Tektronix®
COMMITTED TO EXCELLENCE

Please Check for
CHANGE INFORMATION
at the Rear of this Manual

4114
Option 31
Color Enhanced Refresh

SERVICE MANUAL

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

MANUAL PART NO.
061-2511-00

First Printing MAY 1981

WARNING

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

MANUAL REVISION STATUS

PRODUCT: 4114 Option 31

This manual supports the following versions of this product: Serial Numbers B010100 and up.

REV.	DATE	DESCRIPTION
@	MAY 1981	Original Issue

CONTENTS

ILLUSTRATIONS

TABLES

Section 1

INTRODUCTION

GENERAL INFORMATION

Option 31 consists of a different display module for the 4114, which lets the viewer see a different color image in Refresh mode than the standard 4114 display. This difference is seen through a rose-colored crt filter. There are no changes or modifications to the pedestal of the 4114 and all operational parameters as described in the operator's manual for the 4114 remain the same. Option 31 requires no other options along with it and it can work with all other 4114 options.

About This Manual

This manual is written as a supplement to the 4114 service manual and covers the installation, servicing, and hardware characteristics of 4114 Option 31, Color Enhanced Refresh. It is meant to be used in conjunction with the 4114 service manual (Volumes 1 and 2).

This manual is organized as follows:

- Section 1 describes Option 31, the differences between a 4114 Option 31 and a 4114 Computer Display Terminal without Option 31, and the proper use of this manual.
- Section 2 describes different specifications and strap settings.
- Section 3 describes the differences between the theory of operation in the standard 4114 display and the Option 31 display.
- Section 4 contains the adjustment procedure necessary for optimum performance of the Color Enhanced Refresh Display.
- Section 5 discusses the mechanical assembly/disassembly procedures that are different

- Section 6 contains a parts list for unique Option 31 electrical and mechanical parts.
- Section 7 contains the schematics unique to the Option 31.
- Section 8 summarizes the major differences between the standard 4114 and the 4114 Option 31.
- Appendix A contains a short description of all the board-to-board and interconnect signals in the Color Enhanced Refresh Display.

Related Documentation

For more information about the operation and servicing of the 4114 Computer Display Terminal consult the following:

- 4114 Computer Display Terminal Operator's Manual
- 4114 Computer Display Terminal Service Manual (Volume 1)
- 4114 Computer Display Terminal Service Manual (Volume 2)
- 4114 Computer Display Terminal Host Programmer's Manual
- 4110 Series Command Reference Manual
- 4114 Series Host Programmer's Reference Guide

WHAT IS OPTION 31, COLOR ENHANCED REFRESH?

The standard 4114 display has a direct view storage crt which is a bistable crt. Bistable, as the name implies, has two stable states and can either store or not store an image. These two states are called Storage and Refresh (write-thru) modes.

Information is usually written in Storage mode. Written this way, it only needs to be written once. When in Refresh mode, information is continuously written at just below the storage level. In a standard 4114 display, this results in an image displayed at a slightly lower intensity, but in the same color as a stored image.

During operation of the 4114 Option 31, the stored information appears in green (as on a standard 4114 display). During refreshed operations, however, the refreshed information is displayed in a yellow to orange-red color, making it easier for the user to distinguish refreshed information from the stored data.

The color difference is accomplished by coating the inside face of the Option 31 crt with a mixture of red and green phosphors. When the writing speed is slow enough to store (see the 4114 service manual, display specifications), the green phosphor is excited and information is stored in a green color. This is the same as a standard 4114 display, but in the case of Option 31, information is viewed through a rose-colored filter, and the contrast of rose against green makes information easier to see in most overhead lighting situations. When crt writing speed is fast enough for a refresh writing rate, the red phosphor is excited. This is seen as a yellow to orange-red color on the crt.

Minor variations in component tolerances and purity ratios, fluctuations in currents between crts, and other factors may cause the color seen in Refresh mode to vary from instrument to instrument.

FACTORY CHANGES FOR OPTION 31

NOTE

Option 31 is a factory-installed option only. Option 31 parts cannot be used in a standard display.

All dependent logic, electrical, and mechanical components of Option 31 are contained in the display module. A 4114 with Option 31 installed is easily spotted from a distance by its rose-colored crt filter, the only external distinguishing feature.

Internally, Option 31 has many changes when compared to the 4114 standard Display Module. These changes are outlined as follows:

- o A Different Crt

  The Option 31 crt has many differences. For example, it has a coating of red and green phosphor (instead of only green phosphor). It also is a 100-degree deflection crt versus a 90-degree deflection crt; Consequently, it is about 1-1/2 inches shorter than the standard crt. The Option 31 crt also requires about 25% more current to operate.

- o Electrical Changes

  Four circuit boards are different. Modifications are made to the Storage board, Deflection Amplifier board, and Power Supply board in order to compensate for the current increase. In these cases, the modifications consist of resistor and transistor changes. The layout of these three boards remains the same as the standard boards, with no changes to functional blocks or schematic part numbers. The High Voltage and Z-Axis board, however, is different. The board consists of a new layout with different schematic part numbering. The functional blocks of the board remain the same.

- o Mechanical Changes

  The crt shield is shorter than the standard shield and contains two yoke adjusting holes, only one of which is used for yoke adjustment.

Section 2

CHARACTERISTICS

GENERAL INFORMATION

This section contains the specifications, strap settings, and other operating considerations which are unique for Option 31.

THE OPTION 31 CRT AND DISPLAY MODULE

The Option 31 crt, like the 4114 standard, is a bistable storage crt. It can display information two ways, by storing or not storing an image. The Option 31 crt stores in the same color (green) as the standard crt, but writes in a second color when in Refresh mode. This color is a bright yellow to orange-red color, hence the designation "Color Enhanced Refresh."

The Option 31 display uses the same analog and digital signals from the Vector Generator board (in the pedestal) to drive the deflection circuitry that the standard "one-color" crt uses. The only connections that the Option 31 Display Module has with the pedestal are the ac power cord and the cable which connects to J3000 (pedestal) and contains the control signals from the Vector Generator board.

The Display Module circuitry is contained on five circuit boards plus an Interconnect board.

The only external control on the Display Module is the REFRESH INTENSITY control.

SPECIFICATION CHANGES

Table 2-1 lists differences between the standard 4114's specifications and those for a 4114 equipped with Option 31. All other specifications remain unchanged and apply to the Option 31 display (including deflection requirements, graphics specifications, physical characteristics, J3000 rear connections, and all hard copy signals at J5005).

Table 2-1

STANDARD VS. OPTION 31 SPECIFICATIONS

Specification	4114	4114 Option 31
Phosphor Type	P1	A mixture of red and green phosphors for color enhanced refresh.
Power Consumption; 115 V at 60 Hz; full internal load	220 W	240 W
Maximum Running Line Current; 120 V Connection	2.6 A	2.8 A

STRAP SETTINGS

There are ten strap settings which exist in the Option 31 Display Module. Table 2-2 lists the strap settings and the boards on which these straps are located.

Table 2-2

STRAP SETTINGS

Strap Settings	Normal Operational Settings
Deflection Amplifier Board	
X-Y interchange/polarity	Determined by yoke position
Hold IN/OUT	IN
Antiburn IN/OUT	IN
SLU-0 recovery time FAST/SLO	FAST
Storage Board	
Erase TEST/N	N
View Reset Z/TRU Z	TRU-Z
View Reset Z/GBUSY	GB
High Voltage and Z-Axis Board	
Z-Axis polarity Z-1/Z-0	Z-0
CRT deflection 90/100	100
Z-Axis input impedance 75/93/50	50

The settings on the Deflection Amplifier and Storage boards remain in the same positions as for a standard 4114. For a more complete description of these strap settings, see the 4114 service manual (Volume 1) under "Strap Options."

NOTE

The X-Y interchange is determined by yoke position (see "Rotating the Crt 180 Degrees" in the 4114 service manual).

Option 31 requires three new strap settings, all located on the High Voltage and Z-Axis board. A description of each strap, its function, and its proper setting follows.

Selecting Z-Axis Input Polarity

CAUTION

The 4114 Option 31 uses a factory setting of Z-0 in order to be fully compatible with the pedestal. If the strap is set in the wrong position, circuit damage may result. THIS SETTING MUST NEVER BE CHANGED.

This strap setting is the same as both straps on the standard 4114 High Voltage and Z-Axis board, but has been reduced to only one strap on the High Voltage and Z-Axis board for Option 31. The Display Module is designed to accept either a low or high true TTL signal. To accomplish this, a strap (labeled Z-1 and Z-0) on the High Voltage and Z-Axis board is set to choose which true level of Z is used by the Display Controller. If a low true TTL signal is used for Z, the strap must be set in the Z-0 position. The writing beam then turns off when the Z-Axis input signal rises to at least +2 volts and turns on with a signal of less than +0.8 volts. Conversely, if a high true TTL signal is used for Z, the strap must be set in the Z-1 position. The writing beam then turns on when the Z-Axis input signal rises to at least +2 volts and turns off with a signal of less than +0.8 volts.

Selecting the 90/100 strap

This strap selects between a 90-degree deflection crt and a 100-degree deflection crt. If the strap is left in the 90 position when a 100-degree deflection crt is used, there may not be enough range on the Center Focus adjustment to adequately focus the crt. Conversely, the same is true if the strap is in the 100 position when a crt with a 90-degree deflection factor is used.

The 4114 with Option 31 has this strap set in the 100 position.

Selecting the 75/93/50 Strap

This strap selects a matching input impedance of 50, 93, or 75 ohms to match different driving sources. This is accomplished by adding resistors in parallel in order to get the matching input impedance as determined by the strap setting.

The 4114 with Option 31 uses a factory setting of 50 in order to match impedances with the pedestal. For maximum performance, THIS SETTING MUST NOT BE CHANGED.

Section 3

THEORY OF OPERATION

INTRODUCTION

This section supplements the theory of operation section of the 4114 service manual (Volume 1). The differences are few since the Option 31 boards perform the same functions, use the same external signals, and create the same internal signals as the standard 4114.

The 4114 service manual describes the circuitry in blocks as they are labeled on the schematics. This should provide sufficient information for the servicing technician to isolate a specific block of circuitry as the problem area. The technician should then be able to locate the defective component.

There are two points concerning the theory of operation that need to be remembered:

- There has been no deletion of functional blocks or additions of functional blocks on the Option 31 schematics. There has, however, been one block on the High Voltage and Z-Axis Board that has had a name change; the function of the HIGH VOLTAGE SUPPLY block on the standard 4114 schematic is the same as the HIGH VOLTAGE REGULATOR on the Option 31 High Voltage and Z-Axis board.

- All schematics in Section 7 of this manual are labeled with the same numbers as the corresponding schematics in the standard service manual. For example, the High Voltage and Z-Axis schematic is labeled as A16-1 in the 4114 service manual, and the High Voltage and Z-Axis schematic is labeled as A16-1 in this manual. This provides ease of reference between the two manuals. When referring to the schematics, use the schematics located in Section 7 of this manual. These are the schematics that have component changes.

GENERAL INFORMATION ON INTERNAL CHANGES

The theory of operation section in the 4114 service manual (Volume 1) for the display is completely accurate in describing the theory of operation of the 4114 Option 31 Display Module. All block diagrams can be used. All component references (such as reference to Q80 and Q90 on the Deflection Amplifier board) are the same on the Option 31 schematics.

The 4114 Option 31 has a few internal changes. The crt requires about 25% more current to operate. Consequently, the circuit boards are modified slightly to compensate for this current increase. One resistance value is changed on the Storage board, some transistors and resistance values are changed on the Deflection Amplifier board, the Low Voltage Power Supply is modified slightly (to provide slightly higher maximum output currents), and the High Voltage and Z-Axis board is a different board layout than the 4114 standard. Functionally, however, the two instruments are the same.

Section 4

ADJUSTMENT PROCEDURE

GENERAL INFORMATION

The adjustment procedure for the 4114 Option 31 display is virtually the same as for the standard 4114 display. There are no new adjustments or patterns used, since the circuit boards are functionally the same, and most of the specifications are the same (for the specifications that have changed, see Section 2 of this manual).

However, because the High Voltage and Z-Axis board is different (the circuit board is a new layout), the referencing numbers for the potentiometers are different and their board locations are different. See Figure 4-1.

Rather than attempt to change what is no longer correct for Option 31, the adjustment procedure is repeated here with the necessary changes inserted. This is done so that references to another manual do not have to be made while following this adjustment procedure.

