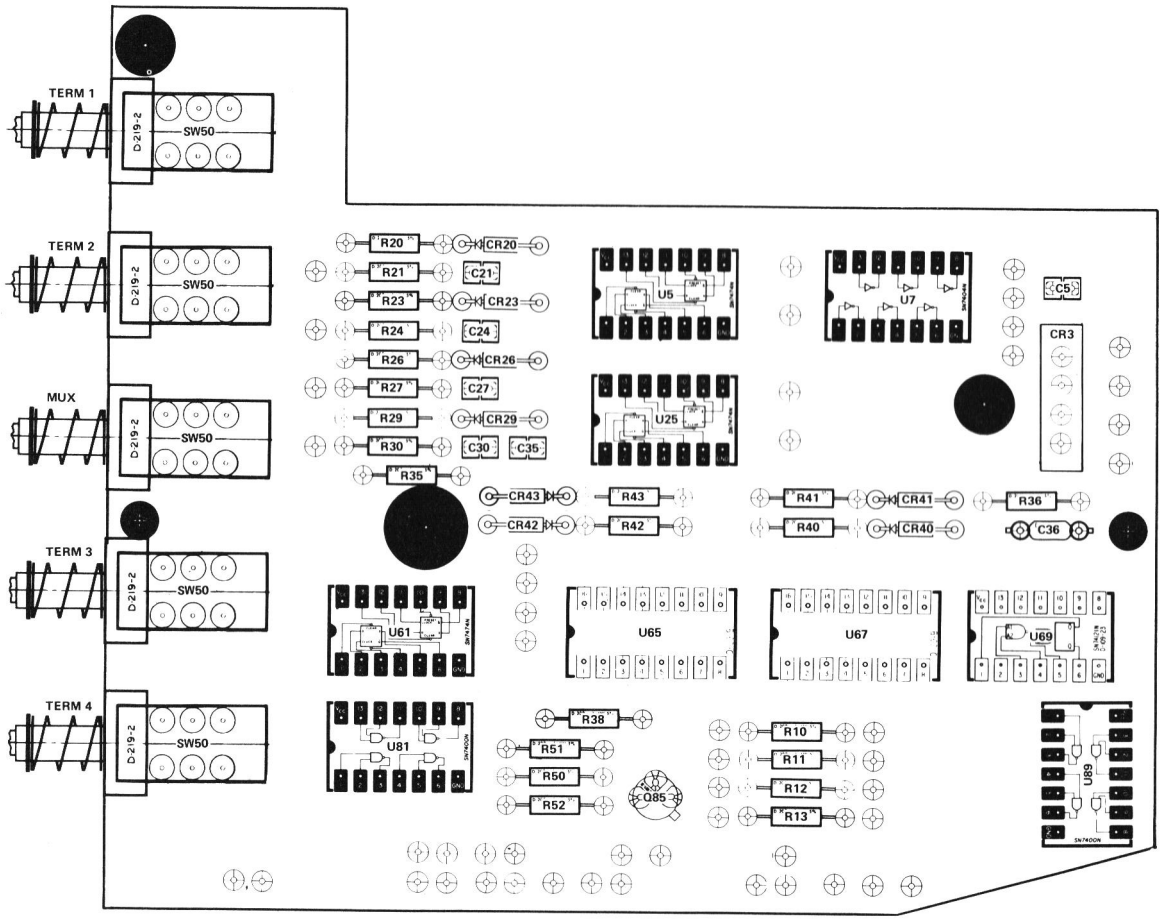
Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CONNECTORS				
J100	131-0292-01			Receptacle, electrical, 56 pin contact
J300	131-0292-01			Receptacle, electrical, 56 pin contact
J308	131-0689-00			Receptacle, electrical, 15 female contact
J400	131-0292-01			Receptacle, electrical, 56 pin contact
J500	131-0292-01			Receptacle, electrical, 56 pin contact



NOTE:

*COPY GATE FROM PIN R (TIMING ③) IS FED TO PIN 13. IF THE MULTIPLEXER OPTION IS USED THIS SIGNAL IS CALLED HCU AND COMES FROM Q85 IN THE MULTIPLEXER.

WHEN THE MULTIPLEXER IS USED THE WAIT SIGNAL FROM THE MULTIPLEXER IS APPLIED TO PIN 14.



Multiplexer 7

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ELECTRICAL PARTS LIST

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ABBREVIATIONS AND REFERENCE DESIGNATORS

A	Assembly, separable or repairable	FL	Filter	PTM	paper or plastic, tubular molded
AT	Attenuator, fixed or variable	H	Heat dissipating device (heat sink, etc.)	R	Resistor, fixed or variable
B	Motor	HR	Heater	RT	Thermistor
BT	Battery	J	Connector, stationary portion	S	Switch
C	Capacitor, fixed or variable	K	Relay	T	Transformer
Cer	Ceramic	L	Inductor, fixed or variable	TP	Test point
CR	Diode, signal or rectifier	LR	Inductor/resistor combination	U	Assembly, inseparable or non-repairable
CRT	cathode-ray tube	M	Meter	V	Electron tube
DL	Delay line	Q	Transistor or silicon-controlled rectifier	Var	Variable
DS	Indicating device (lamp)	P	Connector, movable portion	VR	Voltage regulator (zener diode, etc.)
Elect.	Electrolytic	PMC	Paper, metal cased	WW	wire-wound
EMC	electrolytic, metal cased	PT	paper, tubular	Y	Crystal
EMT	electrolytic, metal tubular				
F	Fuse				

MULTIPLEXER OPTION ⑦

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CAPACITOR				
C4	290-0021-00			1000 µF, Elect., 15 V
CONNECTORS				
J701	131-0458-00			Receptacle, electrical, 15 female contact
J702	131-0458-00			Receptacle, electrical, 15 female contact
J703	131-0458-00			Receptacle, electrical, 15 female contact
J704	131-0458-00			Receptacle, electrical, 15 female contact
INTEGRATED CIRCUIT				
U3	156-0178-00			Triple 3-input nor gate, replaceable by SN7427N
ASSEMBLY				
A7	**670-1963-00**			**MULTIPLEXER Circuit Board Assembly (OPTION 1)**
CAPACITORS				
C5	290-0527-00			15 µF, Elect., 20 V, 20%
C21	290-0534-00			1 µF, Elect., 35 V, 20%
C24	290-0534-00			1 µF, Elect., 35 V, 20%
C27	290-0534-00			1 µF, Elect., 35 V, 20%
C30	290-0534-00			1 µF, Elect., 35 V, 20%
C35	290-0527-00			15 µF, Elect., 20 V, 20%
C36	283-0080-00			0.022 µF, Cer, 25 V, +80%-20%
DIODES				
CR3	152-0488-00			Silicon, rectifier bridge
CR20	152-0141-02			Silicon, replaceable by 1N4152
CR23	152-0141-02			Silicon, replaceable by 1N4152
CR26	152-0141-02			Silicon, replaceable by 1N4152
CR29	152-0141-02			Silicon, replaceable by 1N4152
CR40	152-0141-02			Silicon, replaceable by 1N4152
CR41	152-0141-02			Silicon, replaceable by 1N4152
CR42	152-0141-02			Silicon, replaceable by 1N4152
CR43	152-0141-02			Silicon, replaceable by 1N4152
TRANSISTOR				
Q85	151-0190-00			Silicon, NPN, replaceable by 2N3904 or TE3904

MULTIPLEXER OPTION ⑦ (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS				
R10	315-0102-00			1 kΩ, 1/4 W, 5%
R11	315-0102-00			1 kΩ, 1/4 W, 5%
R12	315-0102-00			1 kΩ, 1/4 W, 5%
R13	315-0102-00			1 kΩ, 1/4 W, 5%
R20	315-0202-00			2 kΩ, 1/4 W, 5%
R21	315-0101-00			100 Ω, 1/4 W, 5%
R23	315-0202-00			2 kΩ, 1/4 W, 5%
R24	315-0101-00			100 Ω, 1/4 W, 5%
R26	315-0202-00			2 kΩ, 1/4 W, 5%
R27	315-0101-00			100 Ω, 1/4 W, 5%
R29	315-0202-00			2 kΩ, 1/4 W, 5%
R30	315-0101-00			100 Ω, 1/4 W, 5%
R35	315-0202-00			2 kΩ, 1/4 W, 5%
R36	315-0273-00			27 kΩ, 1/4 W, 5%
R38	315-0512-00			5.1 kΩ, 1/4 W, 5%
R40	315-0202-00			2 kΩ, 1/4 W, 5%
R41	315-0202-00			2 kΩ, 1/4 W, 5%
R42	315-0202-00			2 kΩ, 1/4 W, 5%
R43	315-0202-00			2 kΩ, 1/4 W, 5%
R45	315-0471-00			470 Ω, 1/4 W, 5%
R46	315-0471-00			470 Ω, 1/4 W, 5%
R47	315-0471-00			470 Ω, 1/4 W, 5%
R48	315-0471-00			470 Ω, 1/4 W, 5%
R50	315-0202-00			2 kΩ, 1/4 W, 5%
R51	315-0202-00			2 kΩ, 1/4 W, 5%
R52	315-0202-00			2 kΩ, 1/4 W, 5%
SWITCH				
S50	260-1435-00			Pushbutton, 1, 2, MUX, 3, 4
INTEGRATED CIRCUITS				
U5	156-0041-00			Dual 15 MHz D-type pos-edge-trig flip-flop, replaceable by SN7474N
U7	156-0092-00			Hex. inverter, replaceable by SN7405N
U25	156-0041-00			Dual 15 MHz D-type pos-edge-trig flip-flop, replaceable by SN7474N
U61	156-0041-00			Dual 15 MHz D-type pos-edge-trig flip-flop, replaceable by SN7474N
U65	156-0141-00			Dual 2-line-to-4-line decoder/demultiplexer, replaceable by SN74156N
U67	156-0098-00			Dual 4-line-to-1-line data select/multiplex, replaceable by SN74153N
U69	156-0072-00			Single monotable multivibrator-one shot, replaceable by SN74121N
U81	156-0030-00			Quad 2-input positive nand gate, replaceable by SN7400N
U89	156-0030-00			Quad 2-input positive nand gate, replaceable by SN7400N

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MULTIPLEXER (OPTION 1)

General

The Multiplexer, mounted inside the Hard Copy Unit, provides switching functions and connections for using up to four Display Terminals with the same Hard Copy Unit.

To drive the Multiplexer, signals from the Timing Board in the Hard Copy unit are required, including the Fast Ramp Gate, to be used as a switching clock. Also required is a 9 volt AC from the power transformer.

Signals

Refer to the Block Diagram of the Multiplexer.

The signals coming in to the Multiplexer from the Timing board are: $\overline{\text{Interrogate}}$; $\overline{\text{Read}}$; Copy Gate and Fast Ramp Gate.

The output signals from the Multiplexer going to the Timing board are $\overline{\text{Make Copy}}$ and $\overline{\text{Tarsig}}$.

The signal inputs to the Multiplexer from each Display Terminal are $\overline{\text{Make Copy}}$ and $\overline{\text{Tarsig}}$.

The output signals from the Multiplexer going to each Display Terminal are $\overline{\text{Interrogate}}$, $\overline{\text{Read}}$, $\overline{\text{HCU}}$, and $\overline{\text{Wait}}$.

In addition to this, the Slow Ramp and the Fast Ramp are paralleled to all four Terminals. The Front Panel COPY button on the Hard Copy Unit is disabled when in the Multiplexer mode.

Terminal Selection

The "select" signals, A and B, are sent to the $\overline{\text{Make Copy}}$ Data Selector U67B; the $\overline{\text{Tarsig}}$ Data Selector U67A; the $\overline{\text{Interrogate}}$ mulitplexer U65A; and the $\overline{\text{Read}}$ multiplexer U65B. These "Select" signals determine which of the Display Terminals will be connected to the Hard Copy Unit. Selection is as shown in the following table.

A	B	Terminal
low	low	1
high	low	2
low	high	3
high	high	4

The A and B "Select" signals are controlled by the back panel switches. (See Fig. 5-3.)

If the MUX button is depressed, the COPY on the front panel of the Hard Copy Unit is disconnected, and the Hard Copy Unit can receive a $\overline{\text{Make Copy}}$ command from any one of the four Display Terminals. A memory in the Multiplexer stores a $\overline{\text{Make Copy}}$ request if the unit is busy making a copy from another Terminal.

If any one of the Terminal buttons 1 through 4 is pushed in, signals can only be sent to and received from that particular Terminal. If the front panel COPY is pushed, a copy will be made from that particular Terminal.

For example, if Terminal 2 button is depressed, the Hard Copy Unit can only accept a $\overline{\text{Make Copy}}$ command from Terminal 2, and pushing the front panel COPY button will result in a copy of the information displayed on Terminal 2.

Circuit Description

In the MUX mode, pins 2, 5, 9, and 11 of U81 are all high and all four gates work as inverters. While waiting for a Copy command, the Copy Gate is low and the Fast Ramp Gate is coupled thru U89B and U89D to the Clock inputs of U61A and U61B. These flip-flops are coupled so that the Q outputs, (pin 5 of U61A and pin 9 of U61B), which are the A and B "Select" signals, are switched as shown in Fig. 5-4.

If no $\overline{\text{Make Copy}}$ command has been received, pins 10, 11, 12, and 13 on U67B are all high, so the output (pin 9) is also high and the one-shot multivibrator U69 is disabled.

A $\overline{\text{Make Copy}}$ command from one of the Display Terminals will preset one of the memory gates and cause a low at one of the inputs to U67B.

For example, a $\overline{\text{Make Copy}}$ from Terminal 2 will preset U5A, giving a low at $\overline{Q}$ and therefore, a low at pin 11 of U67B. When the "select" signals A and B reach the state corresponding to Terminal 2—that is A high and B low, the following will happen:

a. Pin 9 of U67B will go low.

b. The step occuring in a, or the next positive edge of the Fast Ramp Gate, will trigger U69 and give a negative pulse of approximately 250 μs to the $\overline{\text{Make Copy}}$ input of the timing board.

c. This pulse will initiate a copy and the Copy Gate will go high.

d. The Copy Gate is fed to the Multiplexer at pins 1 and 2 of U89A. The inverted Copy Gate will hold pin 6 of U89B high, preventing the Fast Ramp Gate from reaching U61A and U61B and switching them. Therefore the "select" signals A and B will stay in the "Terminal 2" state.

e. Under these conditions of A and B, the $\overline{\text{Read}}$ signal at pin 15 of U65B will appear on pin 10 of U65B and be sent to Terminal 2; the $\overline{\text{Interrogate}}$ to pin 2 of U65A will appear on pin 6 of U65A going to Terminal 2; and Data Selector U67A will only accept the $\overline{\text{Tarsig}}$ from Terminal 2. The signal at pin 7 of U67A will follow the signal at pin 5, so the $\overline{\text{Tarsig}}$ from Terminal 2 will be sent to the timing board.

f. When the scanning of Terminal 2 is completed, $\overline{\text{Read}}$ will go high (refer to Fig. 5-1), and this signal on pin 10 of U65B is fed back to the clock input of U5A, resetting Q (pin 5) low, and $\overline{Q}$ (pin 6) high, so pin 9 of U67B will go high.

g. When the Hard Copy Unit is ready to make another copy, the Copy Gate goes low, allowing the Fast Ramp Gate to reach U61A and U61B and cause them to again switch the state of "select" signals A and B, and search for another low on the inputs (pin 10 thru pin 13) of U67B.

If any of the other Display Terminals have sent a $\overline{\text{Make Copy}}$ request to the Multiplexer during the time the Hard Copy Unit has been busy, this request will be stored in the memory gate, and as soon as Copy Gate goes low and select signals A and B have changes to the proper state, the requested copy will be initiated.

To select an individual Terminal to be used with the Hard Copy Unit, one of the buttons 1 through 4 must be pushed.

In any of these modes the MUX button will be out and, therefore, pin 12 of U81D and pin 2 of U81A will be held low and their outputs will always be high. U81B and U81C are acting as inverters and the flip-flops U61A and U61B are logically separated.

Under these conditions, the signals from the back panel switches (1 through 4) to pin 5 on U81B and to pin 9 on U81C will determine the state of the U61 outputs or the "select" signals A and B. For example, if Terminal 3 is depressed, pin 5 of U81B will be low, so "select" signal B will be high. Also, pin 9 of U81C will be high, so "select" signal A will be low, and a $\overline{\text{Make Copy}}$ command will be accepted from Terminal 3 or, if the COPY button on the Hard Copy Unit is activated, Terminal 3 will be copied.

There is also an output from the Multiplexer board called the $\overline{\text{Wait}}$ signal.

When a $\overline{\text{Make Copy}}$ command is sent from one of the Display Terminals to its memory gate, U5A, U5B, U25A or U25B, the Q output of that gate will go high and produce a $\overline{\text{Wait}}$ to that terminal. This $\overline{\text{Wait}}$ signal will remain low until the copy from that Terminal has been completed.

The $\overline{\text{HCU}}$ output from the multiplexer is a signal to all Display Terminals to inform them that the Hard Copy Unit is on and ready to copy.