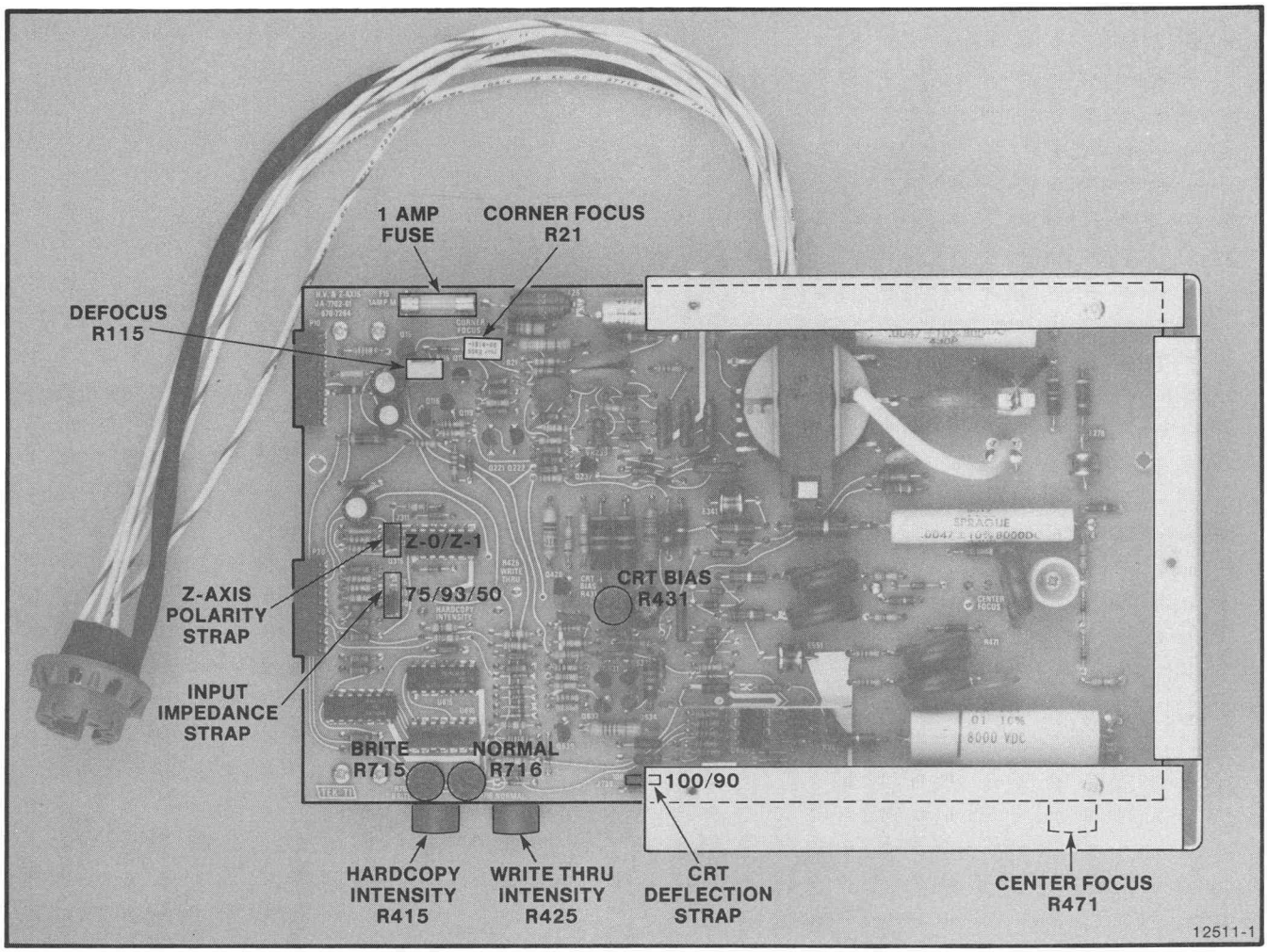


Figure 4-1. High Voltage and Z-Axis Board Strap Settings and Adjustments.

INSPECTION AND ADJUSTMENT-INTRODUCTION

The following adjustment procedure adjusts the 4114 Option 31 Display Module for optimum performance. This procedure is also used to check the performance specifications of the display. For continued optimum performance, check -- and adjust if necessary -- every 1000 hours of operation or every twelve months (if the 4114 is used infrequently).

NOTE

In order to adjust the instrument the cabinet cover and front panel must first be removed (see cabinet cover and front panel removal and installation in the 4114 service manual).

Test Equipment Required

- Oscilloscope (TEKTRONIX 465 or equivalent). Dual trace with a vertical defection factor of at least 5 mV per division, and a sweep rate of at least 10 ns per division. Bandwidth from dc to 100 MHz.
- Digital Voltmeter (TEKTRONIX DM 501 or equivalent). Range -30 V to +600 V with at least 0.1% accuracy. Measurement to -6400 V with 1% accuracy (if no divide-by-10 high voltage probe is used).
- Power Module (TEKTRONIX TM 503 or equivalent). Used if a TEKTRONIX DM 501 Digital Multimeter is used.
- TEKTRONIX 4631 Hard Copy Unit. Used for adjusting copy-making circuitry which must be adjusted if the 4114 Option 31 is used with a Hard Copy Unit.
- High Voltage Probe. Divide-by-10 test probe used in measuring the high voltage supply (divide-by-100 or divide-by-1000 probes can also be used in measuring this voltage if the reading on the DVM (Digital Voltmeter) is adjusted accordingly).

- Adjustment Tools. Non-conductive. One screwdriver at least 10.0 inches in overall length, one at least 5.0 inches in overall length, and a third 1.0 to 2.0 inches in length.

- Set of hand tools for hardware adjustment checks. Should include nutdrivers, screwdrivers, etc.

Performance Conditions

The following conditions must be met before the 4114 display characteristics and performance specifications are valid:

- The display must be adjusted at room temperature (68 to 86 degrees Farenheit or 20 to 30 degrees Celsius).

- The Display must have power applied for at least 20 minutes.

INSPECTION PROCEDURE

WARNING

Hazardous voltages are present in the 4114 circuitry. Always use proper servicing techniques to avoid being injured or killed. Only qualified service technicians should perform the following inspection procedure. Also, before doing this inspection procedure, DISCONNECT THE POWER CORD AND WAIT 60 SECONDS. Failure to do so may result in injury or death.

1. **Check** for loose, damaged, or improperly mounted hardware.

2. **Make sure** that circuit boards are installed in the correct slots.

3. **Make sure** that board level numbers are correct and that circuit modifications are installed correctly.

4. **Check** the crt and shield for foreign material and scratches.

5. **Make sure** the crt ground straps are screwed tightly to the chassis.

6. **Check** all wiring and harmonica connectors for proper installation.

7. **Check** edge connectors and Interconnect board pins for damage.

8. **Check** the crt filter for proper installation; also, make sure that the ground clips are securely fastened.

9. **Make sure** that the crt socket is properly connected.

10. **Check** the strap settings on the High Voltage and Z-Axis board. Make sure that the Z-Axis jumper is set to the Z-0 position (inner position), the 90/100 jumper is set to the 100 position (lower position), and that the 75/93/50 jumper is set to the 50 position (outer position). Also, make sure that the board has a 1 A fast blow fuse in place.

11. **Perform** the following checks on the Low Voltage Power Supply (LVPS) board. Check the cables from the power supply to the Interconnect board for defects. Make sure that all wiring is fastened securely. Make sure that the line fuse is securely seated. Also, make sure that the following fuses have the correct ratings and are installed properly. The location of these fuses is shown in Figure 4-2.

F30	.15 A fast
F35	.25 A fast
F137	.15 A fast
F139	2.00 A fast
F141	2.00 A fast
F144	6.00 A slow
F146	5.00 A slow

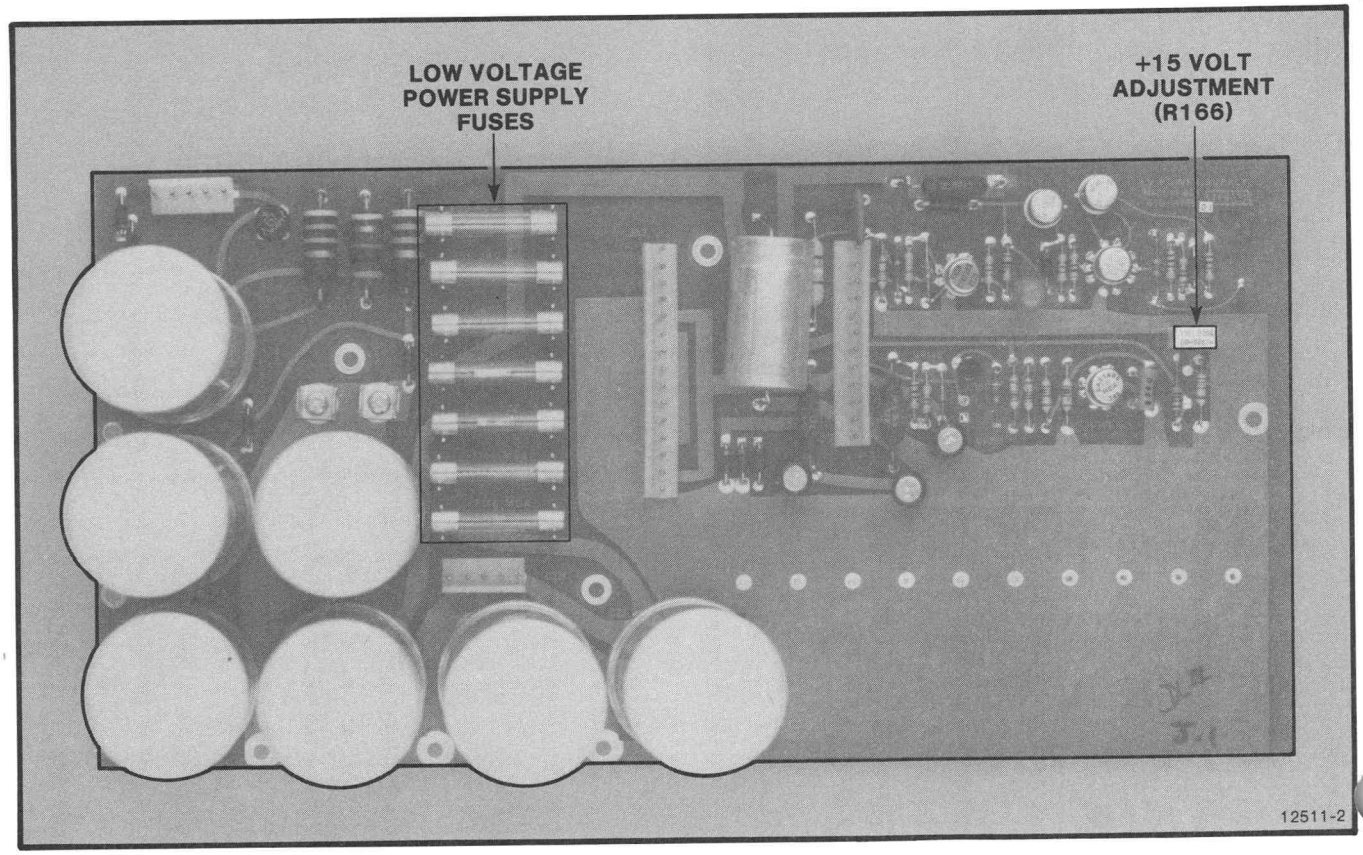


Figure 4-2. Low Voltage Power Supply Fuses and Adjustments.

12. **Check** the strap settings on the Storage board. Make sure that the VIEW RESET jumper is set to the GB (lower) position and also that the Z-TRU-Z jumper is set to the TRU-Z (lower) position. Set the NORMAL/TEST jumper to the "N" (top) position. Figure 4-3 shows the location of these straps.

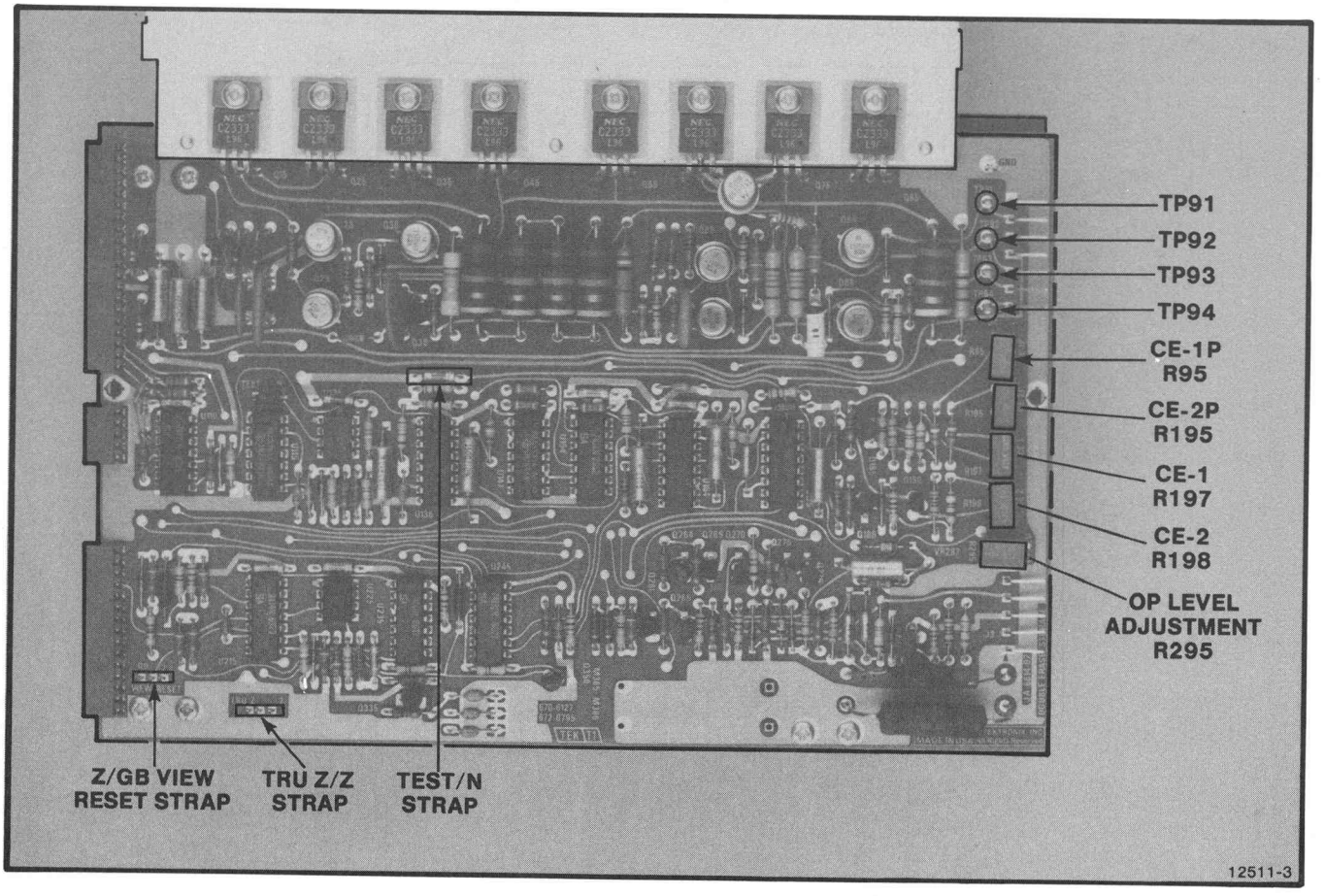


Figure 4-3. Storage Board Adjustments, Straps and Test Points.