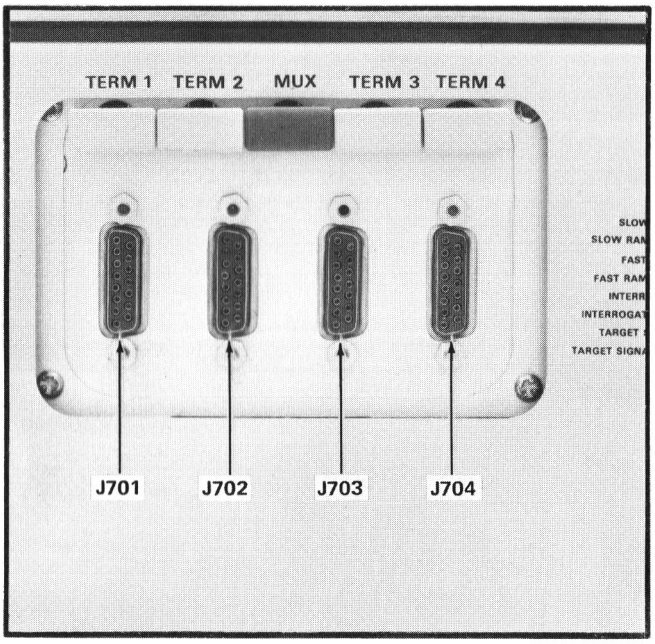

Fig. 6-3. Rear panel pushbutton connectors for Multiplexer option.

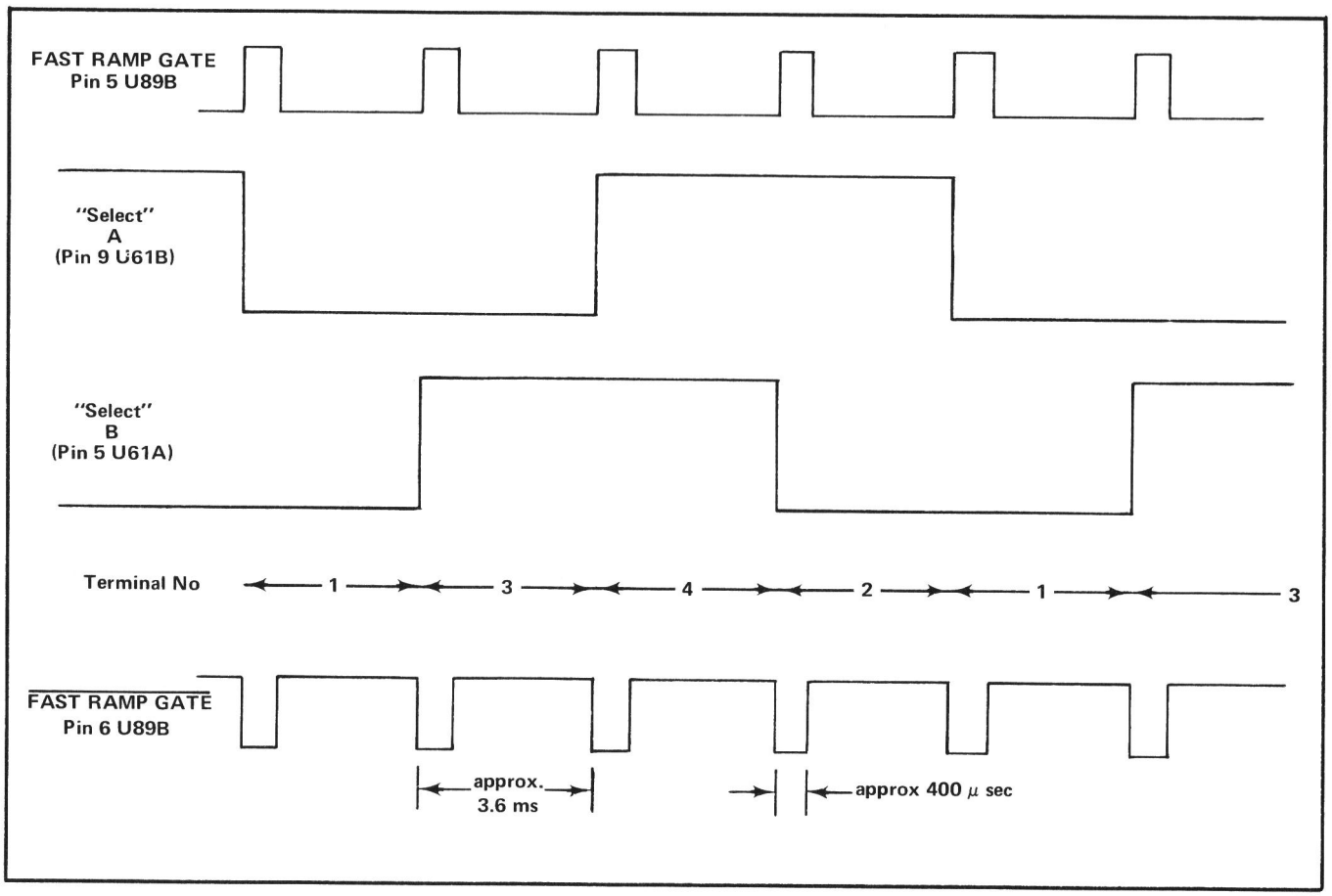

Fig. 6-4. Multiplexer select signals.

POWER FROM 9V WINDING ON TRANSFORMER
CR3
5V REGULATOR
U5
C4 1000µF
C5 15µF
+5V

SLOW RAMP FROM TIMING 3
FAST RAMP FROM TIMING 3

SLOW RAMP J701-1 TO J704-1
SLOW RAMP GROUND J701-2 TO J704-2
FAST RAMP J701-3 TO J704-3
FAST RAMP GROUND J701-4 TO J704-4

R10 1K, R11 1K, R12 1K, R13 1K
U67A ½ SN74153

TARSIG J701-7
TARSIG J702-7
TARSIG J703-7
TARSIG J704-7
TARSIG GROUND J701-8 TO J704-8

TARSIG TO TIMING 3

MAKE COPY J701-11
MAKE COPY J702-11
MAKE COPY J703-11
MAKE COPY J704-11

CR20, CR23, CR26, CR29
R20 2K, R23 2K, R26 2K, R29 2K
R21 100, R24 100, R27 100, R30 100
C21 1µF, C24 1µF, C27 1µF, C30 1µF

U5B ½ SN7474
U5A ½ SN7474
U25B ½ SN7474
U25A ½ SN7474
CLEAR

R35 2K, C35 15µF
U67B ½ SN74153

R36 27K, C36 .022µF
U69 SN74121

MAKE COPY TO TIMING 3

U7D, U7E, U7F, U7A

WAIT J701-14
WAIT J702-14
WAIT J703-14
WAIT J704-14

CR40, CR41, CR42, CR43
R40 2K, R41 2K, R42 2K, R43 2K

R38 5.1K, Q85

HCU J701-13 TO J704-13

READ FROM TIMING

U65B ½ SN74156

READ J701-9
READ J702-9
READ J703-9
READ J704-9

U65A ½ SN74156

INTERROGATE FROM TIMING

INTERROGATE J701-5
INTERROGATE J702-5
INTERROGATE J703-5
INTERROGATE J704-5
INTERROGATE GROUND J701-6 TO J704-6

S50
TERM 1, TERM 2, MUX, TERM 3, TERM 4
OFF / ON

U89A, U89B, U89D
U61A, U61B
U81A, U81B, U81C, U81D

COPY GATE FROM TIMING
FAST RAMP GATE

R50 2K, R51 2K, R52 2K

COPY FROM FRONT PANEL

MAKE COPY TO TIMING 3

A7 MULTIPLEXER OPTION CARD

MECHANICAL PARTS LIST

Replacement parts should be ordered from the Tektronix Field Office or Representative in your area. Changes to Tektronix products give you the benefit of improved circuits and components. Please include the instrument type number and serial number with each order for parts or service.

ABBREVIATIONS

BHB	binding head brass	h	height or high	OHB	oval head brass
BHS	binding head steel	hex.	hexagonal	OHS	oval head steel
CRT	cathode-ray tube	HHB	hex head brass	PHB	pan head brass
csk	countersunk	HHS	hex head steel	PHS	pan head steel
DE	double end	HSB	hex socket brass	RHS	round head steel
FHB	flat head brass	HSS	hex socket steel	SE	single end
FHS	flat head steel	ID	inside diameter	THB	truss head brass
Fil HB	fillister head brass	lg	length or long	THS	truss head steel
Fil HS	fillister head steel	OD	outside diameter	w	wide or width

FIGURE 1 FRONT FRAME & CRT SHIELD

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
1-1	426-0666-03			1	FRAME-PANEL, cabinet front
-2	348-0013-00			2	FOOT, rubber
-3	105-0199-00			2	STOP, latch
	- - - - - -			-	mounting hardware for each: (not included w/stop)
-4	211-0507-00			1	SCREW, 6-32 x 0.312 inch, PHS
-5	348-0128-00			2	FOOT, cabinet
	- - - - - -			-	mounting hardware for each: (not included w/foot)
-6	211-0514-00			2	SCREW, 6-32 x 0.075 inch, PHS
-7	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-8	348-0128-00			2	FOOT, cabinet
	- - - - - -			-	mounting hardware for each: (not included w/foot)
-9	211-0514-00			1	SCREW, 6-32 x 0.75 inch, PHS
-10	211-0516-00			1	SCREW, 6-32 x 0.875 inch, PHS
-11	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-12	426-0688-00			1	FRAME SECTION, lower left
	- - - - - -			-	mounting hardware: (not included w/frame section)
-13	212-0043-00			6	SCREW, 8-32 x 0.50 inch, 100° csk, FHS
	212-0040-00			1	SCREW, 8-32 x 0.375 inch, 100° csk, FHS (not shown)
-14	426-0687-00			1	FRAME SECTION, lower right
	- - - - - -			-	mounting hardware: (not included w/frame section)
-15	212-0043-00			6	SCREW, 8-32 x 0.50 inch, 100° csk, FHS
	212-0040-00			1	SCREW, 8-32 x 0.375 inch, 100° csk, FHS (not shown)
-16	337-1364-00			1	SHIELD, electrical
	- - - - - -			-	mounting hardware: (not included w/shield)
-17	211-0504-00			2	SCREW, 6-32 x 0.25 inch, PHS
-18	407-0833-00			1	BRACKET, component mounting, processor connector
	- - - - - -			-	mounting hardware: (not included w/bracket)
-19	211-0504-00			2	SCREW, 6-32 x 0.25 inch, PHS
-20	210-0202-00			1	LUG, solder, SE #6

FIGURE 1 FRONT FRAME & CRT SHIELD (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
1-21	131-0689-00			1		CONNECTOR, receptacle, female, 15 contact
	- - - - - -			-		mounting hardware: (not included w/connector)
-22	213-0192-00			2		SCREW, thread forming, 6-32 x 0.50 inch, Fil HS
-23	352-0264-00			1		HOLDER, interconnecting cable
	- - - - - -			-		mounting hardware: (not included w/holder)
-24	211-0504-00			2		SCREW, 6-32 x 0.25 inch, PHS
-25	- - - - - -			2		DIODE
	- - - - - -			-		mounting hardware for each: (not included w/diode)
-26	210-0010-00			1		WASHER, lock, internal, 0.20 ID x 0.376 inch OD
-27	260-1198-00			1		SWITCH, rocker
	- - - - - -			-		mounting hardware: (not included w/switch)
-28	211-0025-00			2		SCREW, 4-40 x 0.375 inch, 100° csk, FHS
-29	210-0586-00			2		NUT, keps, 4-40 x 0.25 inch
-30	366-1264-00			1		KNOB--CONTRAST
	- - - - - -			-		knob includes:
	213-0153-00			1		SETSCREW, 5-40 x 0.125 inch, HSS (not shown)
-31	366-1263-00			1		PUSHBUTTON--COPY
-32	- - - - - -			1		RESISTOR, variable
	- - - - - -			-		mounting hardware: (not included w/resistor)
-33	210-0465-00			2		NUT, hex., 0.25-32 x 0.375 inch
-34	210-0940-00			2		WASHER, flat, 0.25 ID x 0.375 inch OD
-35	260-0574-00			1		SWITCH, push--COPY, w/hardware
	- - - - - -			-		mounting hardware: (not included w/switch)
-36	210-0414-00			1		NUT, hex., 0.469-32 x 0.562 inch
-37	407-1026-00			1		BRACKET, component mounting
	- - - - - -			-		mounting hardware: (not included w/bracket)
-38	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch
-39	426-0685-00			2		FRAME SECTION, upper
	- - - - - -			-		mounting hardware for each: (not included w/frame section)
-40	212-0040-00			2		SCREW, 8-32 x 0.375 inch, 100° csk, FHS
-41	381-0323-00			1		BAR, support, CRT
	- - - - - -			-		mounting hardware: (not included w/bar)
-42	212-0106-00			1		SCREW, 8-32 x 0.875 inch, 100° csk, FHS
-43	212-0011-00			1		SCREW, 8-32 x 0.50 inch, 100° csk, FHS
-44	210-0458-00			2		NUT, keps, 8-32 x 0.344 inch

FIGURE 1 FRONT FRAME & CRT SHIELD (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
1-45	351-0308-00			1	GUIDE, cable
	- - - - - -			-	mounting hardware: (not included w/guide)
-46	212-0023-00			1	SCREW, 8-32 x 0.375 inch, PHS
-47	352-0255-00			2	HOLDER, CRT, right & left
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-48	212-0020-00			2	SCREW, 8-32 x 1.0 inch, PHS
-49	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch
-50	346-0082-00			1	STRAP, CRT, retaining, lower front
	- - - - - -			-	mounting hardware: (not included w/strap)
-51	211-0541-00			2	SCREW, 6-32 x 0.25 inch, 100° csk, FHS
-52	348-0262-01			4	PAD-SCREW ASSEMBLY, CRT
	- - - - - -			-	mounting hardware for each: (not included w/pad-screw
	- - - - - -			-	assembly)
-53	210-0585-00			1	NUT, camera adapter, 10-32 x 0.375 inch diameter
-54	220-0596-00			1	NUT, CRT, retaining, 10-32 x 0.75 inch diameter
-55	252-0603-00			in	PLASTIC STRIP, 22 inches long
-56	337-1347-01			1	SHIELD, CRT, face plate
-57	337-1348-01			1	SHIELD, CRT, front
-58	343-0290-00			1	CLAMP HALF, CRT, upper rear
	- - - - - -			-	mounting hardware: (not included w/clamp half)
-59	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-60	343-0291-00			1	CLAMP HALF, CRT, lower rear
	- - - - -			-	mounting hardware: (not included w/clamp half)
	212-0067-00			2	SCREW, 8-32 x 0.375 inch, THS (not shown)
-61	348-0002-00			1	GROMMET, rubber, 0.25 inch diameter
-62	337-0979-01			1	SHIELD, CRT, rear
	- - - - - -			-	mounting hardware: (not included w/shield)
-63	343-0152-00			1	CLAMP, CRT, shield
-64	354-0320-00			1	RING, yoke support
-65	348-0132-00			1	LINER, coil, plastic
-66	- - - - - -			1	COIL
-67	351-0266-00			1	SLIDE, guide, 11.50 inches long, w/brackets (pair)
	- - - - - -			-	mounting hardware: (not included w/slide)
-68	212-0040-00			4	SCREW, 8-32 x 0.375 inch, 100° csk, FHS
-69	212-0023-00			8	SCREW, 8-32 x 0.375 inch, PHS
-70	210-0804-00			8	WASHER, flat, 0.17 ID x 0.375 inch OD
-71	210-0458-00			8	NUT, keps, 8-32 x 0.344 inch