13. **Set** the ANTIBURN jumper to the IN (lower) position on the Deflection board. Check the J311 and J314 straps for proper installation. Make sure that the J199 four-pin jumper is set to the FAST position. And make sure that the Hold mode jumper is set to the IN position (toward the rear). Figure 4-4 shows the Deflection board straps and jumpers.

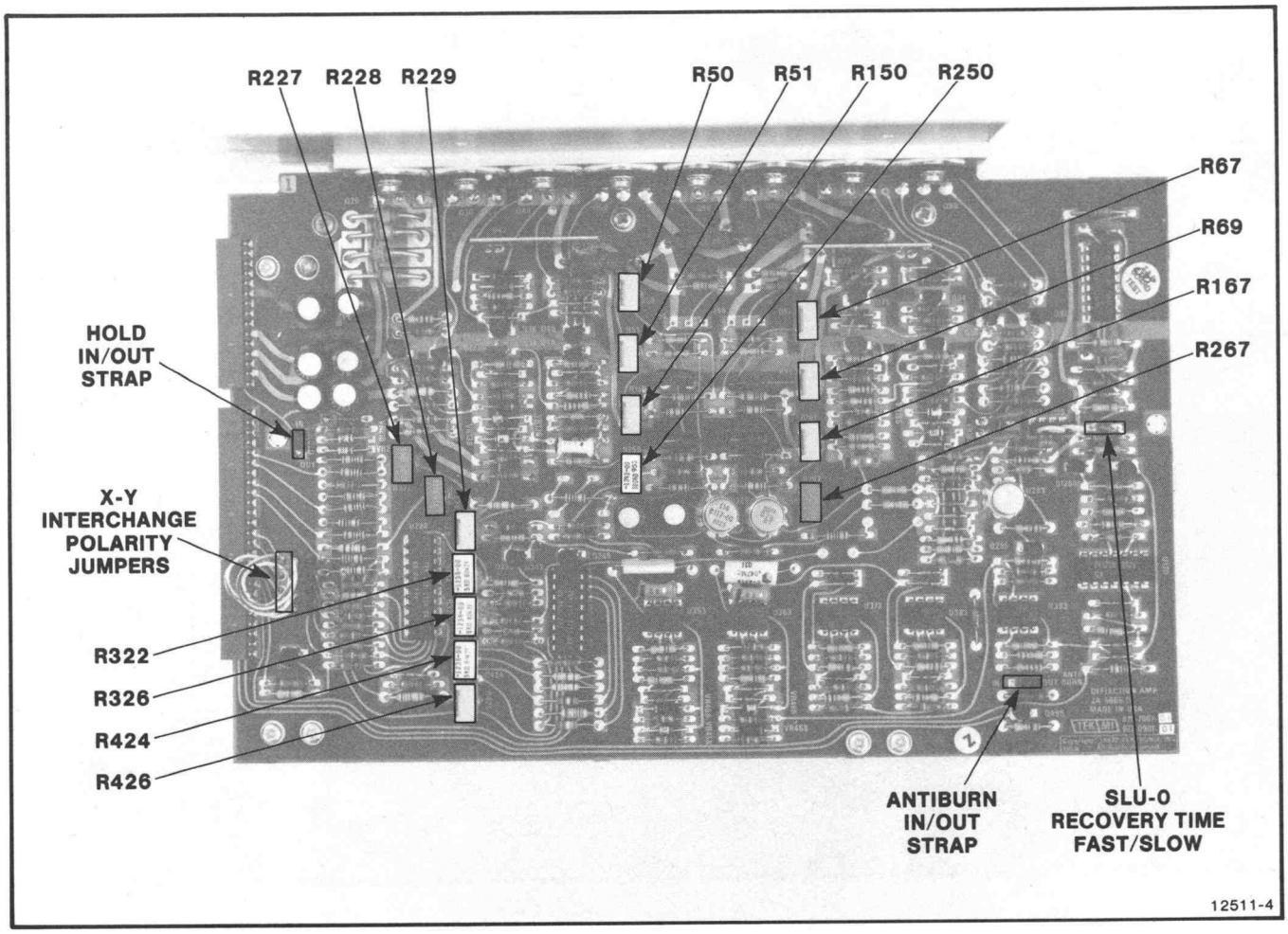


Figure 4-4. Deflection Amplifier Board Adjustments, Straps, Jumpers, and Test Points.

14. **Make sure** that the harmonica plugs are correcly installed on the Hard Copy board, and that no parts are shorted together. Also, make sure that the Danger Warning is in place on the plastic shield. Check the attaching screws for secureness.

ADJUSTMENT PROCEDURE

WARNING

Hazardous voltages are present in the 4114 circuitry when the power is on. Always use proper servicing techniques to avoid being injured or killed. Only qualified service technicians should perform the following adjustment procedure.

Low Voltage Power Supply

1. **Connect** the terminal power cord to the ac voltage source.

2. **Turn** the 4114 terminal POWER switch on.

CAUTION

Observe the crt for the first minute to insure that the beam does not remain in one spot with high intensity for more than a few seconds. This would cause a permanent deterioration of the crt phosphor in that spot. If a bright spot appears, turn off the 4114 immediately.

3. **Erase** the crt by pressing the PAGE key.

4. **Connect** the digital voltmeter probe to the +15 V test point on the Interconnect board. The voltage test points on the Interconnect board are all located in the rear left-hand corner of the board. For a more precise location of these test points, refer to the Interconnect Board Component Location photograph in the schematic section of the 4114 service manual.

5. **Adjust** R166 (at the upper right of LVPS board) for a reading of +14.97 to +15.03 V.

6. **Check** the +5 V test point on the Interconnect board for a reading of 4.80 to 5.20 V.

7. **Check** the remaining voltage test points on the Interconnect board for the following values:

Test Point	Value
-15 V (regulated)	-14.85 V to -15.15 V
+12 V (unregulated)	no tolerance (about +9 V)
-12 V (unregulated)	no tolerance (about -9 V)
+20 V (unregulated)	no tolerance
-20 V (unregulated)	no tolerance
+175 V (unregulated)	no tolerance
+290 V (regulated)	+287.0 V to +293.0 V
+490 V (unregulated)	no tolerance

8. **Set up** the oscilloscope -- 0.5 V/div, 10 us /div, ac coupled -- and check to see that the following ripple voltages are within range. These are measured at the same Interconnect board test points that the dc voltages were measured at.

Test Point	Value
+15 V (regulated)	5 mV p-p max
-15 V (regulated)	5 mV p-p max
+5 V (regulated)	10 mV p-p max
+12 V (unregulated)	1.5 V p-p max
-12 V (unregulated)	1.5 V p-p max
+20 V (unregulated)	1.2 V p-p max
-20 V (unregulated)	1.2 V p-p max
+175 V (unregulated)	7.0 V p-p max
+290 V (regulated)	100 mV p-p max
+490 V (unregulated)	5 V p-p max

High Voltage Check

WARNING

The following measurement involves a potentially lethal voltage. Use extreme care when making this measurement.

Use the 10X high voltage probe of the digital voltmeter to check Pin 3 of the crt for a reading of -570.0 V to -630.0 V (the actual voltage is -5700 V to -6300 V).

Storage Board Adjustments

CAUTION

The $\pm$X and the $\pm$Y signals from the Vector Generator board should be checked if the 4114 pedestal is not adjusted prior to adjusting the Display Module. If these signals are not correct, the crt patterns which follow will not be positioned on the crt correctly. The $\pm$X signals should range from +5.00 V to -5.00 V and the $\pm$Y signals should range from +3.75 V to -3.75 V (see the Vector Generator board adjustment procedure in the standard 4114 service manual).

All the test points and adjustments on the Storage board are located across the top edge of the Storage board. See Figure 4-3.

1. **Set** the digital voltmeter to 1 Vdc.
2. **Connect** the digital voltmeter probe to TP 91 (the flood gun anode).
3. **Check** for a voltage of 142.5 V to 157.5 V.

4. **Connect** the digital voltmeter probe to TP 94.

NOTE

Overhead lighting may affect how bright the crt seems to the viewer during the following adjustment.

5. **Adjust** R295 (the OP LEVEL adjustment -- at the top edge of the Storage board) so that the crt gets bright but does not store.

6. **Note** this voltage as the OP Level voltage.

7. **Remove** the digital voltmeter probe from TP 94 and connect it to TP 93 (CE-2).

8. **Adjust** R198 (the CE-2 adjustment -- at the top edge of the Storage board) so that the flood gun pattern is within 1/16-inch from the crt target edge, that is, the edge of the phosphor.

9. **Note** this voltage (this is the CE-2 voltage). Then remove the probe from TP 93 and attach it to TP 92.

10. **Adjust** R197 (the CE-1 adjustment -- at the top edge of the Storage board) to illuminate the target background uniformly. Make sure the corners of the crt screen are at the same level of brightness as the center.

11. **Check** for oscillation in the background illumination. If background oscillation is present, readjust CE-1. CE-1 is typically 5 to 10 V higher than CE-2. Note that there may be some interaction between R196 and R197.

12. **Connect** the digital voltmeter probe to TP 91 (the flood gun anode).

13. **Press** the PAGE key. This should erase the screen.

14. **Make sure** that the flood gun anode voltage does not change during an erase of the screen.

Storage Board Erase Waveforms

1. **Set** the oscilloscope as follows:

   - o V/div to 50V/div
   - o time/div adjustment to 0.1 sec/div
   - o Source to channel 1 (using 10X probe)
   - o Trigger Mode to "Normal"
   - o Trigger level to "+"
   - o ac/GND/dc to dc

WARNING

Always disconnect the ac power cord AND wait at least 60 seconds before moving the test jumper on the Storage board or moving ANY jumpers on ANY boards. The capacitors on the Low Voltage Power Supply board discharge to a safe level in 60 or more seconds. It is a good idea to monitor the +490 or +290 V supplies with the DVM as they are discharging as a added safety measure before touching the boards to remove the jumpers.

2. **Disconnect** the ac power cord and wait at least 60 seconds before continuing.

3. **Remove** the test jumper (on the bottom of the Storage board) from the "N" position and place the jumper in the "TEST" position. The jumper may be left in the TEST position while making oscilloscope waveform checks on the Storage board but must be moved back to the "N" position when making voltage checks with the digital voltmeter. If the jumper is not used in the "TEST" position, the crt screen must be erased for each waveform check.

4. **Reconnect** the ac power cord and turn the 4114 on.

5. **Note** that the crt goes into Hold mode and erases every three seconds.

6. **Set** the oscilloscope trigger mode to "AUTO".

7. **Adjust** the oscilloscope vertical positioning so that ground reference is lined up with the second graticule line from the bottom of the oscilloscope screen.

8. **Set** the trigger mode to "NORMAL".

9. **Connect** the oscilloscope probe to TP 94.

10. **Refer** to the target erase waveform (Figure 4-5) and do the following:

    a. Verify that the second positive-going ramp (c) is between 600 and 900 ms long.

    b. Verify that the most negative portion of the waveform falls between 0 V and +25 V.

    c. Verify that the pulse height (a) is 135 V to 165 V above the OP level. For example, if the OP level is 150 V, the pulse height must be between 285 V and 315 V.

11. **Set** the oscilloscope time/div adjustment to 20 ms/division.

12. **Observe** the first ramp, shown as (b) in Figure 4-5.

13. **Refer** to Figure 4-6, which shows the first ramp of the target erase waveform in more detail.

    a. Verify that the time between pulses is 85 ms to 115 ms.

    b. Verify that the ramp time is a minimum of 65 ms. Also make sure that the end of the ramp is not less than 80% of the OP Level value. For example, if the OP Level is 150 V, the end of the first ramp should not fall below 120 V (0.8 x 150 V).

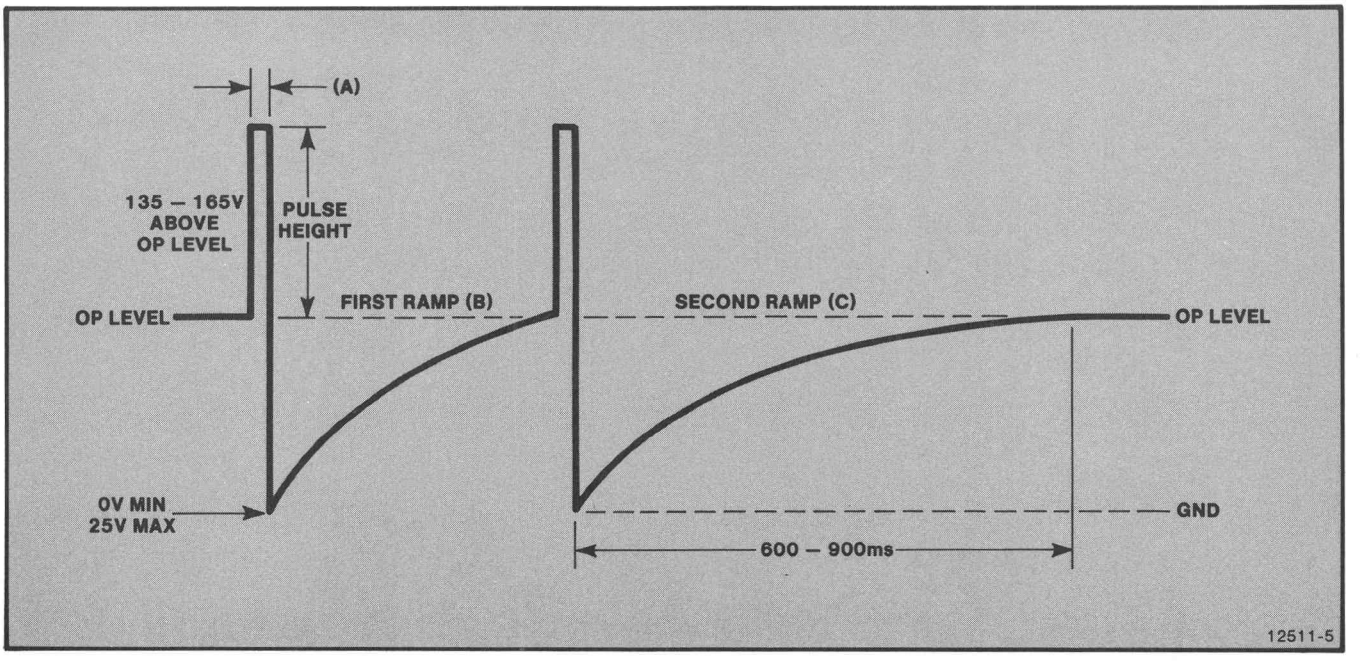


Figure 4-5. Target Erase Waveform.

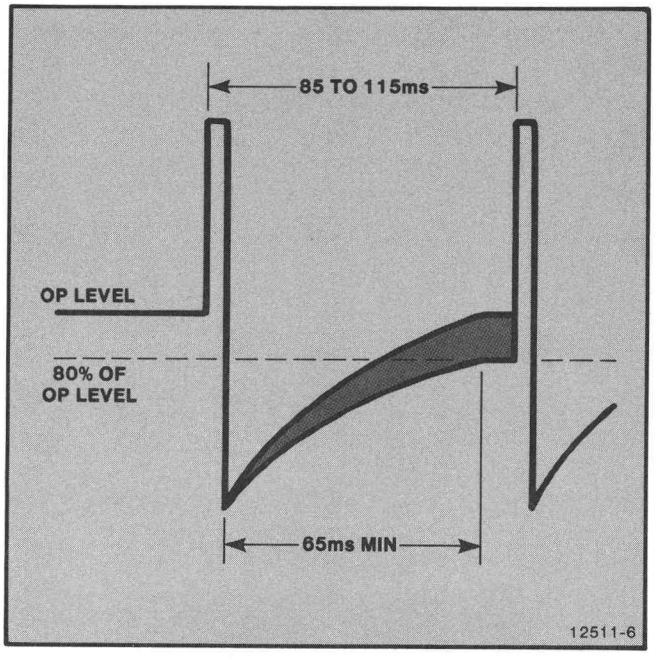


Figure 4-6. First Ramp of Target Erase Waveform.

14. **Set** the oscilloscope time/div adjustment to 0.5 ms/div.

15. **Adjust** the oscilloscope so that the OP LEVEL trace is at the center of the oscilloscope graticule.

16. **Observe** the pulse waveform shown in Figure 4-7. This waveform is also indicated as (a) in Figure 4-5.)

17. **Verify** that the pulse, as measured from half way up its rising and falling edges, has from 1.7 ms to 2.3 ms pulse width. (This check measures both positive pulses).

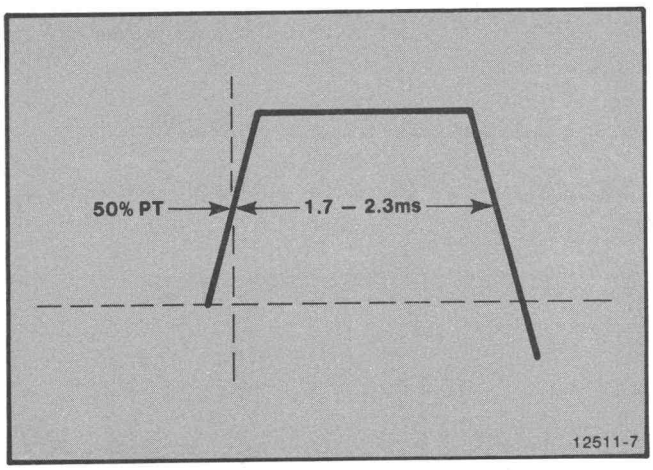


Figure 4-7. Target Erase Pulse Waveform.

18. **Connect** the oscilloscope probe to TP 93.

19. **Set** the oscilloscope time/div adjustment to 50 ms/division.

20. **Do** the following using the waveform in Figure 4-8:

    a. Verify that the first ramp time is greater than 70 ms. Also, make sure that the end of the ramp is at least 75% of the CE-2 level. For example, if the CE-2 level is 60 V, the end of the first ramp should not fall below 45 V (0.75 x 60 V).

b. Verify that the second ramp is 70 to 120 ms long.

c. Verify that the beginning of both ramps is between 0 V and +15 V.

d. Verify that the time between pulses is 85 ms to 115 ms.

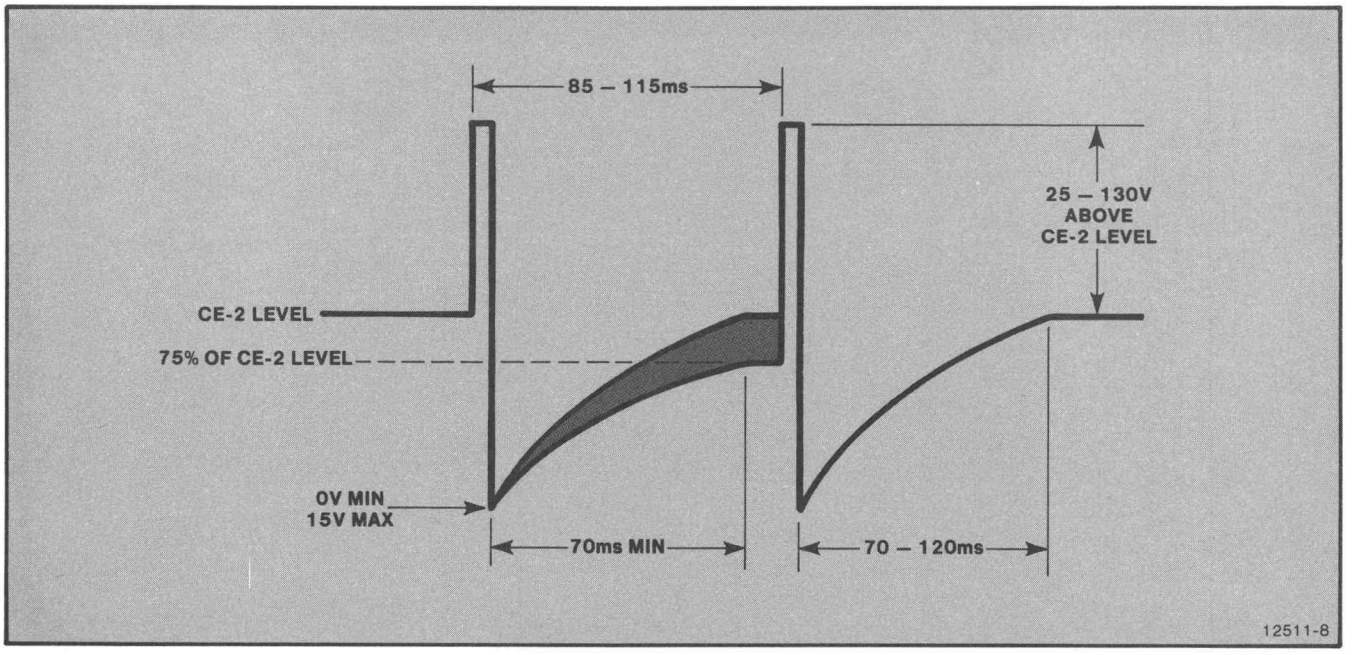


Figure 4-8. CE-2 Waveform.

21. **Connect** the oscilloscope probe to TP 92.

22. **Set** the oscilloscope time/div adjustment to 20 ms/division.

23. **Observe** the waveform in Figure 4-9 and make sure that the time from the beginning of the first pulse to the beginning of the second pulse is 85 to 115 ms.

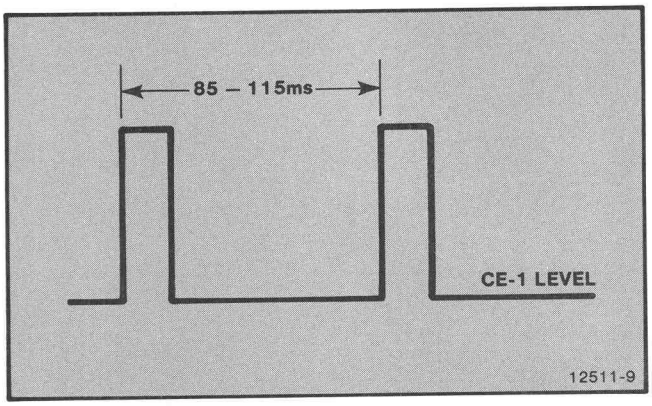


Figure 4-9. CE-1 Waveform.

24. **Adjust** R95 (CE-1 pulse control, on the top edge of the Storage board) while erasing the crt and observe the edges of the crt for full coverage. Usually, the erase covers the full screen when R95 is turned fully clockwise or very close to fully clockwise. If no change is noticed during this adjustment, leave R95 adjusted at 90% clockwise.

25. **Adjust** R195 (the CE-2 pulse control, at the top edge of the Storage board) while erasing. At the same time, make sure that the erase extends fully to the corners of the screen.

NOTE

The OP LEVEL, CE-1, and CE-2 adjustments interact. Because of this, slight readjustment of the OP LEVEL, CE-1 level, CE-2 level, and CE-2 pulse may be required to make the crt screen look right. Readjust if necessary for proper background appearance, full screen target coverage, and full screen erasing.

26. **Turn** off the 4114, disconnect the ac power cord, and wait 60 seconds before continuing.

WARNING

Always disconnect the ac power cord and wait at least 60 seconds before moving the test jumper on the Storage board or moving ANY jumpers on ANY of the boards. The capacitors on the Low Voltage Power Supply board discharge to a safe level in 60 seconds or more. As an added safety measure, it is a good idea to watch the +490 or the +290 V supplies discharge using the DVM while the display is unplugged.

27. **Remove** the test jumper from the "TEST" position and reinstall it in the "N" position.

28. **Reconnect** the ac power cord and apply power to the 4114.

Flood Gun Anode

1. **Connect** the oscilloscope probe to TP 91 on the Storage board.

2. **Set** the oscilloscope time/div adjustment to 2 ms/division.

3. **Press** the PAGE key. This restarts the Hold mode timer.

4. **Verify** that the terminal enters Hold mode 90 and 135 seconds after pressing the PAGE key.

5. **Refer** to the waveform in Figure 4-10 while the crt is in Hold mode.

a. Verify that the positive pulse is 12% to 16% of the period of the waveform. This represents a duty cycle of 12% to 16%. It may be easier to see if the time/division on the oscilloscope is taken out of the calibrated position and the positive and negative transitions of the waveform are aligned with the graticule of the oscilloscope. The period of the waveform, however, must have a real time of 8.3 to 12.5 ms.

b. Verify that the most negative part of the waveform is -15 V.

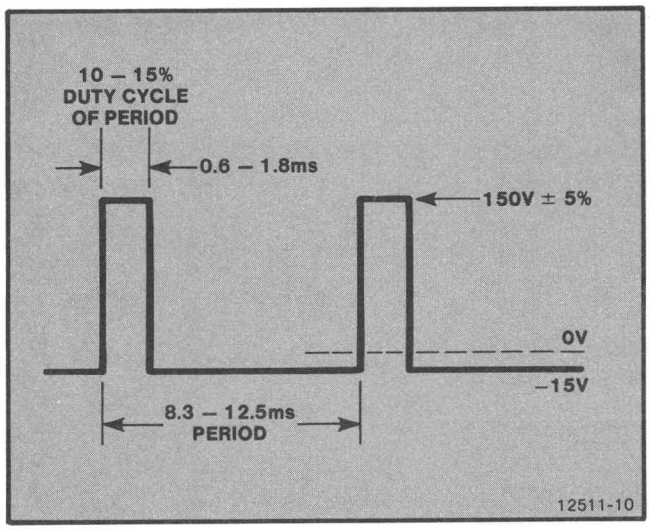


Figure 4-10. Flood Gun Anode Waveform.

6. **Connect** the digital voltmeter probe to Pin 43 (DBUSY) on the Interconnect board. (Refer to the Interconnect Board Component Location photograph in the schematic section of the 4114 service manual.)

7. **Check** for less than 0.8 V (TTL low) during Hold mode.

8. **Remove** the oscilloscope probe from the Storage board.

Grid Bias

WARNING

Always disconnect the ac power cord and wait at least 60 seconds before moving the ANTIBURN strap on the Deflection Amplifier board or moving ANY jumpers on ANY of the boards. The capacitors on the Low Voltage Power Supply board discharge to a safe level in 60 seconds or more. As an added safety measure, it is a good idea to watch the +490 or the +290 V supplies discharge using the DVM while the display is unplugged.

1. **Disconnect** the ac power cord and wait 60 seconds before continuing.

2. **Change** the ANTIBURN strap on the Deflection Amplifier board from the "IN" position to the "OUT" position.

3. **Reconnect** the ac power cord and reapply power to the 4114.