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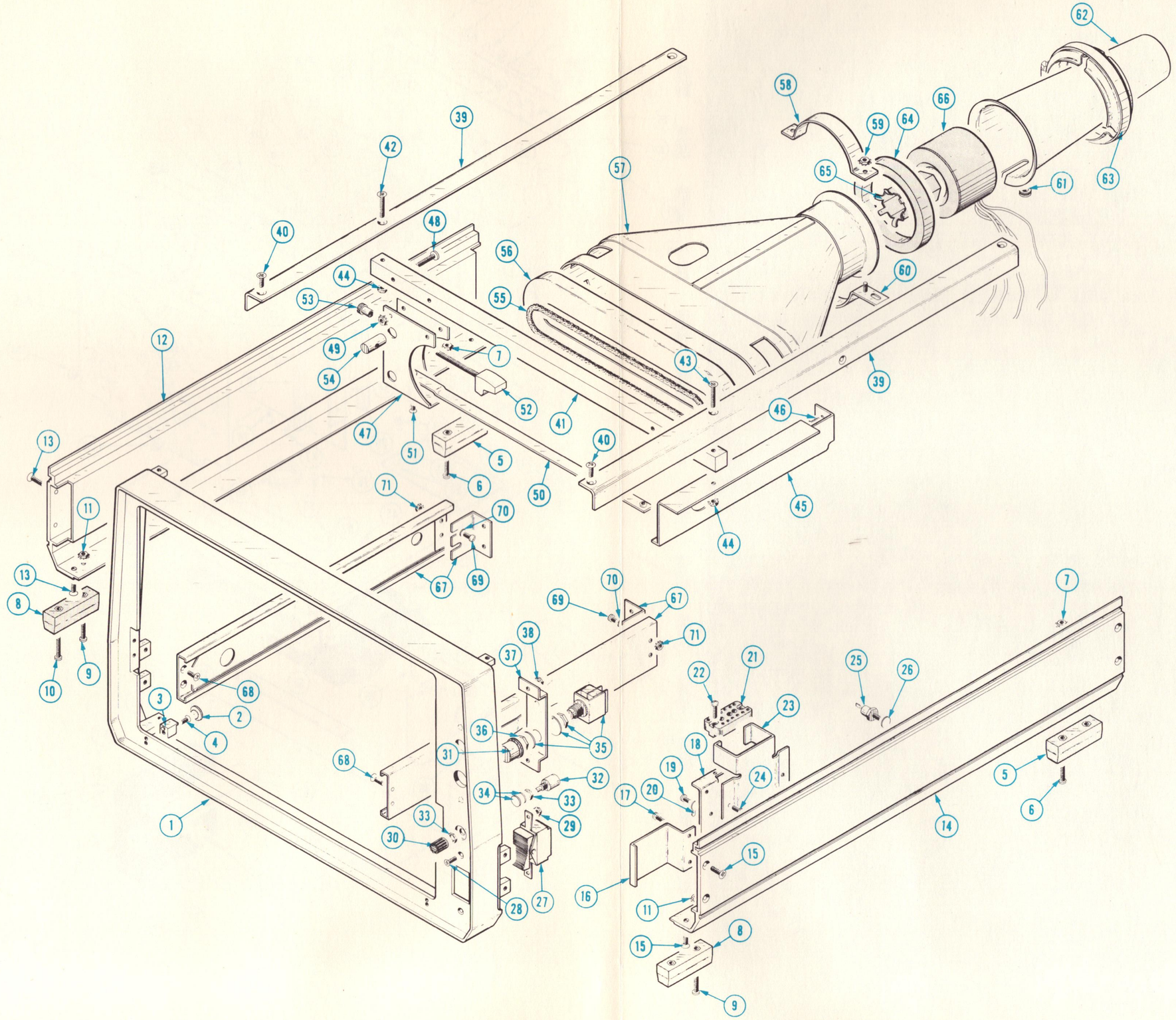
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FIG. 2 CHASSIS & CIRCUIT CARDS

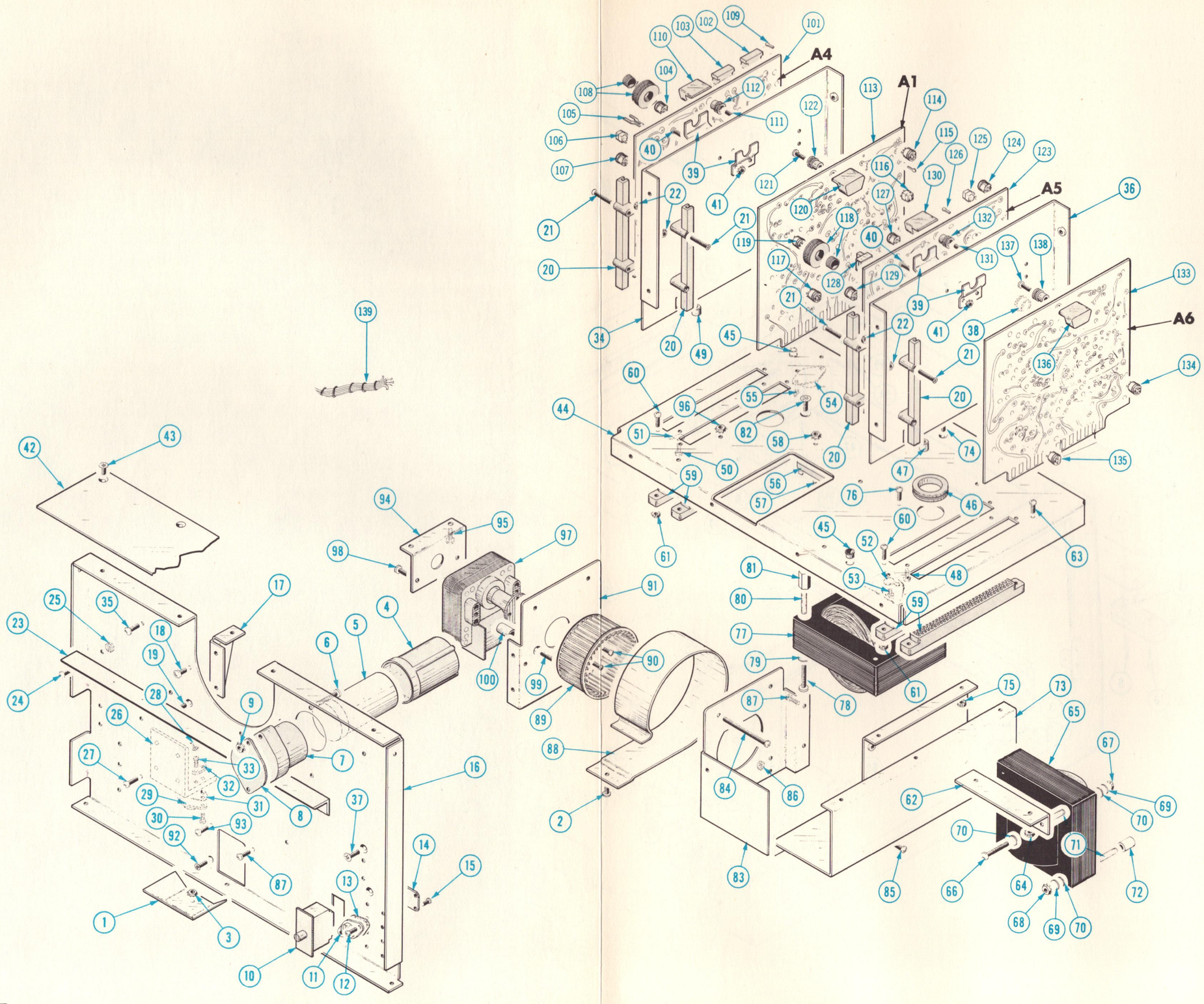


FIGURE 2 CHASSIS & CIRCUIT CARDS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
2-1	214-1434-00			1		DEFLECTOR, air
	- - - - - -			-		mounting hardware: (not included w/deflector)
-2	211-0507-00			1		SCREW, 6-32 x 0.312 inch, PHS
-3	210-0457-00			1		NUT, keps, 6-32 x 0.312 inch
-4	200-0293-00			1		COVER, capacitor
-5	- - - - - -			1		CAPACITOR
	- - - - - -			-		mounting hardware: (not included w/capacitor)
-6	211-0516-00			2		SCREW, 6-32 x 0.875 inch, PHS
-7	432-0048-00			1		BASE, capacitor mounting, plastic
-8	386-0254-00			1		PLATE, capacitor mounting, fiber, large
-9	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch
-10	260-1107-00			1		SWITCH, push, snap-in mounting--DPDT
-11	- - - - - -			2		TRANSISTOR
	- - - - - -			-		mounting hardware for each: (not included w/transistor)
-12	213-0104-00			2		SCREW, thread forming, 6-32 x 0.375 inch, PHS
-13	386-0143-00			1		PLATE, mica, insulating, small
-14	136-0270-00			2		SOCKET, transistor
	- - - - - -			-		mounting hardware for each: (not included w/socket)
-15	213-0088-00			2		SCREW, thread forming, 4-24 x 0.25 inch, PHS
-16	386-1857-00			1		SUPPORT, chassis, main
	- - - - - -			-		mounting hardware: (not included w/support)
	212-0040-00			4		SCREW, 8-32 x 0.375 inch, 100° csk, FHS (not shown)
	210-0458-00			4		NUT, keps, 8-32 x 0.344 inch (not shown)
-17	386-1850-00			2		SUPPORT, CRT, center (right & left)
	- - - - - -			-		mounting hardware for each: (not included w/support)
-18	212-0070-00			1		SCREW, 8-32 x 0.312 inch, 100° csk, FHS
-19	212-0004-00			1		SCREW, 8-32 x 0.312 inch, PHS
-20	351-0182-00			8		GUIDE, circuit card, single, plastic
	- - - - - -			-		mounting hardware for each: (not included w/guide)
-21	211-0109-00			2		SCREW, 4-40 x 0.875 inch, 100° csk, FHS
-22	210-0586-00			2		NUT, keps, 4-40 x 0.25 inch
-23	386-1921-00			1		STIFFENER, chassis, 0.75 x 14.73 inches long
	- - - - - -			-		mounting hardware: (not included w/stiffener)
-24	212-0023-00			4		SCREW, 8-32 x 0.375 inch, PHS
-25	210-0458-00			4		NUT, keps, 8-32 x 0.344 inch

FIGURE 2 CHASSIS & CIRCUIT CARDS (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
2-26	407-0405-00			1	BRACKET, angle
	- - - - - -			-	mounting hardware: (not included w/bracket)
-27	211-0511-00			4	SCREW, 6-32 x 0.50 inch, PHS
-28	210-0457-00			4	NUT, keps, 6-32 x 0.312 inch
-29	- - - - - -			1	TRANSISTOR
	- - - - - -			-	mounting hardware: (not included w/transistor)
-30	211-0513-00			2	SCREW, 6-32 x 0.625 inch, PHS
-31	386-0978-00			1	PLATE, mica, insulating
-32	136-0135-00			1	SOCKET, transistor
	- - - - - -			-	mounting hardware: (not included w/socket)
-33	213-0013-00			2	SCREW, thread forming, 2-56 x 0.312 inch, PHS
-34	386-1849-00			1	SUPPORT, circuit card, right & left
	- - - - - -			-	mounting hardware: (not included w/support)
-35	212-0004-00			4	SCREW, 8-32 x 0.312 inch, PHS
-36	386-1849-00			1	SUPPORT, circuit card, right & left
	- - - - - -			-	mounting hardware: (not included w/support)
-37	212-0070-00			1	SCREW, 8-32 x 0.312 inch, 100° csk, FHS
	212-0004-00			2	SCREW, 8-32 x 0.312 inch, PHS (not shown)
-38	348-0063-00			1	GROMMET, plastic, 0.50 inch diameter
-39	361-0235-00			4	RESTRAINT, circuit card
	- - - - - -			-	mounting hardware for each: (not included w/restraint)
-40	211-0012-00			1	SCREW, 4-40 x 0.375 inch, PHS
-41	210-0586-00			1	NUT, keps, 4-40 x 0.25 inch
-42	386-2197-00			1	STIFFENER, chassis
	- - - - - -			-	mounting hardware: (not included w/stiffener)
-43	212-0070-00			4	SCREW, 8-32 x 0.312 inch, 100° csk, FHS
-44	441-1066-00			1	CHASSIS, main
	- - - - - -			-	mounting hardware: (not included w/chassis)
	212-0004-00			4	SCREW, 8-32 x 0.312 inch, PHS (not shown)
-45	348-0055-00			2	GROMMET, plastic, 0.25 inch diameter
-46	348-0051-00			2	GROMMET, rubber, 0.75 inch diameter
-47	210-0592-00			3	NUT, spacer, 6-32 x 0.312 inch
	- - - - - -			-	mounting hardware for each: (not included w/nut)
-48	211-0511-00			1	SCREW, 6-32 x 0.50 inch, PHS

FIGURE 2 CHASSIS & CIRCUIT CARDS (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
2-49	210-0592-00			1	NUT, spacer, 6-32 x 0.312 inch
	- - - - - -			-	mounting hardware: (not included w/nut)
-50	211-0511-00			1	SCREW, 6-32 x 0.50 inch, PHS
-51	210-0202-00			1	LUG, solder, SE #6
-52	210-0201-00			3	LUG, solder, SE #4
	- - - - - -			-	mounting hardware: (not included w/lug)
-53	213-0044-00			2	SCREW, thread forming, 5-32 x 0.188 inch, PHS
-54	- - - - - -			1	THERMO CUTOUT
	- - - - - -			-	mounting hardware: (not included w/thermo cutout)
-55	213-0044-00			2	SCREW, thread forming, 5-32 x 0.188 inch, PHS
-56	352-0031-00			1	HOLDER, fuse, single
	- - - - - -			-	mounting hardware: (not included w/holder)
-57	211-0510-00			1	SCREW, 6-32 x 0.375 inch, PHS
-58	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-59	131-0292-01			4	CONNECTOR, receptacle, 56 pin
	- - - - - -			-	mounting hardware for each: (not included w/connector)
-60	211-0014-00			2	SCREW, 4-40 x 0.50 inch, PHS
-61	210-0586-00			2	NUT, keps, 4-40 x 0.25 inch
-62	407-1027-00			1	BRACKET, angle, transformer
	- - - - - -			-	mounting hardware: (not included w/bracket)
-63	212-0004-00			1	SCREW, 8-32 x 0.312 inch, PHS
	212-0070-00			1	SCREW, 8-32 x 0.312 inch, 100° csk, FHS (not shown)
-64	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch
-65	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
-66	212-0553-00			2	SCREW, 10-32 x 1.50 inches, PHS
	212-0074-00			2	SCREW, 8-32 x 2 inches, FHS (not shown)
-67	220-0410-00			2	NUT, keps, 10-32 x 0.375 inch
-68	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch
-69	210-0805-00			4	WASHER, flat, 0.204 ID x 0.438 inch OD
-70	210-0812-00			6	WASHER, fiber, shouldered, 0.188 ID x 0.375 inch OD
-71	166-0226-00			4	TUBE, insulating, 1.125 inches long
-72	166-0100-00			2	TUBE, spacer, 0.375 inch long
-73	378-0798-00			1	DUCT, air
	- - - - - -			-	mounting hardware: (not included w/duct)
-74	211-0538-00			2	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-75	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-76	211-0504-00			3	SCREW, 6-32 x 0.25 inch, PHS

FIGURE 2 CHASSIS & CIRCUIT CARD (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
2-77	- - - - - -			1	TRANSFORMER
	- - - - - -			-	mounting hardware: (not included w/transformer)
-78	212-0533-00			4	SCREW, 10-32 x 1.50 inches, PHS
-79	210-0812-00			4	WASHER, fiber, shouldered, 0.188 ID x 0.375 inch OD
-80	166-0226-00			4	TUBE, insulating, 1.125 inches long
-81	129-0287-00			4	POST, hex., 10-32 x 0.75 inch long
-82	212-0506-00			4	SCREW, 10-32 x 0.375 inch, 100° csk, FHS
-83	380-0272-00			1	HOUSING HALF, fan, right
	- - - - - -			-	mounting hardware: (not included w/housing half)
-84	211-0530-00			4	SCREW, 6-32 x 1.75 inches, PHS
-85	211-0504-00			1	SCREW, 6-32 x 0.25 inch, PHS
-86	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-87	211-0507-00			3	SCREW, 6-32 x 0.312 inch, PHS
-88	214-1468-00			1	SCROLL, fan
-89	369-0029-00			1	IMPELLER, fan, axial
	- - - - - -			-	mounting hardware: (not included w/impeller)
-90	213-0234-00			2	SCREW, 3-48 x 0.375 inch, PHS
-91	380-0224-00			1	HOUSING HALF, fan, left
	- - - - - -			-	mounting hardware: (not included w/housing)
-92	211-0538-00			1	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-93	211-0507-00			1	SCREW, 6-32 x 0.312 inch, PHS
-94	407-0834-00			1	BRACKET, component, fan motor
	- - - - - -			-	mounting hardware: (not included w/bracket)
-95	212-0023-00			2	SCREW, 8-32 x 0.375 inch, PHS
-96	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch
-97	147-0031-00			1	MOTOR, AC, 115 V
	147-0031-01			1	MOTOR, AC, 220 V, (4610-1 only)
	- - - - - -			-	mounting hardware: (not included w/motor)
-98	212-0507-00			2	SCREW, 10-32 x 0.375 inch, PHS
-99	212-0562-00			2	SCREW, 10-32 x 0.875 inch, 100° csk, FHS
-100	361-0347-00			2	SPACER, sleeve, 0.219 ID x 0.375 OD x 0.625 inch long
-101	- - - - - -[1]			1	CIRCUIT CARD ASSEMBLY--TIMING A4
	- - - - - -			-	circuit card assembly includes:
	388-2464-00			1	CIRCUIT CARD
-102	136-0269-00			12	SOCKET, integrated circuit, 14 pin
-103	136-0260-01			2	SOCKET, integrated circuit, 16 pin

[1] See Electrical Parts List for part number.