4. **Use** the cursor for the following adjustments.

NOTE

For the location of the following High Voltage and Z-Axis board adjustments, Figure 4-1 in the beginning of this section may be helpful.

5. **Adjust** R431 (the CRT BIAS adjustment, in the middle of the High Voltage and Z-Axis board) slowly clockwise until a low intensity dot appears in one corner of the cursor. Retrace lines will also appear in an area around the cursor.

6. **Adjust** R471 (Center Focus adjustment, on the upper right of the High Voltage and Z-Axis board) for a sharp, focused dot.

7. **Adjust** R431 until the dot just disappears. Erase the display if the dot stores while making the CRT BIAS adjustment.

8. **Measure** the voltage at the upper end of C438 (lower right side of the High Voltage and Z-Axis board) with the digital voltmeter and adjust R431 counterclockwise until the reading increases by +5 V.

9. **Disconnect** the ac power cord and wait at least 60 seconds before continuing.

10. **Change** the ANTIBURN strap from the "OUT" position to the "IN" position.

11. **Reconnect** the ac power cord and reapply power to the 4114.

Normal Intensity

1. **Connect** the oscilloscope probe to the top of R637 (the 20K resistor near the center of the High Voltage and Z-Axis board).

2. **Set** the oscilloscope V/div adjustment to 10 V/division and the time/div adjustment to 2 ms/division.

3. **Hold** down a character key in order to repeat the key.

4. **Adjust** R716 to 40 V measuring from the top of the small pulses to the top of the large pulses. See Figure 4-11.

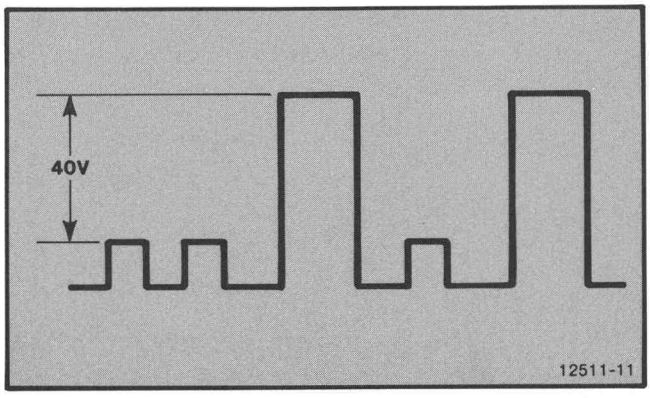


Figure 4-11. Normal Intensity Waveform.

Origin Shift

Press PAGE eight times and watch the cursor move down and to the left seven times. The eighth time it returns to the upper right (adjusting the REFRESH INTENSITY control may make the cursor easier to see).

Self Test Patterns

The rest of the adjustment procedure uses patterns that are stored in ROMs in the 4114 pedestal. Whenever these patterns are needed, use the following procedure to display the appropriate pattern on the crt screen.

1. **Press** the SELF TEST button and hold it in. This button is located on the front of the pedestal, below the keyboard, to the left of the MASTER RESET button.

2. **Press** the MASTER RESET button and then release it. The keyboard LED lights come on and go off as different parts of circuitry are tested.

3. **Check** that keyboard LED lights have begun to "cycle," then release the SELF TEST button. The 4114 bell sounds at the start of the Self Test key check.

4. **Press** and hold the CONTROL and C keys at the same time until the keyboard lights acknowledge that the keys have been pressed, and then release them. This displays a general "menu," which is a list of Self Test routines.

5. **Select** Display from this menu. This displays a second menu of the patterns to be used in adjusting the screen.

Self Test has the following "commands" which can be used at any point in the Adjustment Self Test procedure.

- CONTROL C. Displays the general menu.
- CONTROL D. Displays the current menu.
- CONTROL E. Exits from the current routine.
- SPACE BAR. Repeats the current pattern.

Once the display "menu" has been called from memory, it is not necessary to repeat the rest of the Self Test in order to get the patterns needed for the Display Module adjustment. Simply use CONTROL D to get back to the display "menu," and select the desired test pattern from this menu. In the rest of the adjustment procedure (such as in the SLU-0 test section, which calls for displaying the X COMP pattern using the Self Test), go back only to the display menu using CONTROL D and do not repeat the previous part of the Self Test.

Frequency Compensation

1. **Display** the X COMP pattern using the Self Test procedure. (Adjusting the REFRESH INTENSITY control may make this pattern easier to see.)

2. **Adjust** R51 and R150 on the Deflection Amplifier board so that only one line can be seen. See Figure 4-12.

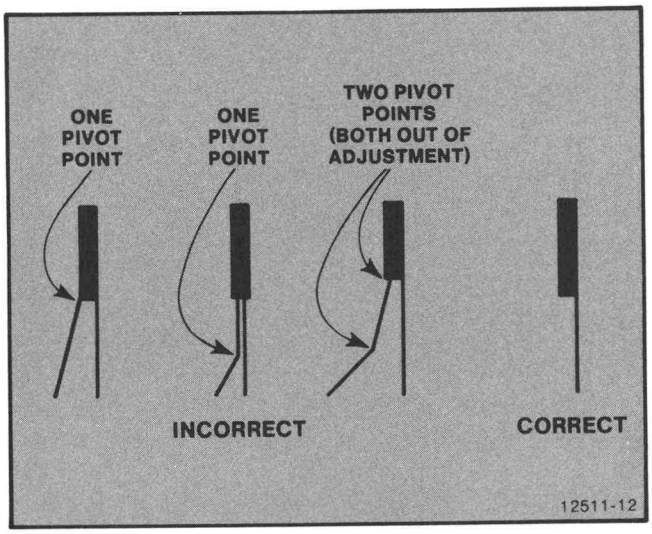


Figure 4-12. Frequency Compensation Pattern.

3. **Display** the Y COMP pattern using the Self Test procedure.

4. **Adjust** R69 and R167 on the Deflection Amplifier board so that only one line can be seen. Again refer to Figure 4-12.

Gain, Positioning, and Geometry (Including Yoke Adjustment)

NOTE

The following part of the adjustment procedure requires that the Display Controller and Vector Generator boards have been adjusted. If they have not been previously adjusted prior to starting the adjustment procedure for the display and they are far out of adjustment, it may not be possible to check accurately for gain, positioning, and geometry. To adjust these boards, see the respective adjustment procedures located in the 4114 service manual.

1. **Display** the GAIN pattern using the Self Test procedure. Note that this pattern alternates between Storage and Write-Thru modes if the SPACE BAR is pressed.

2. **Adjust** the REFRESH INTENSITY control (on the bezel) so that the lines do not store in Refresh mode.

3. **Adjust** the yoke using a 5/16-inch nut driver. Loosen the yoke adjustment nut and rotate the yoke so that the center vertical line is equidistant from both the left and right edges of the chassis. For example, if the top of the center vertical line is 9.85 inches from the right-hand side of the chassis, the bottom of the same center vertical line should also be 9.85 inches from the right edge of the chassis. Conversely, the top and bottom measurements from the left edge of the chassis should be the same. Since the chassis is mechanically square, the vertical line should now be lined up square in relation to the chassis.

4. **Adjust** R250 (the Long Axis Positioning control, at the bottom right of the Deflection Amplifier board) and R50 (the Long Axis Gain control, at the bottom left of the Deflection Amplifier board) so that the midpoint of the left and right vertical display lines is the same distance from the left and right edges of the crt screen (or crt filter).

5. **Adjust** R267 (the Short Axis Positioning control, at the top right of the Deflection Amplifier board) and R67 (the Short Axis Gain control, at the top left of the Deflection Amplifier board) so that the midpoint of the top and bottom horizontal lines is the same distance from the top and bottom of the crt screen (or crt filter).

6. **Adjust** R326 (the Long Axis Geometry control, at the lower center of the Deflection Amplifier board) for the straightest top horizontal line.

7. **Make sure** that the bottom horizontal line is adjusted so that any deviations of the line fall equally above and below a line placed horizontally through the middle (a clear straight edge may be used for this measurement). The deviations above and below this horizontal line cannot exceed 3/16 of an inch on either side of the horizontal line. If the deviation does exceed 3/16 of an inch, a compromise between the top and bottom horizontal lines must be made while trying to keep the top line as as straight as possible.

8. **Adjust** R322 (the Short Axis Geometry control, at the lower center of the Deflection Amplifier board) for the straightest left-hand vertical line.

9. **Pass** a straight edge vertically through the right-hand vertical line of the display pattern to measure the straightness of the right-hand vertical line. (This procedure is similar to the procedure for measuring the straightness of the bottom horizontal line.) Any deviations of the display line should fall equally on both sides of the straight edge and should not exceed 1/8 of an inch on either side of the straight edge. If the display line does fall outside these limits, a compromise must be made between the left-hand and right-hand display lines while keeping the left-hand line as straight as possible.

NOTE

Adjusting the geometry in one axis affects the gains in the other. Readjustments in gain, therefore, are necessary when making geometry adjustments.

10. **Tighten** the yoke adjustment nut and recheck the line straightness.

Orthogonality

Make sure when the center vertical display line has been aligned that the angle between the intersection of the center vertical line and the center horizontal line is not more than 91.2 degrees or less than 88.8 degrees.

NOTE

A compromise between line straightness and orthogonality may be made as long as both are within the tolerances stated previously and are made at the same yoke setting.

Dynamic Focus

1. **Call up** the GAIN pattern using the Self Test procedure.
2. **Attach** the scope probe to the upper end of R26 (on the High Voltage and Z-Axis board).
3. **Adjust** R424 (the Dynamic Focus control, at the lower center of the Deflection Amplifier board) so that the lowest portion of the waveform changes less than 2 volts as R21 (CORNER FOCUS adjustment -- High Voltage and Z-Axis board) is ranged from one extreme to the other. See Figure 4-13.
4. **Remove** the oscilloscope probe.

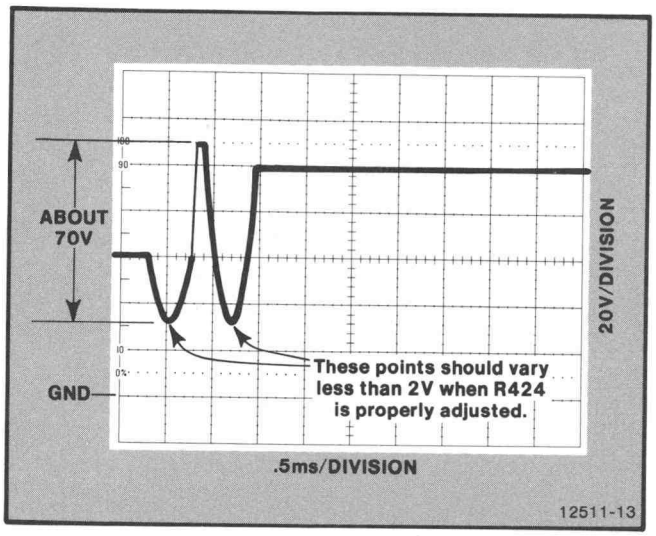


Figure 4-13. Dynamic Focus Waveform.

SLU-0

1. **Display** the X COMP pattern using the Self Test procedure.

2. **Set** the oscilloscope time/div adjustment to 20 us/division and the volts/div adjustment to 2 V/division. Set the slope adjustment to "-".

3. **Connect** the oscilloscope probe to Pin 36 (SLU-0) on the Interconnect board. (Refer to the component location photograph in the 4114 service manual.)

4. **Check** for a TTL pulse (a low of less than 0.8 V and a high of greater than 4 V).

5. **Remove** the oscilloscope probe.

FOCUS

1. **Display** the FOCUS pattern using the Self Test procedure.

2. **Adjust** R471 (the Center Focus adjustment, at the upper right of the High Voltage and Z-Axis board) while characters are being displayed for the sharpest characters at the center of the crt.

3. **Adjust** R21 (the Corner Focus control, at the lower center of High Voltage and Z-Axis board) while characters are being displayed for a compromise between the
sharpest characters at all four corners of the crt.

Dropout

1. **Display** the HARD COPY pattern using the Self Test procedure and wait 2-1/2 minutes. This allows the display to drop into Hold mode.

2. **Bring** the display out of Hold mode by pressing the SHIFT key.

3. **Increase** the OP LEVEL adjustment or the NORMAL INTENSITY adjustment or both in 5 V increments if breaks occur in the Hard Copy pattern. Repeat the Hard Copy pattern for the best picture with a minimum number of breaks. An example of dropout is shown in Figure 4-14.

4. **Check** FOCUS again if NORMAL INTENSITY adjustments are made.

5. **Check** the CE-1, CE-2, display gain, and positioning adjustments if OP Level adjustments are made.