FIGURE 2 CHASSIS & CIRCUIT CARD (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
2-104	136-0183-00			3	SOCKET, transistor, 3 pin
-105	344-0154-00			2	CLIP, electrical, fuse
-106	136-0220-00			11	SOCKET, transistor, 3 pin, square
-107	136-0235-00			1	SOCKET, transistor, 6 pin
-108	214-0761-00			1	HEATSINK
-109	214-0579-00			4	PIN, test point
-110	367-0090-00			1	GRIP, circuit card
	- - - - - -			-	mounting hardware: (not included w/grip)
-111	213-0082-00			1	SCREW, thread cutting, 4-40 x 0.50 inch, PHS
-112	210-1062-00 [1]			1	WASHER, recessed, plastic, 0.125 ID x 0.50 inch OD
-113	- - - - - - [1]			1	CIRCUIT CARD ASSEMBLY--POWER SUPPLY & HV REG A1
	- - - - - -			-	circuit card assembly includes:
	388-2458-00			1	CIRCUIT CARD
-114	136-0235-00			3	SOCKET, transistor, 6 pin
-115	214-0579-00			4	PIN, test point
-116	136-0220-00			5	SOCKET, transistor, 3 pin square
-117	136-0237-00			1	SOCKET, transistor, 8 pin
-118	214-0761-00			1	HEATSINK, transistor
-119	136-0183-00			9	SOCKET, transistor, 3 pin
-120	367-0090-00			1	GRIP, circuit card
	- - - - - -			-	mounting hardware: (not included w/grip)
-121	213-0082-00			1	SCREW, thread cutting, 4-40 x 0.50 inch, PHS
-122	210-1062-00 [1]			1	WASHER, recessed, plastic, 0.125 ID x 0.50 inch OD
-123	- - - - - - [1]			1	CIRCUIT CARD ASSEMBLY--DEFL AMP & DYN FOCUS A5
	- - - - - -			-	circuit card assembly includes:
	388-2518-00			1	CIRCUIT CARD
-124	136-0237-00			1	SOCKET, transistor, 8 pin
-125	136-0220-00			7	SOCKET, transistor, 3 pin square
-126	214-0579-00			4	PIN, test point
-127	136-0235-00			1	SOCKET, transistor, 6 pin
-128	260-0723-00			1	SWITCH, slide
-129	136-0183-00			3	SOCKET, transistor, 3 pin
-130	367-0090-00			1	GRIP, circuit card
	- - - - - -			-	mounting hardware: (not included w/grip)
-131	213-0082-00			1	SCREW, thread cutting, 4-40 x 0.50 inch, PHS
-132	210-1062-00 [1]			1	WASHER, recessed, plastic, 0.125 ID x 0.50 inch OD
-133	- - - - - - [1]			1	CIRCUIT CARD ASSEMBLY--Z AXIS A6
	- - - - - -			-	circuit card assembly includes:
	388-2465-00			1	CIRCUIT CARD
-134	136-0235-00			1	SOCKET, transistor, 6 pin
-135	136-0183-00			3	SOCKET, transistor, 3 pin
-136	367-0090-00			1	GRIP, circuit card
	- - - - - -			-	mounting hardware: (not included w/grip)
-137	213-0082-00			1	SCREW, thread cutting, 4-40 x 0.50 inch, PHS
-138	210-1062-00			1	WASHER, recessed, plastic, 0.125 ID x 0.50 inch OD
-139	179-1814-00			1	WIRING HARNESS, chassis
	179-1561-00			1	WIRING HARNESS, 40 volt
	179-1756-00			1	WIRING HARNESS, AC
	- - - - - -			-	wiring harness includes:
	214-0768-00			6	CONTACT, electrical, female (not shown)

[1] See Electrical Parts List for part number.

FIGURE 3 CABINET & REAR

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
3-1	380-0221-00			1	HOUSING, wraparound
	- - - - - -			-	housing includes:
	214-0816-00			4	LATCH ASSEMBLY
	- - - - - -			-	each latch assembly includes:
-2	386-0226-00			1	PLATE, locking
-3	386-0227-00			1	PLATE, index, plastic
-4	214-0604-00			1	SPRING
-5	214-0603-01			1	PIN, securing
-6	390-0179-00			1	CABINET BOTTOM
	- - - - - -			-	cabinet bottom includes:
	214-0816-00			6	LATCH ASSEMBLY
	- - - - - -			-	each latch assembly includes:
-7	386-0226-00			1	PLATE, locking
-8	386-0227-00			1	PLATE, index, plastic
-9	214-0604-00			1	SPRING
-10	214-0603-01			1	PIN, securing
-11	378-0787-00			1	AIR DEFLECTOR
	- - - - - -			-	mounting hardware: (not included w/air deflector)
-12	211-0541-00			4	SCREW, 6-32 x 0.25 inch, 100° csk, FHS
-13	210-0457-00			4	NUT, keps, 6-32 x 0.312 inch
-14	407-1029-00			1	BRACKET, capacitor
	- - - - - -			-	mounting hardware: (not included w/bracket)
	212-0004-00			1	SCREW, 8-32 x 0.312 inch, PHS (not shown)
	212-0070-00			1	SCREW, 8-32 x 0.312 inch, 100° csk, FHS (not shown)
-15	- - - - - -			2	CAPACITOR
	- - - - - -			-	mounting hardware for each: (not included w/capacitor)
-16	211-0516-00			2	SCREW, 6-32 x 0.875 inch, PHS
-17	432-0048-00			1	BASE, capacitor mounting, large
-18	386-0254-00			1	RETAINER, capacitor, 2.188 x 1.531 inches
-19	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-20	200-0293-00			1	COVER, capacitor, 1.365 ID x 2.562 inches long
-21	- - - - - -			1	CAPACITOR
	- - - - - -			-	mounting hardware: (not included w/capacitor)
-22	211-0516-00			2	SCREW, 6-32 x 0.875 inch, PHS
-23	432-0047-00			1	BASE, capacitor mounting, small
-24	386-0252-00			1	RETAINER, capacitor, small
-25	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-26	200-0256-00			1	COVER, capacitor, 1 ID x 2.031 inches long
-27	- - - - - -			4	CAPACITOR
	- - - - - -			-	mounting hardware for each: (not included w/capacitor)
-28	211-0534-00			2	SCREW, sems, 6-32 x 0.312 inch, PHS
-29	386-0252-00			1	RETAINER, capacitor, small
-30	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch

FIGURE 3 CABINET & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
3-31	333-1350-12			1	PANEL, rear
	333-1350-14			1	PANEL, rear (4610-1 only)
	- - - - - -			-	mounting hardware: (not included w/panel)
-32	211-0565-00			8	SCREW, 6-32 x 0.25 inch, THS
-33	378-0647-00			1	FILTER, air, plastic foam, 3.125 inches square
-34	426-0666-02			1	FRAME-PANEL, cabinet, rear
	- - - - - -			-	mounting hardware: (not included w/frame-panel)
-35	212-0023-00			10	SCREW, 8-32 x 0.375 inch, PHS
-36	386-2130-00			1	SUBPANEL, rear
	- - - - - -			-	mounting hardware: (not included w/subpanel)
-37	212-0004-00			4	SCREW, 8-32 x 0.312 inch, PHS
-38	200-1177-00			1	COVER, line voltage selector
	200-1177-01			1	COVER, line voltage selector (4610-1 only)
	- - - - - -			-	cover includes:
-39	352-0102-00			2	HOLDER, fuse
	- - - - - -			-	mounting hardware for each: (not included w/holder)
-40	213-0088-00			2	SCREW, thread forming, 4-24 x 0.25 inch, PHS
-41	204-0454-00			1	BODY, line voltage selector
	- - - - - -			-	mounting hardware: (not included w/body)
-42	210-0407-00			2	NUT, hex., 6-32 x 0.25 inch
-43	210-0006-00			2	WASHER, lock, internal, 0.146 ID x 0.283 inch OD
-44	361-0100-00			2	SPACER, sleeve, 0.42 inch long
-45	131-0997-00			1	CONNECTOR, power male
	131-1080-00			1	CONNECTOR, power male (4610-1 only)
	- - - - - -			-	mounting hardware: (not included w/connector)
-46	211-0513-00			2	SCREW, 6-32 x 0.625 inch, PHS
-47	361-0170-00			2	SPACER, sleeve, 0.332 inch long
-48	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch
-49	200-0196-01			2	COVER, transistor
-50	- - - - - -			2	TRANSISTOR
	- - - - - -			-	mounting hardware for each: (not included w/transistor)
-51	211-0510-00			2	SCREW, 6-32 x 0.375 inch, PHS
-52	386-0978-00			1	INSULATOR, plate, mica
-53	136-0135-00			2	SOCKET, transistor
	- - - - - -			-	mounting hardware for each: (not included w/socket)
-54	213-0113-00			2	SCREW, thread forming, 2-32 x 0.312 inch, RHS
-55	386-2198-00			1	PLATE, connector mounting
	- - - - - -			-	mounting hardware: (not included w/plate)
-56	211-0504-00			4	SCREW, 6-32 x 0.25 inch, PHS

FIGURE 3 CABINET & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
3-57	131-0458-00			1	CONNECTOR, receptacle, 15 pin
	- - - - - -			-	mounting hardware: (not included w/connector)
	210-0201-00			1	LUG, solder, SE #4 (not shown)
-58	129-0260-00			2	POST, connecting
-59	210-0004-00			1	WASHER, lock, internal, 0.12 ID x 0.26 inch OD
-60	210-0406-00			2	NUT, hex., 4-40 x 0.188 inch
-61	337-1561-00			1	SHIELD, electrical, rear
	- - - - - -			-	mounting hardware: (not included w/shield)
-62	212-0004-00			4	SCREW, 8-32 x 0.312 inch, PHS
-63	337-1560-00			1	SHIELD, electrical, front
	- - - - - -			-	mounting hardware: (not included w/shield)
-64	211-0504-00			3	SCREW, 6-32 x 0.25 inch, PHS
-65	337-1349-00			1	SHIELD, electrical
	- - - - - -			-	mounting hardware: (not included w/shield)
-66	211-0101-00			2	SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-67	407-1028-00			1	BRACKET, component mounting
	- - - - - -			-	mounting hardware: (not included w/bracket)
-68	211-0504-00			2	SCREW, 6-32 x 0.25 inch, PHS
-69	- - - - - -			1	RESISTOR, variable
	- - - - - -			-	mounting hardware: (not included w/resistor)
-70	210-0413-00			1	NUT, hex., 0.375-32 x 0.50 inch
-71	210-0840-00			1	WASHER, flat, 0.39 ID x 0.562 inch OD
-72	210-0012-00			1	WASHER, lock, internal, 0.375 ID x 0.50 inch OD
-73	200-0745-00			1	COVER, plastic, variable resistor
-74	407-0836-00			1	BRACKET, component mounting
	- - - - - -			-	mounting hardware: (not included w/bracket)
-75	211-0008-00			2	SCREW, 4-40 x 0.25 inch, PHS
-76	210-0586-00			2	NUT, keps, 4-40 x 0.25 inch
	124-0118-00			1	STRIP, ceramic, 1 notch (not shown)
	- - - - - -			-	strip includes:
	355-0046-00			1	STUD, plastic
	358-0214-00			1	BUSHING, insulator (not shown)
-77	- - - - - -			1	TRANSISTOR
	- - - - - -			-	mounting hardware: (not included w/transistor)
-78	211-0510-00			2	SCREW, 6-32 x 0.375 inch, PHS
-79	386-0978-00			1	INSULATOR, plate, mica

FIGURE 3 CABINET & REAR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
3-80	136-0135-00			1	SOCKET, transistor
	- - - - - -			-	mounting hardware: (not included w/socket)
-81	213-0013-00			2	SCREW, thread forming, 2-32 x 0.312 inch, RHS
-82	129-0006-00			1	POST, connecting, insulating
	- - - - - -			-	mounting hardware: (not included w/post)
-83	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-84	210-0202-00			1	LUG, solder, SE #6
	- - - - - -			-	mounting hardware: (not included w/lug)
-85	211-0504-00			1	SCREW, 6-32 x 0.25 inch, PHS
-86	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-87	343-0005-00			1	CLAMP, cable, plastic, 0.438 inch diameter
	- - - - - -			-	mounting hardware: (not included w/clamp)
-88	211-0578-00			1	SCREW, 6-32 x 0.438 inch, PHS
-89	210-0863-00			1	WASHER, D-shape, 0.191 ID x 0.515 inch OD
-90	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-91	- - - - - -[1]			1	CIRCUIT BOARD ASSEMBLY--HV 2 A3
	- - - - - -			-	circuit board assembly includes:
	388-1727-01			1	CIRCUIT BOARD
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-92	211-0040-00			4	SCREW, plastic, 4-40 x 0.25 inch, BHS
-93	129-0143-00			4	POST, plastic, 4-40 x 0.406 inch long
-94	211-0008-00			4	SCREW, 4-40 x 0.25 inch, PHS
-95	346-0091-00			1	STRAP, mounting, transformer
	- - - - - -			-	mounting hardware: (not included w/strap)
-96	211-0025-00			2	SCREW, 4-40 x 0.375 inch, 100° csk, FHS
-97	220-0634-00			2	NUT, rectangular, 4-40 x 0.25 inch
-98	- - - - - -[1]			1	CIRCUIT BOARD ASSEMBLY--HV 1 A2
	- - - - - -			-	circuit board assembly includes:
	388-2584-00			1	CIRCUIT BOARD
	- - - - - -			-	mounting hardware: (not included w/circuit board assembly)
-99	211-0040-00			5	SCREW, plastic, 4-40 x 0.25 inch, BHS
-100	129-0143-00			5	POST, plastic, 4-40 x 0.406 inch long
-101	211-0008-00			5	SCREW, 4-40 x 0.25 inch, PHS
	136-0484-00			1	SOCKET ASSEMBLY, CRT
	- - - - - -			-	socket assembly includes:
-102	200-0801-00			1	COVER
-103	136-0278-00			1	SOCKET, CRT
-104	131-0383-00			1	CONNECTOR, anode insulator

[1]See Electrical Parts List for part number.