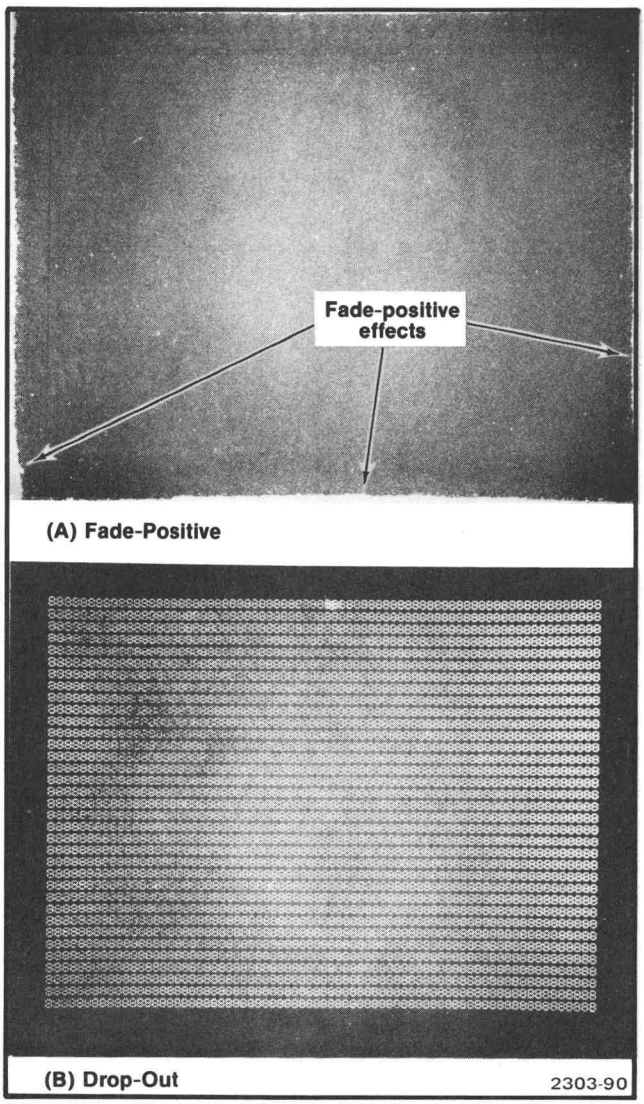


Figure 4-14. Display Conditions.

6. **Make sure** that the final setting of the NORMAL INTENSITY adjustment does not exceed 55 V. If it does and the storage specifications cannot be met by adjusting the OP LEVEL adjustment, by adjusting the collimation voltages, and by reducing the intensity to 55 V or less, THE CRT SHOULD BE REPLACED.

Brite Intensity and Defocus

1. **Display** the DEFOCUS pattern using the Self Test procedure.

2. **Attach** the oscilloscope probe to R637 (the 20K resistor where the Normal Intensity measurement is made).

3. **Adjust** R715 (the Brite Intensity control, at the lower corner of the High Voltage and Z-Axis board) to 10 V higher than the NORMAL INTENSITY adjustment. See Figure 4-15.

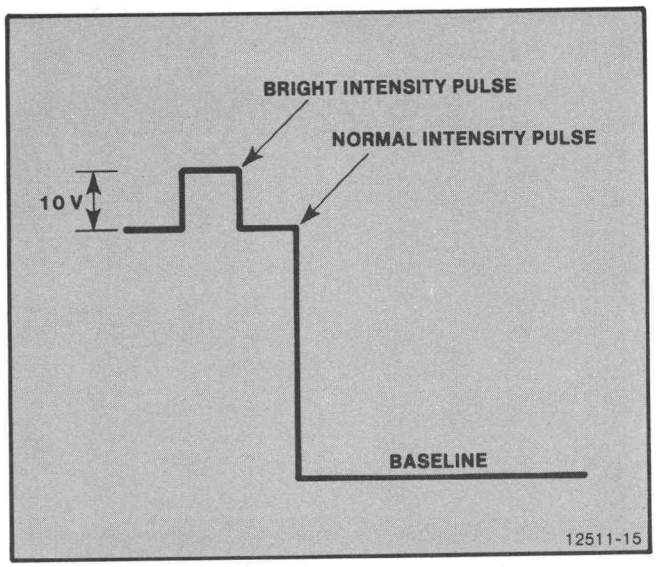


Figure 4-15. Brite Intensity Pulse.

4. **Remove** the oscilloscope probe.

5. **Repeat** the DEFOCUS pattern by pressing the SPACE BAR.

6. **Adjust** R115 (the Defocus adjustment, at the lower left of the High Voltage and Z-Axis board) while characters are being displayed until there is a noticeable difference in characters.

Writethru Intensity

1. **Exit** Self Test by pressing the CONTROL and E keys at the same time.

2. **Press** the LOCAL key. The LED light should remain lit.

3. **Press** the ESC key and then hold the CONTROL and Z keys down at the same time. This produces a set of crosshairs on the screen. The position of the crosshairs can be controlled by the thumbwheels on the keyboard.

4. **Turn** the front panel REFRESH INTENSITY control fully counter-clockwise.

5. **Adjust** R425 (the Coarse Writethru adjustment, at the lower right side of the High Voltage and Z-Axis board) so that the crosshairs are not visible. Turn the front panel REFRESH INTENSITY control clockwise. The crosshairs should become visible and should store when the control is turned fully clockwise.

Hard Copy

1. **Connect** a 4631 Hard Copy Unit to the Display Module.

2. **Set** the digital voltmeter to 2 Vdc.

3. **Display** the HARD COPY pattern using the Self Test procedure.

4. **Press** the HARD COPY key on the 4114 terminal.

5. **Check** to see that the crt screen decreases in intensity during the hard copy scan.

6. **Check** DBUSY (Pin 43 on the Interconnect board) for a TTL low of less than 0.8 V during the hard copy scan.

7. **Adjust** R415 (the Hard Copy Intensity adjustment, at the side of the High Voltage and Z-Axis board) for a visible sweep which does not store on the screen during the scan. This is a rough adjustment.

8. **Adjust** the following potentiometers during a hard copy scan so that the sweep length and position correspond to an area 1/4-inch larger than the pattern being hard-copied (1/8-inch larger on each edge).

   a. R229 (the Hard Copy Long Axis Positioning adjustment, at the lower center of the Deflection Amplifier board).

   b. R426 (the Hard Copy Short Axis Positioning adjustment, at the lower center of the Deflection Amplifier board).

   c. R228 (the Hard Copy Short Axis Gain adjustment, at the lower center of the Deflection Amplifier board).

   d. R227 (the Hard Copy Long Axis Gain adjustment, at the lower center of the Deflection Amplifier board).

9. **Press** the HARD COPY key.

10. **Adjust** R415 (the Hard Copy Intensity adjustment, at the side of the High Voltage and Z-Axis board) to its optimum point. Adjust the display to be as bright as possible without storing on the screen.

11. **Adjust** R26 (the Hard Copy Threshold adjustment, in the center of the Hard Copy Amplifier board) for the highest contrast copies without adding extra "noise" markings.

12. **Make** three copies and compare them for acceptability.

NOTE

Hard copy acceptability is a visual judgement. Some things to look for are:

- **Characters that look whole with no** dropout or excessive bleeding (filling in).
- **Vectors with no more than three** breaks of which none are larger than the width of a line.
- **A minimum of "noise" markings (random** dark spots). Some "noise" may be acceptable.

If the hard copy is not acceptable, slight readjustment of the OP LEVEL, CE-1, CE-2, Normal Intensity, and focus adjustments may improve the hard copy.

13. **Record** the OP LEVEL, CE-1, and CE-2 adjustment values and the crt serial number on the crt adjustment tag.

15. **Erase** the crt using the PAGE key.

16. **Turn off** the terminal.

17. **Reinstall** the cabinet cover and front panel.

Section 5

MAINTENANCE

INTRODUCTION

This section supplements the Maintenance section of the 4114 service manual.

There are no changes to any of the cleaning, parts replacement, or removal/replacement procedures as located in the 4114 service manual. All locations of screws which must be removed to remove assemblies are the same. The subassemblies of the Display Module remain the same as the 4114 standard display.

SELF TEST results, testing, coding, and patterns all remain the same for the Option 31.

Figure 5-1 shows the interior of the Option 31 display with the subassemblies outlined. There are only two distinct mechanical differences that can be found in comparing Figure 5-1 to the corresponding one in the 4114 service manual. These are (a) the crt shield is about 1-1/2 inches shorter on the Option 31 and (b) the Option 31 display has two yoke adjustment holes in the shield (only the one furthest forward provides access to the yoke).

Also note the same yoke is used for the 100-degree deflection crt as is used for a standard 4114 90-degree deflection crt. The locations of the yoke adjustment nut, the nut loosened to remove the yoke, and the yoke wires are the same.

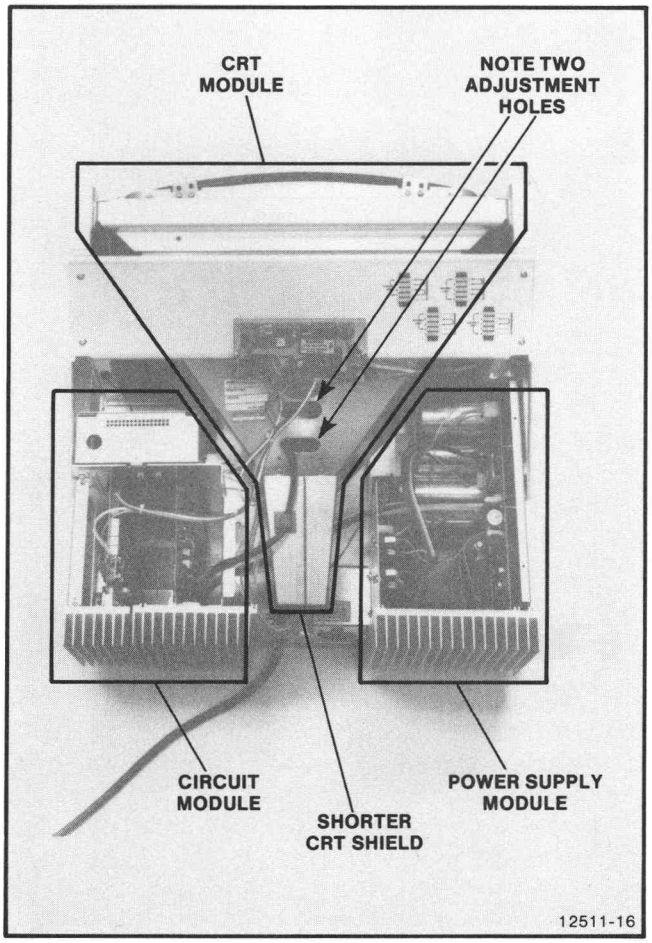


Figure 5-1. Top View of 4114 Option 31 with Display Module Subassemblies Outlined.

Section 6
REPLACEABLE PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
\- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
\- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
\- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000CA	MOLEX	2222 WELLINGTON COURT	LYLE, ILLINOIS 60532
00853	SANGAMO ELECTRIC CO., S. CAROLINA DIV.	P O BOX 128	PICKENS, SC 29671
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02735	RCA CORPORATION, SOLID STATE DIVISION	ROUTE 202	SOMERVILLE, NY 08876
02777	HOPKINS ENGINEERING COMPANY	12900 FOOTHILL BLVD.	SAN FERNANDO, CA 91342
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
09023	CORNELL-DUBILIER ELECTRONIC DIVISION FEDERAL PACIFIC ELECTRIC CO.	2652 DALRYMPLE ST.	SANFORD, NC 27330
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
12969	UNITRODE CORPORATION	580 PLEASANT STREET	WATERTOWN, MA 02172
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
14752	ELECTRO CUBE INC.	1710 S. DEL MAR AVE.	SAN GABRIEL, CA 91776
15454	RODAN INDUSTRIES, INC.	2905 BLUE STAR ST.	ANAHEIM, CA 92806
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
24546	CORNING GLASS WORKS, ELECTRONIC COMPONENTS DIVISION	550 HIGH STREET	BRADFORD, PA 16701
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
27264	MOLEX PRODUCTS CO.	5224 KATRINE AVE.	DOWNERS GROVE, IL 60515
32997	BOURNS, INC., TRIMPOT PRODUCTS DIV.	1200 COLUMBIA AVE.	RIVERSIDE, CA 92507
34371	HARRIS SEMICONDUCTOR, DIV. OF HARRIS CORPORATION	P. O. BOX 883	MELBOURNE, FL 32901
50434	HEWLETT-PACKARD COMPANY	640 PAGE MILL ROAD	PALO ALTO, CA 94304
52306	HIGH VOLTAGE DEVICES, INC.	7485 AVENUE 304	VISALIA, CA 93277
52833	KEYTRONIC CORP., OCR DIV.	SPOKANE INDUSTRIAL PK., P. O. BOX 14687	SPOKANE, WA 99214
55680	NICHICON/AMERICA/CORP.	6435 N PROESEL AVENUE	CHICAGO, IL 60645
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
63743	WARD LEONARD ELECTRIC CO., INC.	31 SOUTH ST.	MOUNT VERNON, NY 10550
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
71482	CLARE, C. P., AND CO.	3101 PRATT BLVD.	CHICAGO, IL 60645
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
74276	SIGNALITE DIV., GENERAL INSTRUMENT CORP.	1933 HECK AVE.	NEPTUNE, NJ 07753
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
75915	LITTELFUSE, INC.	800 E. NORTHWEST HWY	DES PLAINES, IL 60016
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET P. O. BOX 372	INDIANAPOLIS, IN 46206
90484	ITT, SURPRENANT DIV.	172 STERLING STREET	CLINTON, MA 01510
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
95987	WECKESSER CO., INC.	4444 WEST IRVING PARK RD.	CHICAGO, IL 60641

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A11	670-5163-01			CKT BOARD ASSY:INTERCONNECT	80009	670-5163-01
A12	670-4798-04			CKT BOARD ASSY:LV POWER SUPPLY	80009	670-4798-04
A13	672-0795-03			CKT BOARD ASSY:STORAGE	80009	672-0795-03
A13A1	670-6127-XX			(NOT REPLACEABLE SEE A13)		
A14	670-3097-01			CKT BOARD ASSY:HARD COPY AMPL	80009	670-3097-01
A15	672-0998-00			CKT BOARD ASSY:DEFL AMPL	80009	672-0998-00
A15A1	670-7007-XX			(NOT REPLACEABLE SEE A15)		
A16	672-1000-00			CKT BOARD ASSY:HV & Z AXIS	80009	672-1000-00
	----- -----			(OPTION 31 ONLY)		
A16A1	670-7264-XX			(NOT REPLACEABLE SEE A16)		
				A11 INTERCONNECT		
A11	670-5163-01			CKT BOARD ASSY:INTERCONNECT	80009	670-5163-01
A11J10	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
	----- -----			(QUANTITY OF 10)		
A11J20	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
	----- -----			(QUANTITY OF 10)		
A11J80	131-1976-00			TERM. SET,PIN:15 MALE CONT	27264	09-60-1151
A11J130	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
	----- -----			(QUANTITY OF 29)		
A11J230	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
	----- -----			(QUANTITY OF 25)		
A11J330	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
	----- -----			(QUANTITY OF 27)		
A11J430	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
	----- -----			(QUANTITY OF 20)		
A11J530	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL	22526	47350
	----- -----			(QUANTITY OF 27)		

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				A12 LV POWER SUPPLY		
A12	670-4798-04			CKT BOARD ASSY:LV POWER SUPPLY	80009	670-4798-04
A12C1	290-0799-00			CAP.,FXD,ELCTLT:300UF,+100-75%,300V	56289	OBD
A12C40	290-0002-00			CAP.,FXD,ELCTLT:8UF,+50-10%,450V	09023	BR8-450
A12C42	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
A12C48	281-0770-00			CAP.,FXD,CER DI:0.001UF,20%,100V	72982	8035D9AADX5R102M
A12C55	290-0718-00			CAP.,FXD,ELCTLT:22UF,20%,35V	56289	196D226X0035PE4
A12C61	281-0772-00			CAP.,FXD,CER DI:0.0047UF,10%,100V	04222	GC701C472K
A12C101	290-0799-00			CAP.,FXD,ELCTLT:300UF,+100-75%,300V	56289	OBD
A12C111	290-0968-00			CAP.,FXD,ELCTLT:14000UF,+100-10%,30V	90201	PFP143GR3J3P2
A12C141	290-0746-00			CAP.,FXD,ELCTLT:47UF,+50-10%,16V	55680	16U-47V-T
A12C145	290-0746-00			CAP.,FXD,ELCTLT:47UF,+50-10%,16V	55680	16U-47V-T
A12C148	290-0746-00			CAP.,FXD,ELCTLT:47UF,+50-10%,16V	55680	16U-47V-T
A12C163	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
A12C168	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
A12C201	290-0799-00			CAP.,FXD,ELCTLT:300UF,+100-75%,300V	56289	OBD
A12C211	290-0968-00			CAP.,FXD,ELCTLT:14000UF,+100-10%,30V	90201	PFP143GR3J3P2
A12C221	290-0961-00			CAP.,FXD,ELCTLT:18000UF,+100-10%,15V	56289	68D10444
A12C231	290-0961-00			CAP.,FXD,ELCTLT:18000UF,+100-10%,15V	56289	68D10444
A12CR1	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR2	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR10	152-0666-00			SEMICOND DEVICE:RECT,SI,800V,1.5A	80009	152-0666-00
A12CR56	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR66	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR105	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR127	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR141	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR143	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR145	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12CR163	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A12F30	159-0083-00			FUSE,CARTRIDGE:0.15A,250V,FAST-BLOW	71400	AGC 15/100
A12F35	159-0028-00			FUSE,CARTRIDGE:3AG,0.25A,250V,FAST-BLOW	71400	AGC 1/4
A12F137	159-0083-00			FUSE,CARTRIDGE:0.15A,250V,FAST-BLOW	71400	AGC 15/100
A12F139	159-0023-00			FUSE,CARTRIDGE:3AG,2A,250V,5SEC	71400	MDX-2
A12F141	159-0023-00			FUSE,CARTRIDGE:3AG,2A,250V,5SEC	71400	MDX-2
A12F144	159-0013-00			FUSE,CARTRIDGE:3AG,6A,125V,7SEC	71400	MTH6
A12F146	159-0014-00			FUSE,CARTRIDGE:3AG,5A,250V,FAST-BLOW	71400	MTH5
A12J32	131-1976-00			TERM. SET,PIN:15 MALE CONT	27264	09-60-1151
A12J43	131-1975-00			TERM. SET,PIN:12 MALE CONTACTS	27264	09-60-1121
A12J134	131-1974-00			TERM. SET,PIN:5 MALE CONTACTS	000CA	09-60-1051
	----- -----			(QUANTITY OF 2)		
A12Q55	151-0280-00			TRANSISTOR:SILICON,PNP	04713	SS8065
A12Q60	151-0136-00			TRANSISTOR:SILICON,NPN	02735	35495
A12Q150	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A12R21	305-0433-00			RES.,FXD,CMPSN:43K OHM,5%,2W	01121	HB4335
A12R23	305-0303-00			RES.,FXD,CMPSN:30K OHM,5%,2W	01121	HB3035
A12R25	305-0433-00			RES.,FXD,CMPSN:43K OHM,5%,2W	01121	HB4335
A12R41	323-0423-00			RES.,FXD,FILM:249K OHM,1%,0.50W	75042	CECT0-2493F
A12R43	321-0724-03			RES.,FXD,FILM:13.6K OHM,0.25W,0.125W	24546	NC55C1362C
A12R45	315-0681-03			RES.,FXD,CMPSN:680 OHM,5%,0.25W	01121	CB6815
A12R47	315-0133-00			RES.,FXD,CMPSN:13K OHM,5%,0.25W	01121	CB1335
A12R50	308-0223-00			RES.,FXD,WW:35 OHM,5%,3W	91637	RS2B-K35R00J
A12R52	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A12R53	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A12R57	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A12R59	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025

A12 LV POWER SUPPLY(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A12R60	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R62	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R64	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A12R68	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R141	308-0795-00			RES.,FXD,WW:0.2 OHM,5%,3W	91637	RS2BR2000J
A12R143	308-0795-00			RES.,FXD,WW:0.2 OHM,5%,3W	91637	RS2BR2000J
A12R145	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A12R147	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A12R151	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A12R152	321-0289-03			RES.,FXD,FILM:10K OHM,0.25%,0.125W	91637	MFF1816D10001C
A12R153	321-0816-07			RES.,FXD,FILM:5K OHM,0.1%,0.125W	91637	MFF1816C50000B
A12R155	321-0289-03			RES.,FXD,FILM:10K OHM,0.25%,0.125W	91637	MFF1816D10001C
A12R157	321-0816-07			RES.,FXD,FILM:5K OHM,0.1%,0.125W	91637	MFF1816C50000B
A12R166	311-1920-00			RES.,VAR,NONWIR:500 OHM,10%,0.50W	73138	72-190-0
A12R167	321-0239-00			RES.,FXD,FILM:3.01K OHM,1%,0.125W	91637	MFF1816G30100F
A12R169	321-0234-00			RES.,FXD,FILM:2.67K OHM,1%,0.125W	91637	MFF1816G26700F
A12U51	156-0049-02			MICROCIRCUIT,LI:OPNL,AMPL,SCREENED	04713	MC1741CGDS
A12U61	156-0699-01			MICROCIRCUIT,LI:VOLTAGE REGULATOR	07263	723HM
A12U161	156-0921-01			MICROCIRCUIT,LI:OPERATIONAL,AMPLIFIER,SEL	80009	156-0921-01
A12VR50	152-0669-00			SEMICOND DEVICE:ZENER,SI,5W,120V,5%	80009	152-0669-00
A12VR148	152-0127-00			SEMICOND DEVICE:ZENER,0.4W,7.5V,5%	04713	SZG35009K2

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				A13 STORAGE		
A13	672-0795-04			CKT BOARD ASSY:STORAGE	80009	672-0795-04
A13A1	670-6127-XX			(NOT REPLACEABLE SEE A13)		
A13C09	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A13C11	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A13C13	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A13C15	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	72982	811-546E103Z
A13C18	283-0013-00			CAP.,FXD,CER DI:0.01UF,+100-0%,1000V	56289	33C29A7
A13C37	283-0029-00			CAP.,FXD,CER DI:0.005UF,5%,500V	72982	821-000B502J
A13C67	283-0035-00			CAP.,FXD,CER DI:0.0015UF,20%,400V	72982	811-000Z5U0152Z
A13C78	281-0603-00			CAP.,FXD,CER DI:39PF,5%,500V	72982	308-000C0G0390J
A13C109	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A13C110	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C120	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13C121	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13C125	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C126	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A13C130	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A13C132	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13C135	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C143	290-0297-00			CAP.,FXD,ELCTLT:39UF,10%,10V	56289	150D396X9010B2
A13C153	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C159	290-0297-00			CAP.,FXD,ELCTLT:39UF,10%,10V	56289	150D396X9010B2
A13C164	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C165	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13C168	290-0297-00			CAP.,FXD,ELCTLT:39UF,10%,10V	56289	150D396X9010B2
A13C171	290-0183-00			CAP.,FXD,ELCTLT:1UF,10%,35V	90201	TAE105K035P1A
A13C178	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A13C209	290-0288-00			CAP.,FXD,ELCTLT:0.27UF,10%,35V	56289	162D274X9035BC2
A13C214	281-0767-00			CAP.,FXD,CER DI:330PF,20%,100V	12969	CGB331MEX
A13C215	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C225	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C226	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A13C227	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A13C245	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13C281	290-0263-00			CAP.,FXD,ELCTLT:2.7UF,15V	56289	162D275X9015CD2
A13C282	290-0183-00			CAP.,FXD,ELCTLT:1UF,10%,35V	90201	TAE105K035P1A
A13C288	290-0301-00			CAP.,FXD,ELCTLT:10UF,10%,20V	56289	150D106X9020B2
A13C345	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13C346	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13C347	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A13CR32	152-0107-00			SEMICOND DEVICE:SILICON,400V,400MA	01295	G727
A13CR70	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR80	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR86	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR100	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
	----- -----			(OPTION 31 ONLY)		
A13CR110	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
	----- -----			(OPTION 31 ONLY)		
A13CR114	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR124	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR186	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR208	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR221	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR243	152-0075-00			SEMICOND DEVICE:GE,25V,40MA	14433	G866
A13CR273	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012

A13 STORAGE(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A13CR278	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13CR288	152-0333-00			SEMICOND DEVICE:SILICON,55V,200MA	07263	FDH-6012
A13J3	131-0787-00			CONTACT,ELEC:0.64 INCH LONG	22526	47359
	----- -----			(QUANTITY OF 5)		
A13J4	131-0787-00			CONTACT,ELEC:0.64 INCH LONG	22526	47359
	----- -----			(QUANTITY OF 7)		
A13Q15	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q25	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q28	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q29	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q35	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q36	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q38	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A13Q45	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q55	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q65	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q66	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q68	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q73	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q75	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q84	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q85	151-0423-00			TRANSISTOR:SILICON,NPN	01295	EP2970
A13Q86	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A13Q185	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A13Q186	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A13Q190	151-0254-00			TRANSISTOR:SILICON,NPN	03508	X38L3118
A13Q261	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A13Q264	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A13Q265	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A13Q269	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A13Q270	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A13Q275	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A13Q290	151-0254-00			TRANSISTOR:SILICON,NPN	03508	X38L3118
A13Q335	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A13Q350	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A13R8	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
A13R9	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
A13R14	315-0100-02			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A13R15	315-0100-02			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A13R18	315-0100-02			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A13R23	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R26	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R27	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R30	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R38	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R40	304-0184-00			RES.,FXD,CMPSN:180K OHM,10%,1W	01121	GB1841
A13R43	305-0203-00			RES.,FXD,CMPSN:20K OHM,5%,2W	01121	HB2035
A13R46	305-0203-00			RES.,FXD,CMPSN:20K OHM,5%,2W	01121	HB2035
A13R50	305-0203-00			RES.,FXD,CMPSN:20K OHM,5%,2W	01121	HB2035
A13R53	305-0203-00			RES.,FXD,CMPSN:20K OHM,5%,2W	01121	HB2035
A13R56	323-0459-00			RES.,FXD,FILM:590K OHM,1%,0.50W	91637	MFF1226G59002F
A13R60	315-0100-02			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A13R61	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R62	315-0100-02			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A13R63	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A13R64	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R70	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025