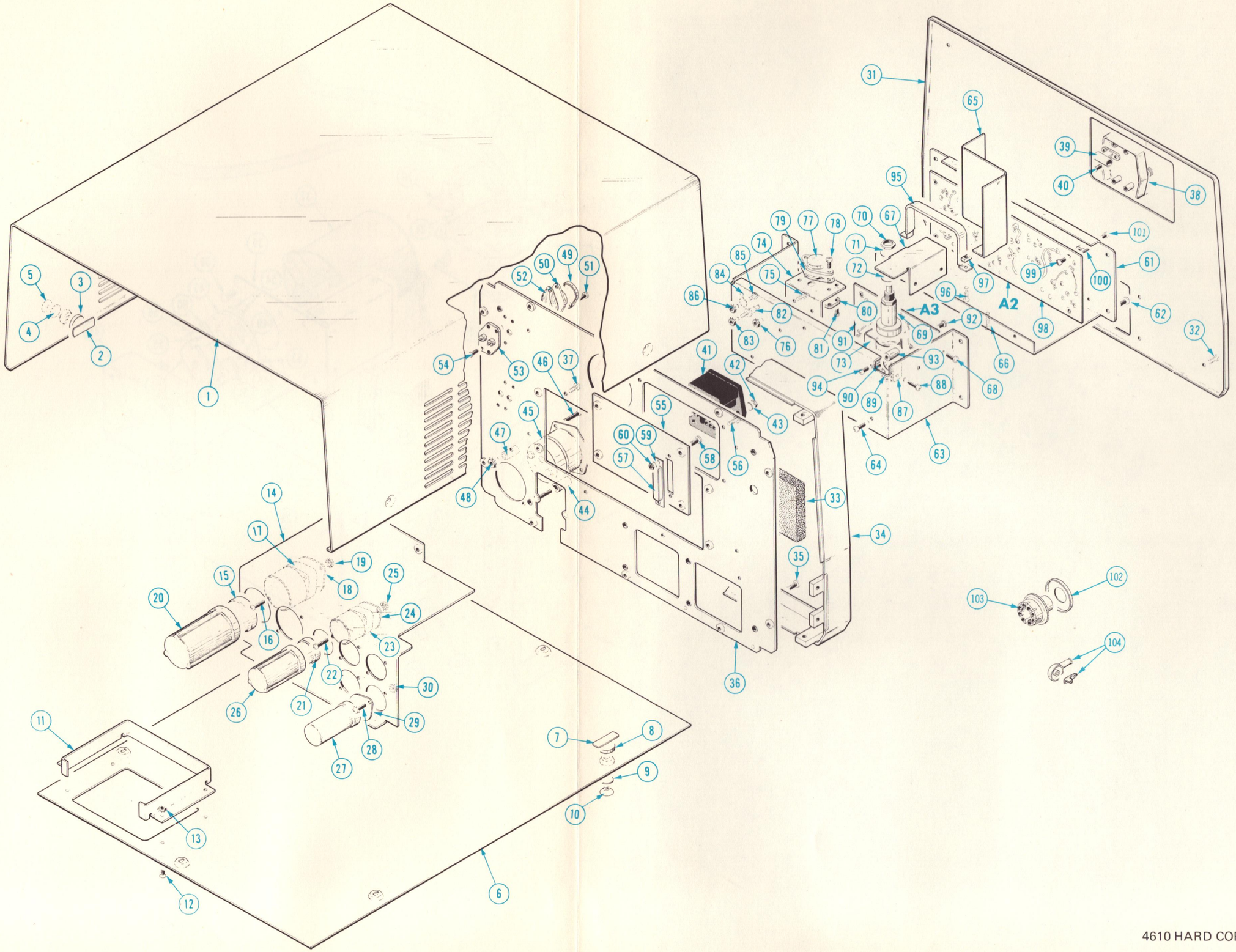


FIG. 3 CABINET & REAR

FIG. 4 PROCESSOR ASSEMBLY

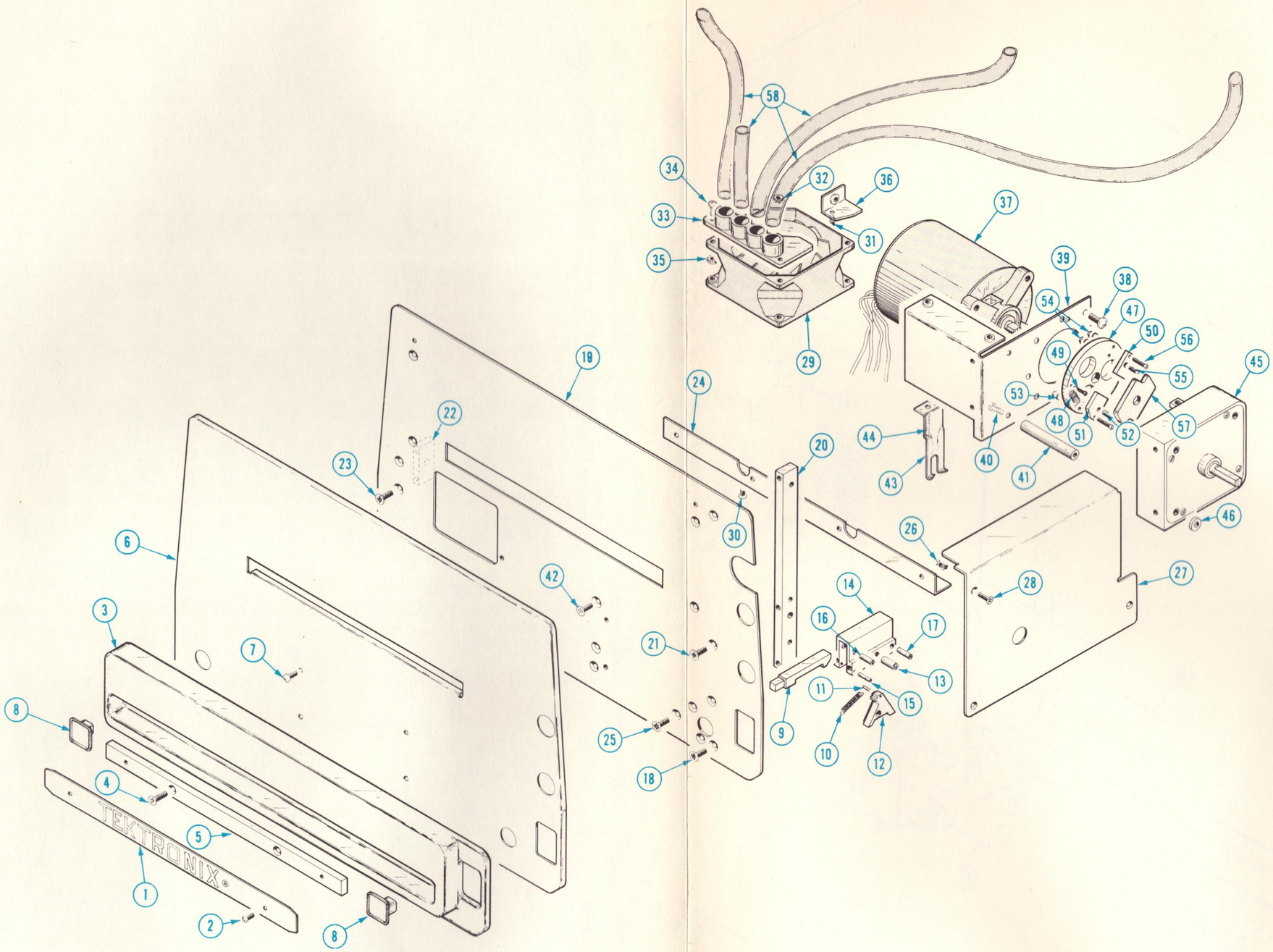


FIGURE 4 PROCESSOR

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
4-	640-0498-00			1	PROCESSOR ASSEMBLY
	- - - - - -			-	processor assembly includes:
-1	334-1654-01			1	PLATE, identification
	334-1654-02			1	PLATE, identification (4610-1 only)
	- - - - - -			-	mounting hardware: (not included w/plate)
-2	211-0007-00			2	SCREW, 4-40 x 0.188 inch, PHS
-3	333-1348-01			1	PANEL, front (lower)
	- - - - - -			-	mounting hardware: (not included w/panel)
-4	211-0552-00			2	SCREW, 6-32 x 0.625 inch, 100° csk, FHS
-5	343-0306-00			1	RETAINER
-6	333-1350-15			1	PANEL, front
	- - - - - -			-	mounting hardware: (not included w/panel)
-7	211-0504-00			2	SCREW, 6-32 x 0.25 inch, PHS
	210-0458-00			2	NUT, keps, 8-32 x 0.344 inch (not shown)
-8	367-0136-00			2	HANDLE
	- - - - - -			-	mounting hardware for each: (not included w/handle)
	213-0004-00			2	SETSCREW, 6-32 x 0.188 inch, HSS (not shown)
	105-0263-00			2	LATCH ASSEMBLY, plug-in unit
	- - - - - -			-	each latch assembly includes:
-9	105-0197-00			1	RELEASE BAR, latch
-10	214-1495-00			1	SPRING, helical compression, 0.65 inch long
-11	214-1691-00			1	PIN, roll, 0.062 inch diameter x 0.187 inch long
-12	105-0196-00			1	CATCH, plug-in
	- - - - - -			-	mounting hardware: (not included w/catch)
-13	214-1471-00			1	PIN, spring, roll, 0.187 OD x 0.625 inch long
-14	380-0215-00			1	HOUSING, plug-in latch
-15	214-0630-00			1	PIN, roll, 0.062 inch diameter x 0.625 inch long
-16	214-1473-00			1	PIN, spring, roll, 0.156 OD x 0.50 inch long
-17	214-1470-00			1	PIN, spring, roll, 0.125 OD x 0.625 inch long
	- - - - - -			-	mounting hardware for each: (not included w/latch assembly)
-18	211-0538-00			2	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-19	386-2156-00			1	SUBPANEL, front
	- - - - - -			-	mounting hardware: (not included w/subpanel)
	212-0040-00			6	SCREW, 8-32 x 0.375 inch, 100° csk, FHS (not shown)
	210-0458-00			6	NUT, keps, 8-32 x 0.344 inch (not shown)
-20	386-1852-00			1	SUPPORT, slide, right front
	- - - - - -			-	mounting hardware: (not included w/support)
-21	212-0040-00			3	SCREW, 8-32 x 0.375 inch, 100° csk, FHS
-22	386-1847-00			1	SUPPORT, slide, left front
	- - - - - -			-	mounting hardware: (not included w/support)
-23	212-0040-00			2	SCREW, 8-32 x 0.375 inch, 100° csk, FHS

FIGURE 4 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
4-24	407-0819-00			1		BRACKET, angle, cabinet bottom
	- - - - - -			-		mounting hardware: (not included w/bracket)
-25	212-0040-00			3		SCREW, 8-32 x 0.375 inch, 100° csk, FHS
-26	210-0458-00			3		NUT, keps, 8-32 x 0.344 inch
-27	200-1141-00			1		COVER, drive pulley
	- - - - - -			-		mounting hardware: (not included w/cover)
-28	211-0538-00			3		SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-29	119-0215-01			1		FAN, axial
	119-0215-03			1		FAN, axial (4610-1 only)
	- - - - - -			-		mounting hardware: (not included w/fan)
-30	211-0538-00			1		SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-31	211-0507-00			1		SCREW, 6-32 x 0.312 inch, PHS
-32	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch
-33	352-0252-00			1		HOLDER, vapor hose
	- - - - - -			-		mounting hardware: (not included w/holder)
-34	211-0510-00			2		SCREW, 6-32 x 0.375 inch, PHS
-35	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch
-36	407-0816-00			1		BRACKET, component, fan
	- - - - - -			-		mounting hardware: (not included w/bracket)
	211-0538-00			1		SCREW, 6-32 x 0.375 inch, 100° csk, FHS (not shown)
-37	147-0032-00			1		MOTOR, AC
	147-0032-01			1		MOTOR, AC (4610-1 only)
	- - - - - -			-		mounting hardware: (not included w/motor)
-38	211-0507-00			4		SCREW, 6-32 x 0.312 inch, PHS
-39	407-0818-01			1		BRACKET, component, motor to gear assembly
	- - - - - -			-		mounting hardware: (not included w/bracket)
-40	211-0507-00			4		SCREW, 6-32 x 0.312 inch, PHS
-41	129-0283-01			4		POST, metallic, 0.312 OD x 1.80 inches long
-42	212-0070-00			2		SCREW, 8-32 x 0.375 inch, 100° csk, FHS
-43	407-0270-00			2		BRACKET, capacitor
	- - - - - -			-		mounting hardware for each: (not included w/bracket)
-44	212-0023-00			1		SCREW, 8-32 x 0.375 inch, PHS
-45	401-0103-00			1		GEAR ASSEMBLY
	- - - - - -			-		mounting hardware: (not included w/gear assembly)
-46	361-0110-00			4		TUBE, spacer, 0.18 ID x 0.25 OD x 0.188 inch long
	211-0619-00			1		SCREW, 6-32 x 1.50 inches, 100° csk, FHS (not shown)
	211-0553-00			3		SCREW, 6-32 x 1.50 inches, PHS (not shown)
	105-0253-00			1		CLUTCH ASSEMBLY
	- - - - - -			-		clutch assembly includes:
-47	214-1566-00			1		DISC, clutch
	- - - - - -			-		mounting hardware: (not included w/disc)
	213-0020-00			1		SETSCREW, 6-32 x 0.125 inch, HSS (not shown)

FIGURE 4 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
4-48	214-1563-00			1		SPRING, helical
-49	210-0680-00			1		RIVET, w/spring shank
-50	214-1567-00			1		WEIGHT, counter balance
-51	214-1567-01			1		WEIGHT, counter balance
	- - - - - -			-		weight includes:
-52	214-1456-00			1		PIN, spring
-53	210-0001-00			3		WASHER, lock, internal, 0.092 ID x 0.18 inch OD
-54	210-0405-00			3		NUT, hex., 2-56 x 0.188 inch
-55	211-0115-00			1		SCREW, 2-56 x 0.50 inch, OHS
-56	211-0034-00			2		SCREW, 2-56 x 0.50 inch, RHS
	361-0407-00			2		SPACER, sleeve (not shown)
-57	391-0092-00			1		BLOCK, clutch disengage
	- - - - - -			-		block includes:
	213-0020-00			1		SETSCREW, 6-32 x 0.125 inch, HSS (not shown)
-58	166-0525-00			ft		PLASTIC TUBING, 32 inches

FIGURE 5 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
5-	640-0498-00			1		PROCESSOR ASSEMBLY (cont)
	- - - - - -			-		processor assembly includes:
-1	200-1140-00			1		COVER, heat control
	- - - - - -			-		mounting hardware: (not included w/cover)
-2	211-0504-00			3		SCREW, 6-32 x 0.25 inch, PHS
-3	214-1589-00			2		ARM, heater tension
-4	214-1574-00			2		SPRING, helical, torsion
	- - - - - -			-		mounting hardware for each: (not included w/spring)
-5	354-0184-00			1		RING, retaining, 0.25 inch ID
-6	214-1574-00			1		SPRING, helical, torsion
	- - - - - -			-		mounting hardware: (not included w/spring)
-7	354-0184-00			1		RING, retaining, 0.25 inch ID
-8	213-0183-00			1		SCREW, thread forming, 6-32 x 0.50 inch, PHS
-9	166-0032-00			1		SPACER, 0.312 inch long
-10	214-1574-00			1		SPRING, helical, torsion
	- - - - - -			-		mounting hardware: (not included w/spring)
-11	354-0184-00			1		RING, retaining, 0.25 inch ID
-12	213-0183-00			1		SCREW, thread forming, 6-32 x 0.50 inch, PHS
-13	131-1130-00			1		CONTACT, electrical
-14	166-0032-00			1		SPACER, 0.312 inch long
-15	426-0671-01			1		FRAME SECTION, left
	- - - - - -			-		mounting hardware: (not included w/frame section)
-16	212-0040-00			1		SCREW, 8-32 x 0.375 inch, 100° csk, FHS
	212-0023-00			1		SCREW, 8-32 x 0.375 inch, PHS (not shown)
-17	386-2002-00			1		SUPPORT, paper exit guide
-18	214-1429-00			1		SPRING, flat, paper stripper
	- - - - - -			-		mounting hardware: (not included w/spring)
-19	213-0088-00			2		SCREW, thread forming, 4-40 x 0.25 inch, PHS
-20	214-1439-00			2		PIN, hinge
	- - - - - -			-		mounting hardware for each: (not included w/pin)
-21	354-0393-00			2		RING, retaining, 0.15 inch ID
-22	334-0002-00			2		CLIP, electrical
	- - - - - -			-		mounting hardware for each: (not included w/clip)
-23	211-0007-00			1		SCREW, 4-40 x 0.188 inch, PHS
-24	210-0586-00			1		NUT, keps, 4-40 x 0.25 inch
-25	351-0265-01			1		GUIDE, vapor, upper
	- - - - - -			-		mounting hardware: (not included w/guide)
-26	211-0504-00			2		SCREW, 6-32 x 0.25 inch, PHS

FIGURE 5 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
5-27	352-0254-00			1		HOLDER, vent hose
	- - - - - -			-		mounting hardware: (not included w/holder)
-28	212-0070-00			1		SCREW, 8-32 x 0.312 inch, 100° csk, FHS
-29	352-0254-00			1		HOLDER, vent hose
	- - - - - -			-		mounting hardware: (not included w/holder)
-30	212-0070-00			1		SCREW, 8-32 x 0.312 inch, 100° csk, FHS
-31	105-0203-00			1		DRUM, paper drive
	- - - - - -			-		mounting hardware: (not included w/drum)
-32	342-0075-00			2		INSULATOR, washer, 0.62 ID x 3.455 inches OD
-33	213-0082-00			4		SCREW, thread forming, 4-40 x 0.50 inch, PHS
-34	358-0418-00			1		BUSHING, sleeve
-35	384-1036-00			1		SHAFT, extension
-36	401-0096-00			2		BEARING
-37	214-0224-00			1		SPRING, helical compression, 1.10 inches long
-38	210-1119-00			1		WASHER, plastic, 0.325 ID x 0.68 inch OD
-39	354-0402-00			1		RING, retaining
-40	351-0264-00			1		GUIDE, vapor, lower
	- - - - - -			-		mounting hardware: (not included w/guide)
-41	212-0001-00			2		SCREW, 8-32 x 0.25 inch, PHS
-42	352-0010-00			1		HOLDER, fuse, w/hardware
-43	200-0582-00			1		CAP, fuse
-44	401-0085-00			2		BEARING, sleeve
	- - - - - -			-		mounting hardware for each: (not included w/bearing)
-45	354-0397-00			1		RING, retaining
-46	426-0670-01			1		FRAME SECTION, right
	- - - - - -			-		frame section includes:
-47	210-0623-00			2		RIVET
-48	105-0257-00			1		CATCH, cabinet top
	- - - - - -			-		mounting hardware: (not included w/frame section)
-49	212-0040-00			1		SCREW, 8-32 x 0.375 inch, 100° csk, FHS
-50	212-0023-00			1		SCREW, 8-32 x 0.375 inch, PHS
-51	129-0006-00			2		POST, connecting
	- - - - - -			-		mounting hardware for each: (not included w/post)
-52	210-0457-00			1		NUT, keps, 6-32 x 0.312 inch
-53	210-0201-00			1		LUG, solder, SE #4
	- - - - - -			-		mounting hardware: (not included w/lug)
-54	213-0088-00			1		SCREW, thread forming, 4-40 x 0.25 inch, PHS
-55	343-0289-00			1		HOLD-DOWN, pully, plastic
	- - - - - -			-		mounting hardware: (not included w/hold-down)
-56	211-0012-00			1		SCREW, 4-40 x 0.375 inch, PHS

FIGURE 5 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
5-57	401-0094-02			1		SPROCKET WHEEL, 32 tooth (medium)
	- - - - - -			-		mounting hardware: (not included w/sprocket wheel)
	213-0006-00			1		SETSCREW, 8-32 x 0.188 inch, HSS (not shown)
-58	401-0087-00			2		ROLLER, belt tension
	- - - - - -			-		mounting hardware for each: (not included w/roller)
-59	211-0038-00			1		SCREW, 4-40 x 0.312 inch, 100° csk, FHS
-60	384-0781-00			1		SHAFT, belt tension
-61	407-0940-00			1		BRACKET, angle
	- - - - - -			-		mounting hardware: (not included w/bracket)
-62	211-0507-00			1		SCREW, 6-32 x 0.312 inch, PHS
-63	210-0005-00			1		WASHER, lock, external, #6
-64	407-0940-00			1		BRACKET, angle
	- - - - - -			-		mounting hardware: (not included w/bracket)
-65	212-0001-00			1		SCREW, 8-32 x 0.25 inch, PHS
-66	210-0804-00			1		WASHER, flat, 0.17 ID x 0.375 inch OD
-67	352-0253-01			2		HOLDER, belt tension roller
	- - - - - -			-		mounting hardware for each: (not included w/holder)
-68	211-0504-00			1		SCREW, 6-32 x 0.25 inch, PHS
-69	210-0803-00			1		WASHER, flat, 0.15 ID x 0.375 inch OD
-70	119-0254-00			1		SOLENOID, w/hardware
-71	407-0815-00			1		BRACKET, component, solenoid
	- - - - - -			-		mounting hardware: (not included w/bracket)
-72	211-0008-00			2		SCREW, 4-40 x 0.25 inch, PHS
-73	214-1495-00			1		SPRING, helical compression, 0.75 inch long
-74	105-0200-00			1		RELEASE, coupler half
-75	214-1475-00			1		SPRING, helical, 0.65 inch long
-76	214-1499-00			1		RING, retaining
-77	343-0295-00			1		RETAINER, spring rocker
-78	376-0111-00			1		COUPLER HALF, rocker
	- - - - - -			-		mounting hardware: (not included w/coupler half)
-79	214-0564-00			1		PIN, roll, 0.125 diameter x 0.25 inch long
-80	376-0112-00			1		COUPLER HALF, toothed
	- - - - - -			-		mounting hardware: (not included w/coupler half)
-81	211-0038-00			3		SCREW, 4-40 x 0.312 inch, 100° csk, FHS
-82	401-0088-00			1		FLANGE
-83	401-0092-01			1		SPROCKET WHEEL, 14 tooth
-84	401-0088-00			1		FLANGE
	- - - - - -			-		mounting hardware: (not included w/flange)
-85	211-0101-00			3		SCREW, 4-40 x 0.25 inch, 100° csk, FHS

FIGURE 5 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
5-86	407-0823-00			1		BRACKET, cancelling roller
	- - - - - -			-		mounting hardware: (not included w/bracket)
-87	212-0081-00			2		SCREW, 8-32 x 1.0 inch, 100° csk, FHS
-88	129-0252-00			2		SPACER, hex., 0.471 inch long
-89	220-0621-00			2		NUT, spacer adjust
-90	214-1443-00			1		ACTUATOR-ROLLER
	- - - - - -			-		mounting hardware: (not included w/actuator-roller)
-91	212-0564-00			1		SCREW, 10-32 x 0.25 inch, Cap H soc
-92	401-0090-00			1		BEARING, sleeve
-93	214-1481-00			1		BELT, positive drive
-94	401-0097-01			1		SPROCKET WHEEL, 11 tooth
	- - - - - -			-		mounting hardware: (not included w/sprocket wheel)
	213-0006-00			1		SETSCREW, 8-32 x 0.188 inch, HSS (not shown)
-95	214-1457-00			1		BELT, positive drive
-96	401-0093-01			1		SPROCKET WHEEL, 38 tooth (large)
	- - - - - -			-		mounting hardware: (not included w/sprocket wheel)
	213-0006-00			1		SETSCREW, 8-32 x 0.188 inch, HSS (not shown)
-97	401-0097-02			1		SPROCKET WHEEL, 11 tooth (small)
	- - - - - -			-		mounting hardware: (not included w/sprocket wheel)
	213-0006-00			1		SETSCREW, 8-32 x 0.188 inch, HSS (not shown)
-98	214-1590-00			4		SPRING, flat, paper guide
	- - - - - -			-		mounting hardware for each: (not included w/spring)
-99	213-0088-00			1		SCREW, thread forming, 4-40 x 0.25 inch, PHS
-100	342-0046-00			1		INSULATOR, heater
-101	119-0241-00			1		HEATER, paper
	119-0241-02			1		HEATER, paper (4610-1 only)
	- - - - - -			-		mounting hardware: (not included w/heater)
-102	384-0787-00			2		ROD, insulator
-103	210-0819-00			4		WASHER, fiber, 0.25 ID x 0.50 inch OD
-104	343-0294-00			3		RETAINER, heater blanket
-105	384-0785-00			1		ROD, temperature sensitive
	- - - - - -			-		mounting hardware: (not included w/rod)
-106	210-0801-00			1		WASHER, flat, 0.14 ID x 0.281 inch OD
-107	214-1512-00			1		SPRING, flat
-108	211-0504-00			1		SCREW, 6-32 x 0.25 inch, PHS
-109	211-0510-00			1		SCREW, 6-32 x 0.375 inch, PHS
-110	210-0407-00			1		NUT, hex., 6-32 x 0.25 inch
-111	214-1449-00			1		ACTUATOR, switch
	- - - - - -			-		mounting hardware: (not included w/actuator)
-112	214-1428-00			1		PIN, hinge
-113	354-0392-00			2		RING, retaining

FIGURE 5 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
5-114	407-0817-00			1		BRACKET, component, temperature control
	- - - - - -			-		mounting hardware: (not included w/bracket)
-115	211-0544-00			2		SCREW, 6-32 x 0.75 inch, PHS
-116	210-0803-00			1		WASHER, flat, 0.15 ID x 0.375 inch OD
-117	210-0813-00			2		WASHER, fiber, shouldered, #10
-118	342-0048-00			1		INSULATOR, block
-119	260-1180-00			1		SWITCH, sensitive
	- - - - - -			-		mounting hardware: (not included w/switch)
-120	211-0516-00			2		SCREW, 6-32 x 0.875 inch, PHS
-121	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch
-122	260-1181-00			1		SWITCH, sensitive
	- - - - - -			-		mounting hardware: (not included w/switch)
-123	211-0516-00			2		SCREW, 6-32 x 0.875 inch, PHS
-124	210-0457-00			2		NUT, keps, 6-32 x 0.312 inch
-125	390-0171-01			1		CABINET TOP
	- - - - - -			-		cabinet top includes:
-126	351-0269-01			1		GUIDE, paper
-127	210-0623-00			2		RIVET
-128	351-0268-04			1		GUIDE, paper
	- - - - - -			-		mounting hardware: (not included w/guide)
-129	211-0007-00			2		SCREW, 4-40 x 0.188 inch, PHS
-130	214-1454-00			1		SPRING, paper guide
	- - - - - -			-		mounting hardware: (not included w/spring)
-131	342-0106-00			1		INSULATOR, plate, plastic
-132	407-0829-00			1		BRACKET, stiffening
-133	211-0504-00			3		SCREW, 6-32 x 0.25 inch, PHS
-134	214-1442-02			2		BLADE, paper cutter
-135	214-1448-00			3		SPRING, flat, paper cutter
	- - - - - -			-		mounting hardware for each: (not included w/spring)
-136	211-0025-00			1		SCREW, 4-40 x 0.375 inch, 100° csk, FHS
-137	361-0345-00			1		SPACER, sleeve
-138	214-1742-01			1		ROLLER, paper, lower
-139	351-0337-00			4		GUIDE, paper (lower roller)
-140	401-0095-01			2		BEARING BLOCK, guide roller
	- - - - - -			-		mounting hardware for each: (not included w/bearing
	- - - - - -			-		block)
-141	211-0062-00			1		SCREW, 2-56 x 0.312 inch, PHS
-142	384-0786-00			2		SHAFT, pinch roller
	- - - - - -			-		mounting hardware for each: (not included w/shaft)
-143	354-0165-00			1		RING, retaining

FIGURE 5 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
5-144	214-1441-01			1		BLADE, paper cutter, upper
	- - - - - -			-		mounting hardware: (not included w/blade)
-145	211-0565-00			2		SCREW, 6-32 x 0.25 inch, THS
-146	214-1451-00			1		ROLLER, paper drive, upper
-147	251-0346-00			8		GUIDE, paper (upper roller)
-148	342-0040-01			2		INSULATOR, plate
-149	358-0419-00			2		BUSHING, sleeve
-150	354-0184-00			1		RING, retaining
-151	426-0669-03			1		FRAME SECTION, roller cutting
-152	384-1026-00			2		SHAFT, extension, lower pinch roller
	- - - - - -			-		mounting hardware for each: (not included w/shaft)
-153	210-0561-00			1		NUT, hex., 6-32 x 0.188 inch
-154	210-0853-00			1		WASHER, flat, 0.266 ID x 0.50 inch OD
-155	214-0564-00			1		PIN, roll
-156	214-1424-00			2		ACTUATOR, pinch rollers
-157	384-0783-01			2		ROD, cutter blade
	- - - - - -			-		mounting hardware for each: (not included w/rod)
-158	214-1479-00			1		PIN, dowel
-159	354-0392-00			2		RING, retaining
-160	214-1453-00			2		ROLLER, spacing
-161	384-0782-00			2		ROD, connector, paper cutter
	- - - - - -			-		mounting hardware for each: (not included w/rod)
-162	401-0089-01			1		BEARING
-163	214-1480-00			1		PIN, dowel
-164	343-0288-01			1		RETAINER
-165	213-0088-00			1		SCREW, thread forming, 4-24 x 0.25 inch, PHS
-166	214-1423-00			1		ACTUATOR, switch
	- - - - - -			-		mounting hardware: (not included w/actuator)
	213-0004-00			1		SETSCREW, 6-32 x 0.188 inch, HSS (not shown)
-167	384-0780-00			1		SHAFT
	- - - - - -			-		mounting hardware: (not included w/shaft)
-168	354-0299-00			2		RING, retaining
-169	214-1711-00			1		SPRING, paper guide
	- - - - - -			-		spring includes:
-170	348-0023-00			2		FOOT, plastic
-171	210-0802-00			2		WASHER, flat, 0.17 ID x 0.312 inch OD
	- - - - - -			-		mounting hardware: (not included w/spring)
-172	211-0007-00			2		SCREW, 4-40 x 0.188 inch, PHS

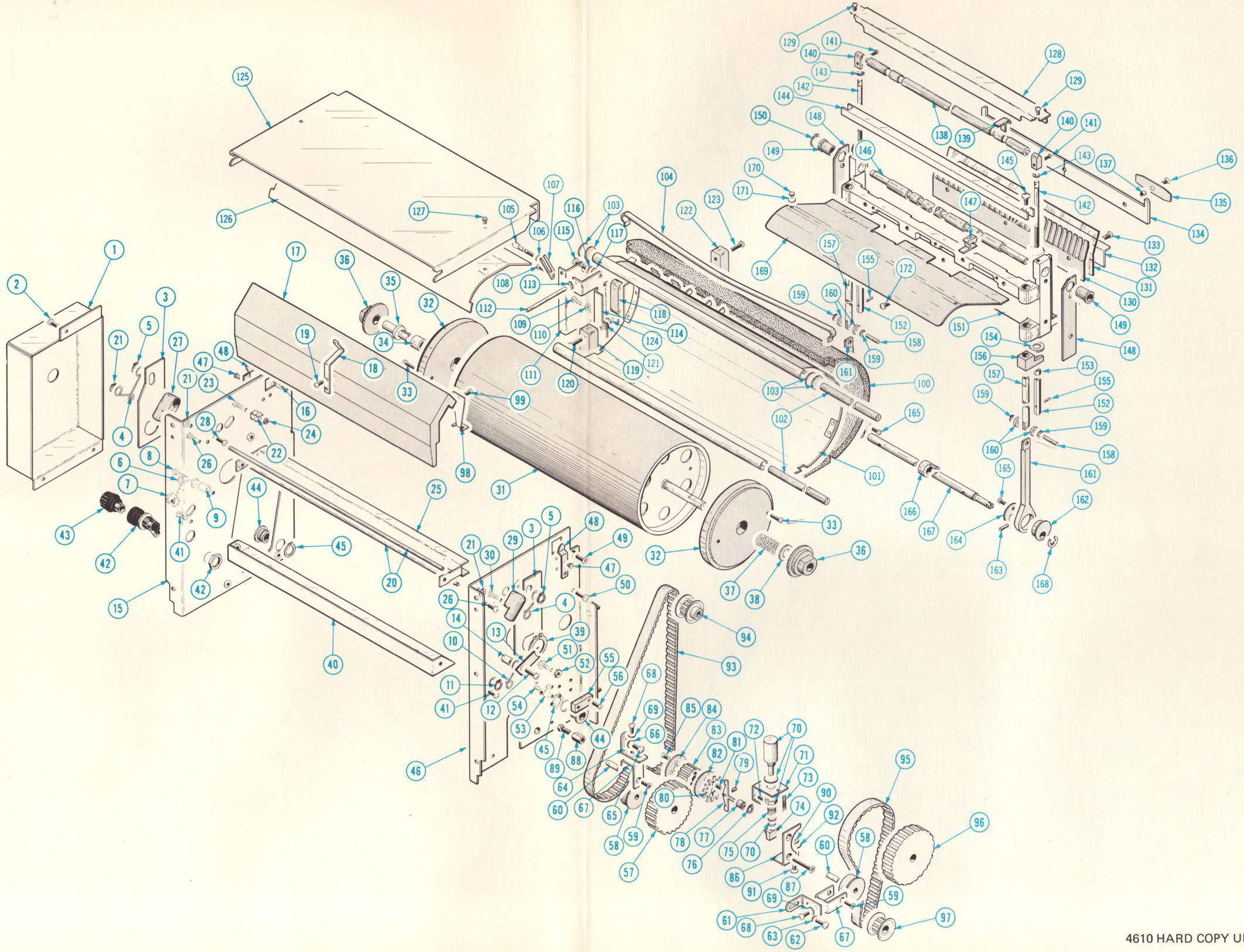
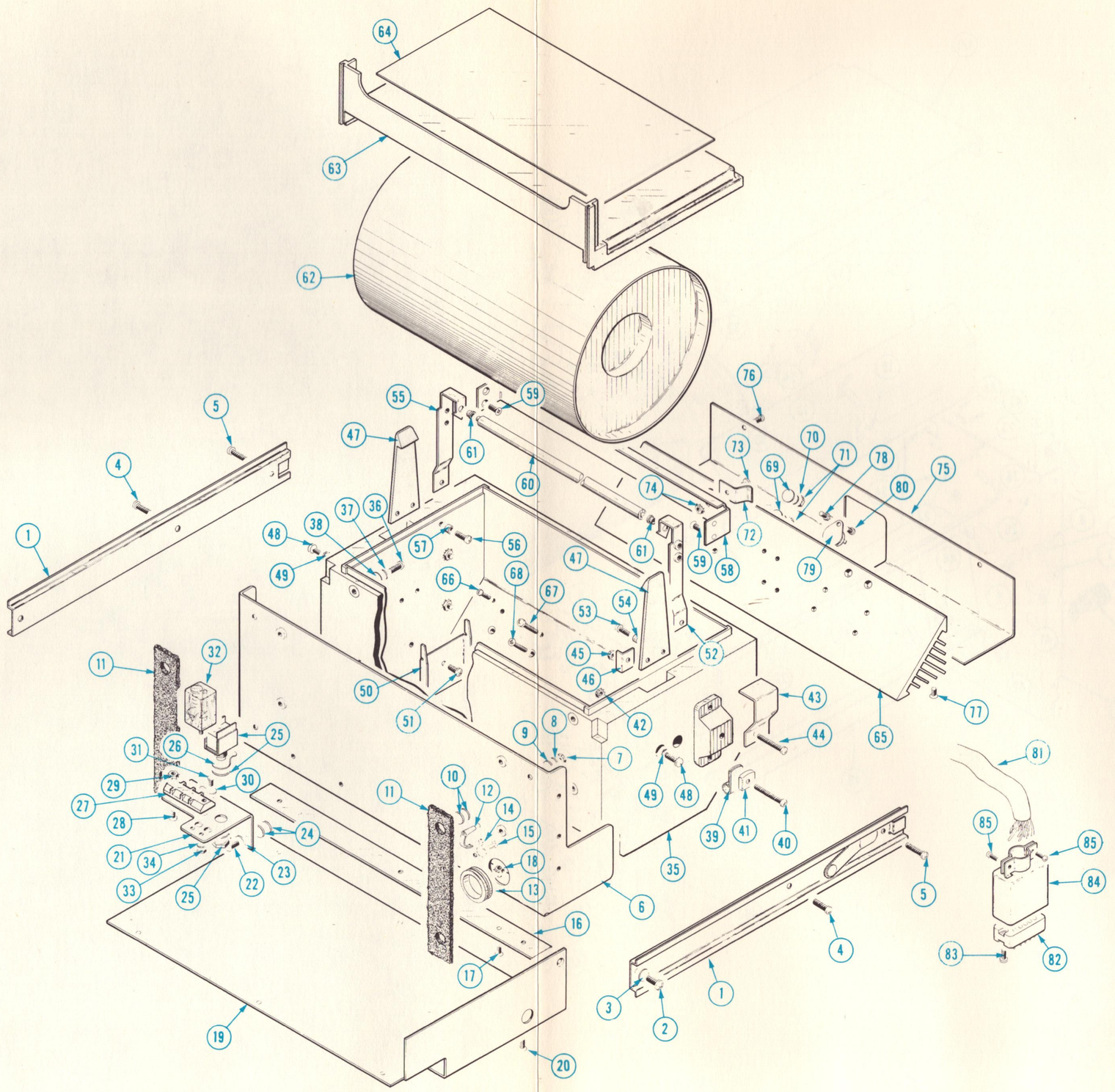


FIG. 5 PROCESSOR ASSEMBLY (cont.)

FIG. 6 PROCESSOR ASSEMBLY (cont.)



4610 HARD COPY UNIT

FIGURE 6 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	Description 1 2 3 4 5
6-	640-0498-00			1	PROCESSOR ASSEMBLY (cont)
	- - - - - -			-	processor assembly includes:
-1	351-0285-00			1	SLIDE, guide (pair)
	- - - - - -			-	mounting hardware: (not included w/slide)
-2	212-0507-00			1	SCREW, 10-32 x 0.375 inch, PHS
-3	210-0805-00			1	WASHER, flat, 0.204 ID x 0.438 inch OD
-4	212-0023-00			2	SCREW, 8-32 x 0.375 inch, PHS
-5	212-0010-00			2	SCREW, 8-32 x 0.625 inch, PHS
	212-0008-00			1	SCREW, 8-32 x 0.50 inch, PHS (not shown)
	210-0804-00			1	WASHER, flat, 0.17 ID x 0.375 inch OD (not shown)
	210-0548-00			1	NUT, keps, 8-32 x 0.344 inch (not shown)
-6	386-1827-00			1	SUPPORT, plug-in unit, center
	- - - - - -			-	mounting hardware: (not included w/support)
-7	210-0458-00			4	NUT, keps, 8-32 x 0.344 inch
-8	210-0804-00			4	WASHER, flat, 0.17 ID x 0.375 inch OD
-9	210-0813-00			4	WASHER, fiber, #10 shouldered
-10	210-0860-00			8	WASHER, fiber, 0.172 ID x 0.438 inch OD
-11	342-0041-00			2	INSULATOR PAD
-12	343-0089-00			1	CLAMP, cable
-13	348-0051-00			1	GROMMET, rubber, 1.125 inches OD
-14	210-0201-00			1	LUG, solder, SE #4
	- - - - - -			-	mounting hardware: (not included w/lug)
-15	213-0088-00			1	SCREW, thread forming, 4-24 x 0.25 inch, PHS
-16	342-0039-00			1	INSULATOR, plate, 12 inches long
	- - - - - -			-	mounting hardware: (not included w/plate)
-17	211-0101-00			2	SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-18	210-0586-00			2	NUT, keps, 4-40 x 0.25 inch
-19	390-0172-00			1	CABINET BOTTOM, plug-in unit
	- - - - - -			-	mounting hardware: (not included w/cabinet bottom)
-20	211-0538-00			8	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-21	407-0814-00			1	BRACKET, component, load copy switch
	- - - - - -			-	mounting hardware: (not included w/bracket)
-22	212-0008-00			2	SCREW, 8-32 x 0.50 inch, PHS
-23	210-0804-00			2	WASHER, flat, 0.17 ID x 0.375 inch OD
-24	210-0860-00			4	WASHER, fiber, 0.172 ID x 0.438 inch OD
-25	260-0976-00			1	SWITCH, sensitive dual, w/hardware
	- - - - - -			-	mounting hardware: (not included w/switch)
-26	210-0241-00			1	LUG, terminal
-27	124-0246-00			1	TERMINAL BOARD
	- - - - - -			-	mounting hardware: (not included w/terminal board)
-28	211-0513-00			2	SCREW, 6-32 x 0.625 inch, PHS
-29	210-0457-00			2	NUT, keps, 6-32 x 0.312 inch

FIGURE 6 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description 1 2 3 4 5
6-30	210-0201-00			1	LUG, solder, SE #4
	- - - - - -			-	mounting hardware: (not included w/lug)
-31	213-0088-00			1	SCREW, thread forming, 4-24 x 0.25 inch, PHS
-32	- - - - - -			1	RELAY
	- - - - - -			-	mounting hardware: (not included w/relay)
-33	210-0442-00			2	NUT, hex., 3-48 x 0.187 inch
-34	210-0004-00			2	WASHER, lock, internal, 0.12 ID x 0.26 inch OD
-35	380-0225-01			1	HOUSING ASSEMBLY, paper cassette
	- - - - - -			-	mounting hardware: (not included w/housing assembly)
-36	212-0008-00			4	SCREW, 8-32 x 0.50 inch, PHS
-37	210-0804-00			4	WASHER, flat, 0.17 ID x 0.375 inch OD
-38	210-0813-00			4	WASHER, fiber, #10 shouldered
-39	343-0004-00			1	CLAMP, cable, plastic, 0.312 inch
	- - - - - -			-	mounting hardware: (not included w/clamp)
-40	211-0553-00			1	SCREW, 6-32 x 1.50 inch, PHS
-41	210-0863-00			1	WASHER, D-shape, 0.191 ID x 0.515 inch OD
-42	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-43	343-0318-00			1	CLAMP, cable
	- - - - - -			-	mounting hardware: (not included w/clamp)
-44	211-0553-00			1	SCREW, 6-32 x 1.50 inch, PHS
-45	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-46	407-0877-00			1	BRACKET
-47	214-1445-01			2	SPRING, latch, paper cover
	- - - - - -			-	mounting hardware for each: (not included w/spring)
-48	211-0553-00			2	SCREW, 6-32 x 1.5 inches, PHS
-49	210-0007-00			2	WASHER, lock, external, 0.172 ID x 0.376 inch OD
-50	351-0263-00			2	GUIDE, cassette
	- - - - - -			-	mounting hardware for each: (not included w/guide)
-51	212-0001-00			1	SCREW, 8-32 x 0.25 inch, PHS
-52	214-1426-00			1	ARM, cassette guide, right
	- - - - - -			-	mounting hardware: (not included w/arm)
-53	211-0008-00			1	SCREW, 4-40 x 0.25 inch, PHS
-54	361-0344-00			1	SPACER, sleeve, 0.12 ID x 0.182 OD x 0.094 inch long
-55	214-1427-00			1	ARM, cassette guide, left
	- - - - - -			-	mounting hardware: (not included w/arm)
-56	211-0008-00			1	SCREW, 4-40 x 0.25 inch, PHS
-57	361-0344-00			1	SPACER, sleeve, 0.12 ID x 0.182 OD x 0.094 inch long
-58	386-1842-00			1	SUPPORT, cassette guide
	- - - - - -			-	mounting hardware: (not included w/support)
-59	211-0101-00			4	SCREW, 4-40 x 0.25 inch, 100° csk, FHS

FIGURE 6 PROCESSOR (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	Description
6-60	214-1452-00			1	ROLLER, paper guide
	- - - - - -			-	mounting hardware: (not included w/roller)
-61	401-0086-00			2	BEARING, sleeve
-62	- - - - - -[1]			1	PAPER CASSETTE
-63	200-1145-01			1	COVER, cassette, plastic
-64	334-1656-00			1	LABEL, instruction
-65	214-1425-00			1	HEATSINK
	- - - - - -			-	mounting hardware: (not included w/heatsink)
-66	211-0503-00			4	SCREW, 6-32 x 0.188 inch, PHS
-67	211-0516-00			4	SCREW, 6-32 x 0.875 inch, PHS
-68	211-0523-00			4	SCREW, 6-32 x 0.875 inch, 100° csk, FHS
-69	210-0813-00			8	WASHER, fiber, #10 shouldered
-70	210-0803-00			8	WASHER, flat, 0.15 ID x 0.375 inch OD
-71	210-0457-00			8	NUT, keps, 6-32 x 0.312 inch
-72	214-0276-00			2	SPRING, ground
	- - - - - -			-	mounting hardware for each: (not included w/spring)
-73	211-0504-00			1	SCREW, 6-32 x 0.25 inch, PHS
-74	210-0457-00			1	NUT, keps, 6-32 x 0.312 inch
-75	200-1142-00			1	COVER, heatsink
	- - - - - -			-	mounting hardware: (no included w/cover)
-76	211-0007-00			2	SCREW, 4-40 x 0.188 inch, PHS
-77	211-0101-00			2	SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-78	131-0382-00			2	CONNECTOR, stand off, insulated
-79	260-0677-00			1	THERMO SWITCH
	- - - - - -			-	mounting hardware: (not included w/thermo switch)
-80	211-0007-00			2	SCREW, 4-40 x 0.188 inch, PHS
-81	179-1562-01			1	WIRING HARNESS
	- - - - - -			-	wiring harness includes:
	131-0992-00			14	CONTACT, electrical (not shown)
-82	131-0690-00			1	CONNECTOR, receptacle, 15 pin, male
	- - - - - -			-	mounting hardware: (not included w/connector)
-83	211-0531-00			2	SCREW, 6-32 x 0.375 inch, Fil HS
-84	200-1159-00			1	COVER, connector
	- - - - - -			-	mounting hardware: (not included w/cover)
-85	211-0012-00			2	SCREW, 4-40 x 0.375 inch, PHS

[1] Roll 3M Type 777 Dry Silver Paper, see standard accessories for part number.

STANDARD ACCESSORIES

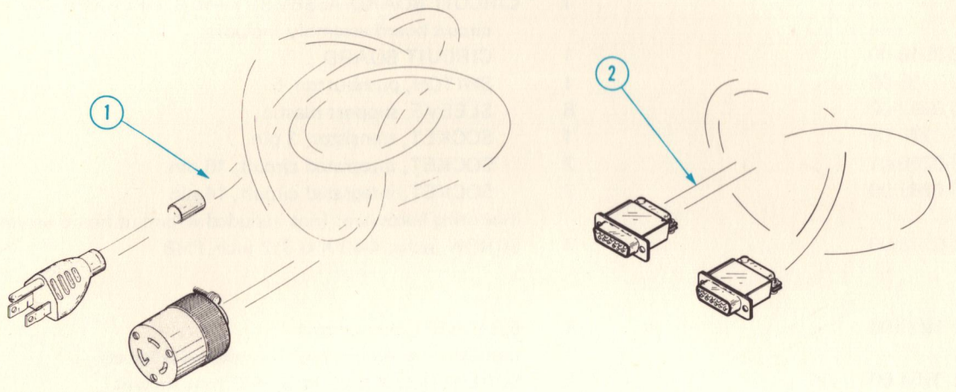


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
7-1	161-0065-01			1		CABLE ASSEMBLY, power
	161-0027-04			1		CABLE ASSEMBLY, power (4610-1 only)
-2	012-0363-00			1		CABLE ASSEMBLY, interconnecting, 10 feet long
	070-1299-00			1		MANUAL, operator's (not shown)
	006-1603-00			1		ROLL 3M Type 777 Dry Silver Paper (not shown)
						OPTIONAL
	012-0363-01			1		CABLE ASSEMBLY, interconnecting, 20 feet long
	012-0363-02			1		CABLE ASSEMBLY, interconnecting, 50 feet long
	070-1300-00			1		MANUAL, maintenance

CARTON ASSEMBLY
(Part No. 065-0147-00)

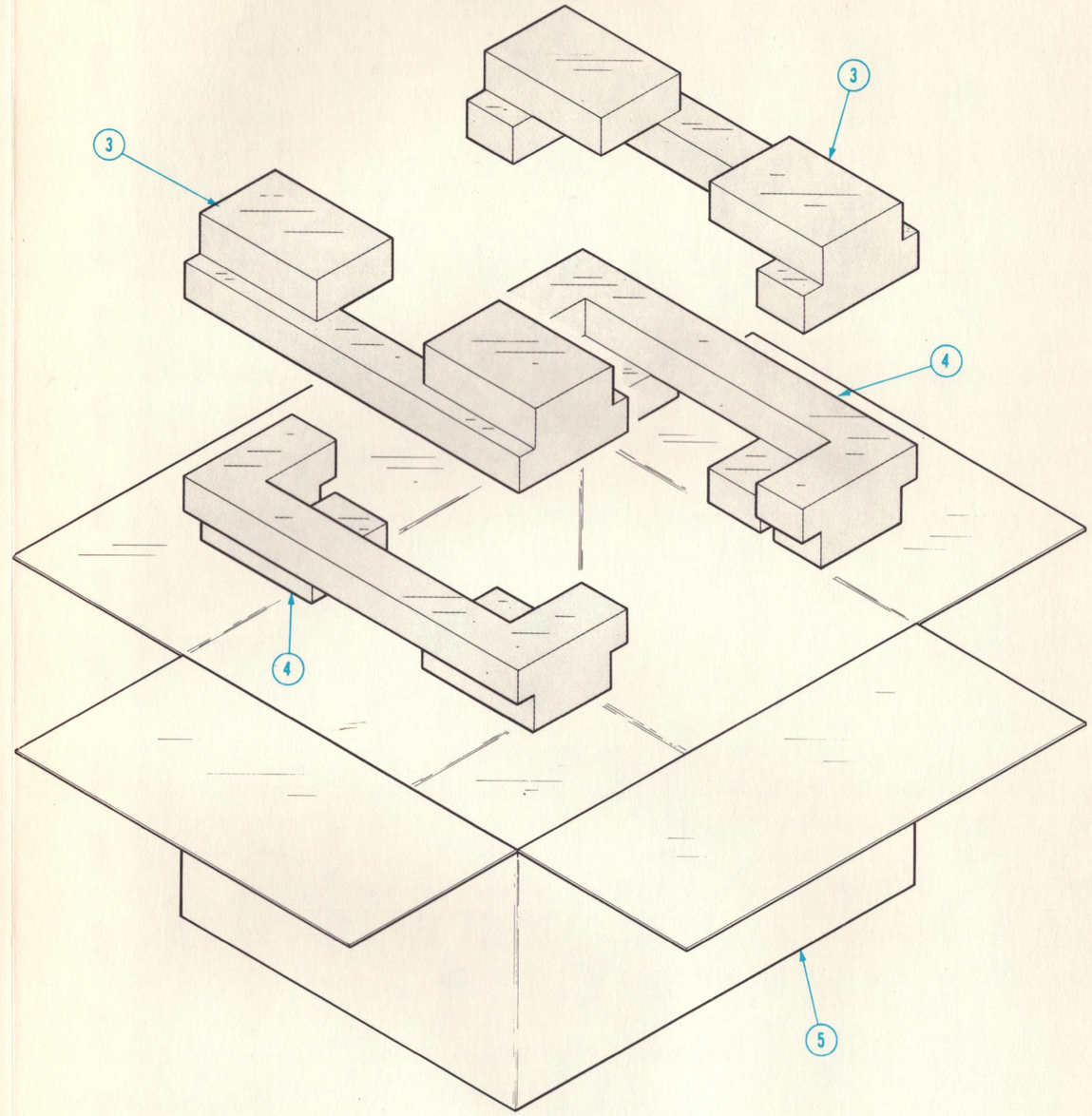


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
7-	065-0147-00			1		CARTON ASSEMBLY
	- - - - - - - - - -			-		carton assembly includes:
-3	004-0261-00			1		FRAME, top
-4	004-0262-00			1		FRAME, bottom
-5	004-0776-00			1		CARTON

OPTION 1 MUX

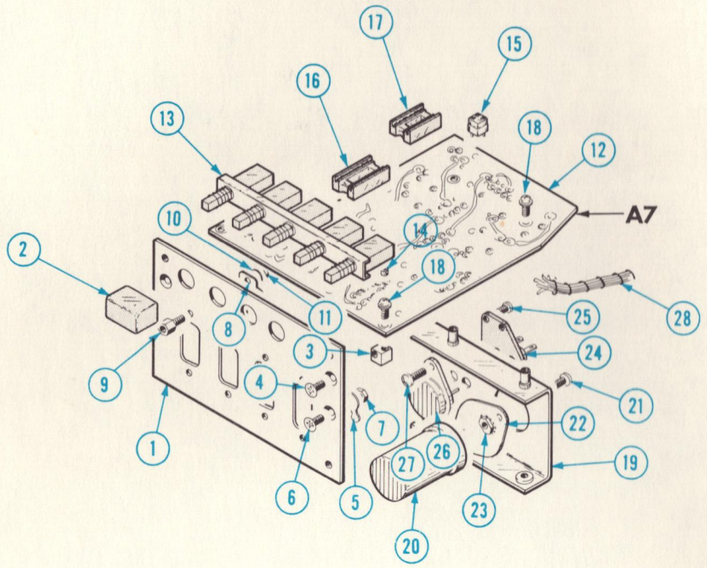


Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty	1 2 3 4 5	Description
8-1	386-2315-00			1		PLATE, mounting, rear
	- - - - - - - - - -			-		mounting hardware: (not included w/plate)
	211-0504-00			4		SCREW, 6-32 X 0.25 inch, PHS (not shown)
-2	366-1415-00			1		KNOB, red—MUX
	366-1416-00			4		KNOB, gray—TERMINAL 1-2-3-4
-3	220-0455-00			2		NUT BLOCK
	- - - - - - - - - -			-		mounting hardware for each: (not included w/nut block)
-4	211-0101-00			1		SCREW, 4-40 X 0.25 inch, 100° csk, FHS
-5	210-0201-00			1		LUG, solder, SE #4
	- - - - - - - - - -			-		mounting hardware: (not included w/lug)
-6	211-0101-00			1		SCREW, 4-40 X 0.25 inch, 100° csk, FHS
-7	210-0406-00			1		NUT, hex., 4-40 X 0.187 inch
8-8	131-0458-00			4		CONNECTOR, 15 pin, female
	- - - - - - - - - -			-		mounting hardware for each: (not included w/connector)
-9	129-0260-00			2		POST, stud w/countersink, 4-40 thread
-10	210-0004-00			2		WASHER, lock, internal, 0.12 ID X 0.26 inch OD
-11	210-0406-00			2		NUT, hex., 4-40 X 0.187 inch
-12	- - - - - - - - - -[1]			1		CIRCUIT BOARD ASSEMBLY—MULTIPLEXER A7
	- - - - - - - - - -			-		circuit board assembly includes:
	388-2516-00			1		CIRCUIT BOARD
-13	260-1435-00			1		SWITCH, pushbutton, 5
-14	166-0292-00			8		SLEEVE, support plastic
-15	136-0220-00			1		SOCKET, transistor, 3 pin
-16	136-0260-01			2		SOCKET, integrated circuit, 16 pin
-17	136-0269-00			7		SOCKET, integrated circuit, 14 pin
	- - - - - - - - - -			-		mounting hardware: (not included w/circuit board assembly)
-18	211-0116-00			4		SCREW, sems, 4-40 X 0.312 inch, PHB
-19	441-1051-00			1		BRACKET, mux chassis
	- - - - - - - - - -			-		mounting hardware: (not included w/bracket)
	211-0504-00			2		SCREW, 6-32 X 0.25 inch, PHS (not shown)
-20	- - - - - - - - - -			1		CAPACITOR
	- - - - - - - - - -			-		mounting hardware: (not included w/capacitor)
-21	211-0507-00			2		SCREW, 6-32 X 0.312 inch, PHS
-22	386-0253-00			1		PLATE, metal
-23	210-0457-00			2		NUT, keps, 6-32 X 0.312 inch
-24	136-0135-00			1		SOCKET, transistor
	- - - - - - - - - -			-		mounting hardware: (not included w/socket)
-25	213-0113-00			2		SCREW, thread forming, 2-32 X 0.312 inch, RHS
-26	- - - - - - - - - -			1		INTEGRATED CIRCUIT
	- - - - - - - - - -			-		mounting hardware: (not included w/integrated circuit)
-27	211-0510-00			2		SCREW, 6-32 X 0.275 inch, PHS
-28	179-1835-00			1		WIRING HARNESS, mux
	179-1824-00			1		WIRING HARNESS, 5 V

STANDARD ACCESSORIES same as **4610.**

[1] See Electrical Parts List for part number.

FIG. 8 OPTION 1 MUX

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Sections of the manual are often printed at different times, so some of the information on the change pages may already be in your manual. Since the change information sheets are carried in the manual until ALL changes are permanently entered, some duplication may occur. If no such change pages appear in this section, your manual is correct as printed.

SCHEMATIC CORRECTIONS

Timing ◇3◇

CHANGE:

R118 to read 4.3 K

R125 to read 2.2 K

Multiplexer Option ◇7◇

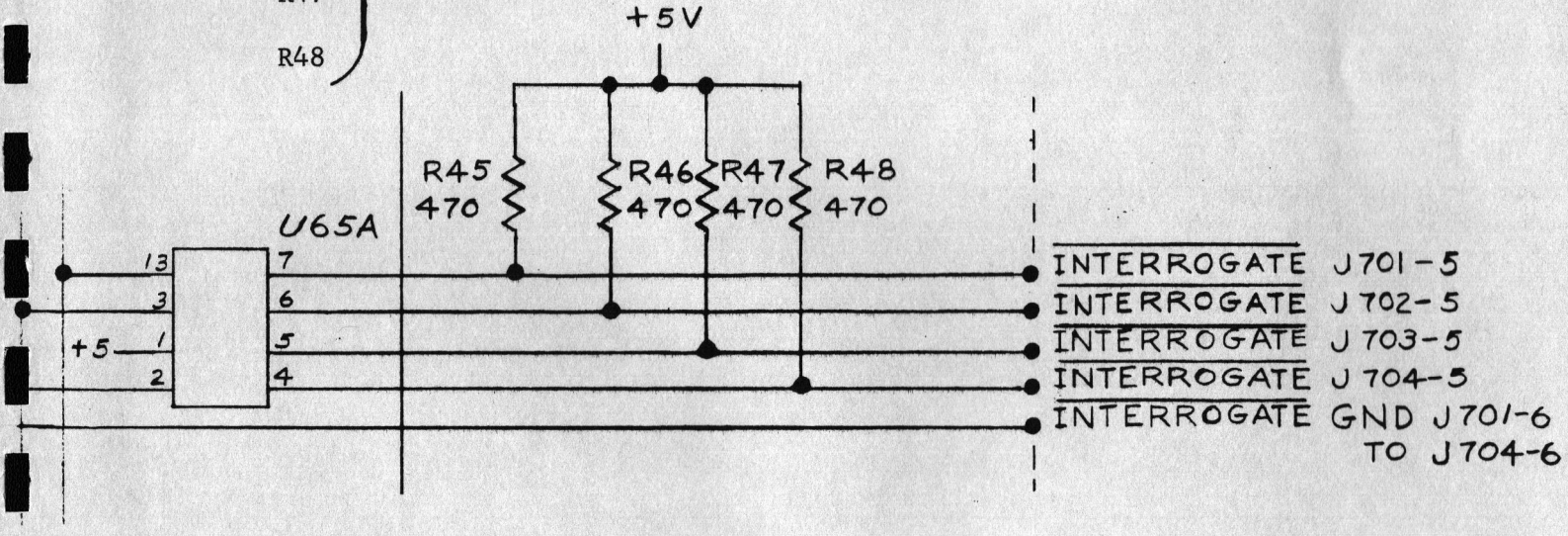
CHANGE:

U5 to U3

ADD:

R45
R46
R47
R48

Add per diagram below



Deflection Amps & Dynamic Focus ◇4◇

CHANGE:

R406 to read 13K

4610 EFF SN B010160-up

ELECTRICAL PARTS LIST AND SCHEMATIC CORRECTION

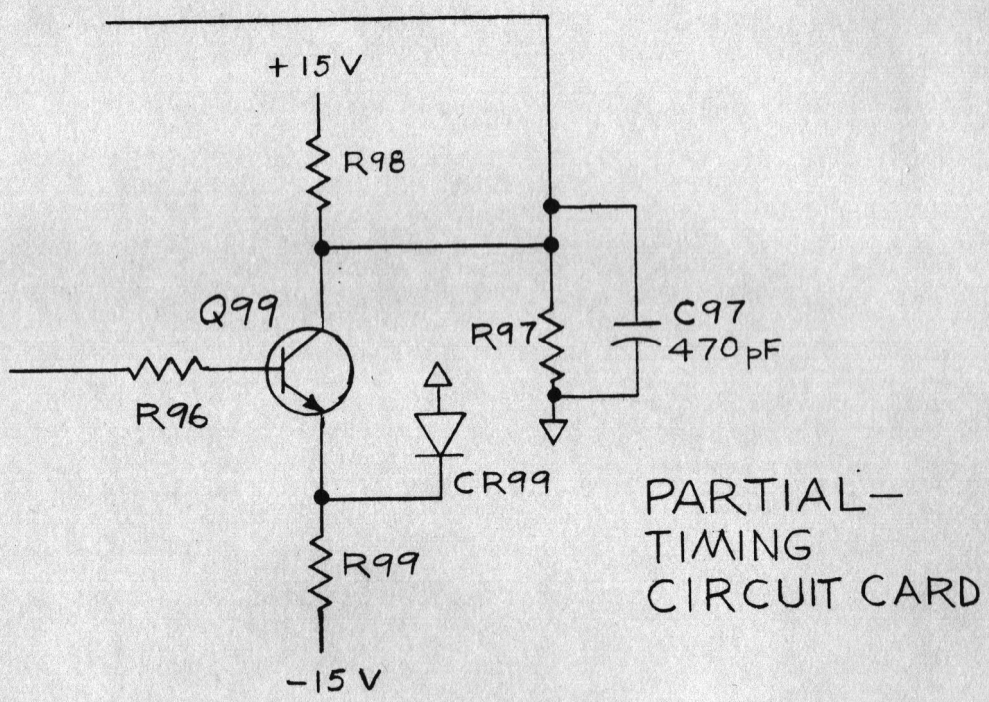
TIMING Circuit Card Assembly

CHANGE TO:

670-1909-01		Complete Card

ADD:

C97	281-0580-00	470 pF	Cer	500 V



M18,724/472

4601 Maintenance EFF SN B160000-up

4602 Maintenance EFF SN B020000-up

4610 Maintenance EFF SN B020000-up

ELECTRICAL PARTS LIST AND SCHEMATIC CORRECTION

POWER SUPPLY & HV REGULATOR ◇1◇

CHANGE TO:

ASSEMBLY		
A1	670-1898-01	POWER SUPPLY & HV REGULATOR Circuit Board Assembly
R378	315-0202-00	2 kΩ, 1/4 W, 5%

ELECTRICAL PARTS LIST CORRECTION

CHANGE TO:

INTEGRATED CIRCUIT

U3	156-0176-00	5 Volt Regulator, replaceable by LM309K

ELECTRICAL PARTS LIST AND SCHEMATIC CORRECTION

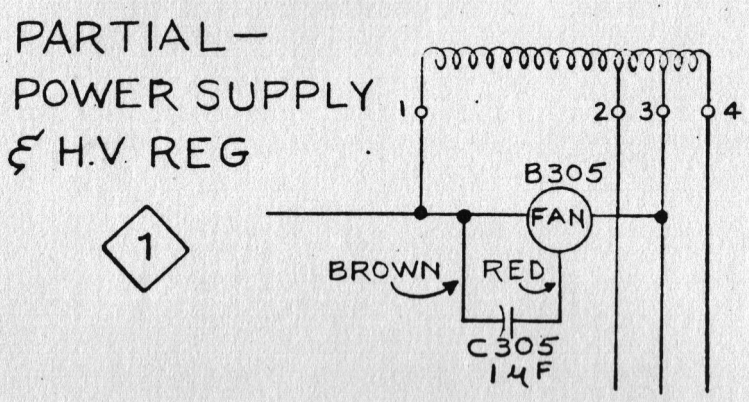
POWER SUPPLY & HV REGULATOR Circuit Board Assemblies

CHANGE TO:

B305	147-0022-00	Motor, AC	115 V

ADD:

C305	285-0706-00	1 µF	400 V



MECHANICAL PARTS LIST CORRECTION

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CHANGE TO:

Fig. 2-83	380-0272-01	1	HOUSING HALF, fan, right
-89	369-0036-01	1	IMPELLER, fan, axial

REMOVE:

-90	213-0234-00	2	SCREW, 3-48 x 0.375 inch, PHS

CHANGE TO:

-91	380-0224-01	1	HOUSING HALF, fan, left

ADD:

	129-0006-00	1	POST, connecting, insulated
	- - - - - -	-	mounting hardware: (not included w/post)
	210-0457-00	1	NUT, keps, 6-32 x 0.312 inch

REMOVE:

-94	407-0834-00	1	BRACKET, component, fan motor
-95	212-0023-00	2	SCREW, 8-32 x 0.375 inch, PHS
-96	210-0458-00	2	NUT, keps, 8-32 x 0.344 inch

CHANGE TO:

Fig. 2-97	- - - - - -	1	MOTOR, AC, 115 V
-98	212-0081-00	2	SCREW, 8-32 x 1.0 inch, PHS
-99	212-0040-00	2	SCREW, 8-32 x 0.375 inch, 100° csk, FHS
-100	385-0121-00	2	ROD, hex, metallic

ADD:

	210-0007-00	4	WASHER, lock, internal, #8
	344-0117-00	2	CLIP, capacitor mounting
	- - - - - -	-	mounting hardware for each: (not included w/clip)
	211-0507-00	1	SCREW, 6-32 x 0.312 inch, PHS
	210-0457-00	1	NUT, keps, 6-32 x 0.312 inch

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CHANGE TO:

Fig. 2-139	179-1814-00	1	WIRING HARNESS, chassis
	179-1561-00	1	WIRING HARNESS, 40 volt
	179-1756-01	1	WIRING HARNESS, AC

ELECTRICAL PARTS LIST AND SCHEMATIC CORRECTION

CHANGE TO:

ASSEMBLY A1	670-1898-02	POWER SUPPLY & HV REG Circuit Card Assembly

REMOVE:

R386	315-0223-00	22 kΩ, 1/4 W, 5%

CHANGE TO:

T605	120-0853-00	HV Power
ASSEMBLY A2	670-0377-01	HIGH VOLTAGE #1 Circuit Board Assembly
CR630	152-0429-00	Silicon, replaceable by VG-5X, 5000 V, 10 mA
CR640	152-0429-00	Silicon, replaceable by VG-5X, 5000 V, 10 mA

ADD:

C644	283-0105-00	0.01 μF, Cer, 2000 V, +80%-20%
C649	283-0105-00	0.01 μF, Cer, 2000 V, +80%-20%
CR631	152-0429-00	Silicon, replaceable by VG-5X, 5000 V, 10 mA
CR641	152-0429-00	Silicon, replaceable by VG-5X, 5000 V, 10 mA

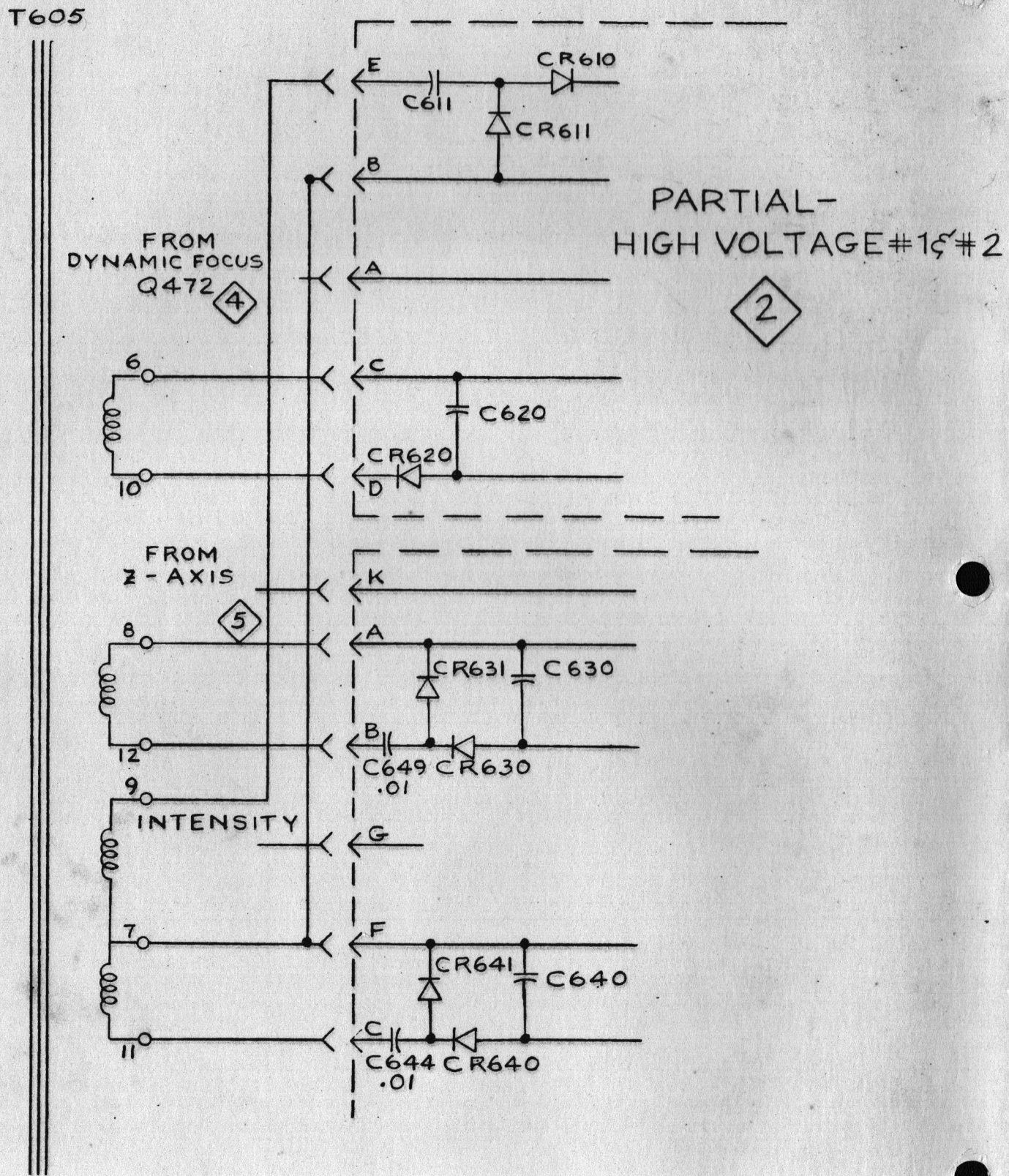
MECHANICAL PARTS LIST CORRECTION

Page 6-43

CHANGE TO:

Fig. 3-96	211-0114-00	2	SCREW, 4-40 x 0.438 inch
Fig. 3-101	136-0484-01	1	SOCKET ASSEMBLY, CRT

SCHEMATIC CORRECTION



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