A13 STORAGE(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A13R72	301-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.50W	01121	EB2245
A13R74	323-0429-00			RES.,FXD,FILM:287K OHM,1%,0.5W	91637	MFF1226G28702F
A13R76	323-0429-00			RES.,FXD,FILM:287K OHM,1%,0.5W	91637	MFF1226G28702F
A13R78	301-0224-00			RES.,FXD,CMPSN:220K OHM,5%,0.50W	01121	EB2245
A13R86	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R88	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A13R89	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R90	305-0823-00			RES.,FXD,CMPSN:82K OHM,5%,2W	01121	HB8235
A13R93	323-0381-00			RES.,FXD,FILM:90.9K OHM,1%,0.50W	75042	CECT0-9092F
A13R95	311-1940-00			RES.,VAR,NONWIR:TRMR,200K OHM,10%	73138	72-206-0
A13R109	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R110	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R112	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A13R114	315-0391-00			RES.,FXD,CMPSN:390 OHM,5%,0.25W	01121	CB3915
A13R125	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
A13R126	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	01121	CB5125
A13R127	315-0514-00			RES.,FXD,CMPSN:510K OHM,5%,0.25W	01121	CB5145
A13R129	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A13R132	321-0333-00			RES.,FXD,FILM:28.7K OHM,1%,0.125W	91637	MFF1816G28701F
A13R135	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R136	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R145	321-0334-00			RES.,FXD,FILM:29.4K OHM,1%,0.125W	91637	MFF1816G29401F
A13R147	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A13R154	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A13R156	321-0328-00			RES.,FXD,FILM:25.5K OHM,1%,0.125W	91637	MFF1816G25501F
A13R157	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R169	321-0334-00			RES.,FXD,FILM:29.4K OHM,1%,0.125W	91637	MFF1816G29401F
A13R174	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R175	321-0237-00			RES.,FXD,FILM:2.87K OHM,1%,0.125W	91637	MFF1816G28700F
A13R180	321-0304-00			RES.,FXD,FILM:14.3K OHM,1%,0.125W	91637	MFF1816G14301F
A13R181	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R183	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R185	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A13R186	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A13R187	321-0311-00			RES.,FXD,FILM:16.9K OHM,1%,0.125W	91637	MFF1816G16901F
A13R188	321-0282-00			RES.,FXD,FILM:8.45K OHM,1%,0.125W	91637	MFF1816G84500F
A13R189	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
A13R190	321-0282-00			RES.,FXD,FILM:8.45K OHM,1%,0.125W	91637	MFF1816G84500F
A13R191	321-0316-00			RES.,FXD,FILM:19.1K OHM,1%,0.125W	91637	MFF1816G19101F
A13R192	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A13R193	321-0316-00			RES.,FXD,FILM:19.1K OHM,1%,0.125W	91637	MFF1816G19101F
A13R194	321-0323-00			RES.,FXD,FILM:22.6K OHM,1%,0.125W	91637	MFF1816G22601F
A13R195	311-1940-00			RES.,VAR,NONWIR:TRMR,200K OHM,10%	73138	72-206-0
A13R197	311-1240-00			RES.,VAR,NONWIR:25K OHM,10%,0.50W	73138	72-30-0
A13R198	311-1940-00			RES.,VAR,NONWIR:TRMR,200K OHM,10%	73138	72-206-0
A13R208	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A13R209	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	01121	CB5105
A13R210	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A13R211	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A13R212	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R220	315-0392-00			RES.,FXD,CMPSN:3.9K OHM,5%,0.25W	01121	CB3925
A13R225	315-0114-00			RES.,FXD,CMPSN:110K OHM,5%,0.25W	01121	CB1145
A13R226	315-0223-00			RES.,FXD,CMPSN:22K OHM,5%,0.25W	01121	CB2235
A13R238	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R245	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	01121	CB3015
A13R247	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R254	316-0126-00			RES.,FXD,CMPSN:12M OHM,10%,0.25W	01121	CB1261

A13 STORAGE(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A13R255	316-0126-00			RES.,FXD,CMPSN:12M OHM,10%,0.25W	01121	CB1261
A13R256	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A13R260	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
A13R261	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
A13R264	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
A13R265	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A13R267	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A13R270	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
A13R271	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A13R272	321-0341-00			RES.,FXD,FILM:34.8K OHM,1%,0.125W	91637	MFF1816G34801F
A13R274	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
A13R276	315-0621-00			RES.,FXD,CMPSN:620 OHM,5%,0.25W	01121	CB6215
A13R279	321-0345-00			RES.,FXD,FILM:38.3K OHM,1%,0.125W	91637	MFF1816G38301F
A13R280	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
A13R281	321-0436-00			RES.,FXD,FILM:340K OHM,1%,0.125W	91637	MFF1816G34002F
A13R287	321-0390-00			RES.,FXD,FILM:113K OHM,1%,0.125W	91637	MFF1816G11302F
A13R288	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A13R290	315-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A13R291	321-0222-00			RES.,FXD,FILM:2K OHM,1%,0.125W	91637	MFF1816G20000F
A13R292	321-0301-00			RES.,FXD,FILM:13.3K OHM,1%,0.125W	91637	MFF1816G13301F
A13R295	311-1935-00			RES.,VAR,NONWIR:TRMR,50K OHM,10%,0.50W	32997	3299X-R27-503
A13R315	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A13R335	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A13R336	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A13R337	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A13R390	308-0165-00			RES.,FXD,WW:0.5 OHM,5%,5W	63743	17951
A13RT389	307-0353-00			RES.,FXD,FILM:5 OHM,10%,DISC	15454	5DA5RO-K-270SS
A13TP91	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A13TP92	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A13TP93	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A13TP94	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A13U110	156-0371-02			MICROCIRCUIT,DI:QUAD 2 INP STNAND GATE	01295	SN74132NP3
A13U115	156-0617-02			MICROCIRCUIT,DI:DUAL 4 BIT CNTR,SCRN	01295	SN74393
A13U125	156-0402-02			MICROCIRCUIT,LI:TIMER,CHK	27014	SL34829/A+
A13U136	156-0733-02			MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN	04713	SN74LS22IN/J
A13U147	156-0093-02			MICROCIRCUIT,DI:HEX INV BUFFER,BURN-IN	27014	DM8016
A13U154	156-0093-02			MICROCIRCUIT,DI:HEX INV BUFFER,BURN-IN	27014	DM8016
A13U164	156-0733-02			MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN	04713	SN74LS22IN/J
A13U175	156-0733-02			MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN	04713	SN74LS22IN/J
A13U215	156-0462-02			MICROCIRCUIT,DI:HEX INVERTER,SCREENED	07263	SL82349
A13U225	156-0402-02			MICROCIRCUIT,LI:TIMER,CHK	27014	SL34829/A+
A13U235	156-0030-03			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	27014	DM8000
A13U245	156-0371-02			MICROCIRCUIT,DI:QUAD 2 INP STNAND GATE	01295	SN74132NP3
A13VR277	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZG35010RL
A13VR287	152-0279-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZG35010RL

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				A14 HARD COPY AMPLIFIER		
A14	670-3097-01			CKT BOARD ASSY:HARD COPY AMPL	80009	670-3097-01
A14C1	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A14C6	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A14C12	281-0623-00			CAP.,FXD,CER DI:650PF,5%,500V	04222	7001-1362
A14C13	281-0623-00			CAP.,FXD,CER DI:650PF,5%,500V	04222	7001-1362
A14C17	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	72982	831-516E102P
A14C31	281-0623-00			CAP.,FXD,CER DI:650PF,5%,500V	04222	7001-1362
A14C34	281-0512-00			CAP.,FXD,CER DI:27PF,+/-2.7PF,500V	72982	308-000C0G0270K
A14C35	281-0623-00			CAP.,FXD,CER DI:650PF,5%,500V	04222	7001-1362
A14C105	281-0523-00			CAP.,FXD,CER DI:100PF,+/-20PF,500V	72982	301-000U2M0101M
A14C122	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
A14C123	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
A14C131	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A14C141	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A14C142	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A14C145	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A14C157	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A14C158	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A14L44	108-0146-00			COIL,RF:5UH	80009	108-0146-00
A14L140	108-0214-00			COIL,RF:400UH	80009	108-0214-00
A14L144	108-0214-00			COIL,RF:400UH	80009	108-0214-00
A14Q115	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
A14Q134	151-0134-00			TRANSISTOR:SILICON,PNP	80009	151-0134-00
A14R2	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A14R5	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A14R7	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R11	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R14	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R15	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A14R16	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
A14R26	311-1228-00			RES.,VAR,NONWIR:10K OHM,20%,0.50W	32997	3386F-T04-103
A14R32	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R33	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R36	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R37	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R45	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A14R54	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A14R106	315-0562-00			RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	01121	CB5625
A14R112	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A14R113	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A14R114	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A14R121	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A14R125	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
A14R126	307-0103-00			RES.,FXD,CMPSN:2.7 OHM,5%,0.25W	01121	CB27G5
A14R132	321-0214-00			RES.,FXD,FILM:1.65K OHM,1%,0.125W	91637	MFF1816G16500F
A14R135	301-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.50W	01121	EB1515
A14R136	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	91637	MFF1816G24900F
A14R145	301-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.50W	01121	EB1515
A14R146	301-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.50W	01121	EB1005
A14T53	120-0827-00			XFMR,TOROID:THREE 12 TURN WINDINGS	80009	120-0827-00
A14TP1	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A14TP12	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A14TP13	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A14TP116	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A14U3	156-0096-02			MICROCIRCUIT,LI:VOLTAGE COMPARATOR,SCRN	27014	LM311H/A+
A14U21	156-0162-00			MICROCIRCUIT,LI:DIFFERENTIAL VIDEO AMPL	80009	156-0162-00
A14U43	156-0162-00			MICROCIRCUIT,LI:DIFFERENTIAL VIDEO AMPL	80009	156-0162-00
A14U101	156-0072-00			MICROCIRCUIT,DI:MONOSTABLE MV,TTL,14 DIP	01295	SN74121(N OR J)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				A15 DEFLECTION AMPLIFIER		
A15	672-0998-00			CKT BOARD ASSY:DEFL AMPL	80009	672-0998-00
A15A1	670-7007-XX			(NOT REPLACEABLE, SEE A15)		
A15C15	290-0779-00			CAP.,FXD,ELCTLT:10UF,+50-10%,50VDC	56289	502D237
A15C16	290-0779-00			CAP.,FXD,ELCTLT:10UF,+50-10%,50VDC	56289	502D237
A15C115	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A15C116	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A15C117	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A15C118	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A15C146	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A15C149	281-0592-00			CAP.,FXD,CER DI:4.7PF,+/-0.5PF,500V	72982	301-023C0H0479D
A15C151	283-0730-00			CAP.,FXD,MICA D:274PF,1%,500V	00853	D155E2740F0
A15C154	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
A15C161	283-0730-00			CAP.,FXD,MICA D:274PF,1%,500V	00853	D155E2740F0
A15C164	283-0594-00			CAP.,FXD,MICA D:0.001UF,1%,100V	00853	D151F102F0
A15C176	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A15C179	281-0592-00			CAP.,FXD,CER DI:4.7PF,+/-0.5PF,500V	72982	301-023C0H0479D
A15C196	283-0060-00			CAP.,FXD,CER DI:100PF,5%,200V	72982	855-535U2J101J
A15C197	283-0060-00			CAP.,FXD,CER DI:100PF,5%,200V	72982	855-535U2J101J
A15C254	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A15C255	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A15C282	281-0826-00			CAP.,FXD,CER DI:2200PF,5%,100V	04222	GC101C222J
A15C290	281-0809-00			CAP.,FXD,CER DI:200PF,5%,100V	72982	8013T2ADDC1G201J
A15C292	281-0826-00			CAP.,FXD,CER DI:2200PF,5%,100V	04222	GC101C222J
A15C334	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
A15C338	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
A15C352	285-1069-00			CAP.,FXD,PLSTC:0.047UF,200V	14752	C2319
A15C353	281-0604-00			CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V	72982	301-000C0J0229C
A15C362	285-1069-00			CAP.,FXD,PLSTC:0.047UF,200V	14752	C2319
A15C363	281-0604-00			CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V	72982	301-000C0J0229C
A15C381	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A15C393	281-0773-00			CAP.,FXD,CER DI:0.01UF,10%,100V	04222	GC70-1C103K
A15C1001	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-518-Z5D0102J
A15C1101	283-0065-00			CAP.,FXD,CER DI:0.001UF,5%,100V	72982	805-518-Z5D0102J
A15C1102	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A15C1106	281-0767-00			CAP.,FXD,CER DI:330PF,20%,100V	12969	CGB331MEX
A15C1202	281-0811-00			CAP.,FXD,CER DI:10PF,10%,100V	72982	8035D2AADC1G100K
A15C1212	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A15C1213	281-0772-00			CAP.,FXD,CER DI:0.0047UF,10%,100V	04222	GC701C472K
A15CR21	152-0676-00			SEMICOND DEVICE:RECT,SI,400V,3A	03508	A115DX112
A15CR22	152-0676-00			SEMICOND DEVICE:RECT,SI,400V,3A	03508	A115DX112
A15CR23	152-0676-00			SEMICOND DEVICE:RECT,SI,400V,3A	03508	A115DX112
A15CR24	152-0676-00			SEMICOND DEVICE:RECT,SI,400V,3A	03508	A115DX112
A15CR36	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR42	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A15CR43	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A15CR45	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR46	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR75	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR76	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR82	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A15CR83	152-0066-00			SEMICOND DEVICE:SILICON,400V,750MA	14433	LG4016
A15CR86	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR119	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
A15CR132	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR137	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R

A15 DEFLECTION AMPLIFIER(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A15CR139	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR142	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR172	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR182	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR187	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR189	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR283	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR284	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR285	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR286	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR372	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR373	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR382	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR383	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR423	152-0322-00			SEMICOND DEVICE:SILICON,15V,HOT CARRIER	50434	5082-2672
A15CR454	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR455	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR464	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR465	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR474	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR484	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR1104	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR1313	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR1411	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15CR1414	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A15J56	131-0589-00 ----- -----			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL (QUANTITY OF 3)	22526	47350
A15J66	131-0589-00 ----- -----			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL (QUANTITY OF 3)	22526	47350
A15J199	131-0589-00 ----- -----			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL (QUANTITY OF 8)	22526	47350
A15J311	131-0589-00 ----- -----			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL (QUANTITY OF 2)	22526	47350
A15J314	131-0589-00 ----- -----			TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL (QUANTITY OF 2)	22526	47350
A15Q20	151-0607-00			TRANSISTOR:SILICON,PNP	01295	EP8106
A15Q26	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q27	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A15Q30	151-0606-00			TRANSISTOR:SILICON,NPN	01295	EP8010
A15Q36	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A15Q38	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q40	151-0606-00			TRANSISTOR:SILICON,NPN	01295	EP8010
A15Q46	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q48	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A15Q50	151-0607-00			TRANSISTOR:SILICON,PNP	01295	EP8106
A15Q60	151-0606-00			TRANSISTOR:SILICON,NPN	01295	EP8010
A15Q70	151-0607-00			TRANSISTOR:SILICON,PNP	01295	EP8106
A15Q75	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A15Q76	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A15Q78	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q80	151-0607-00			TRANSISTOR:SILICON,PNP	01295	EP8106
A15Q84	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q86	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q88	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A15Q90	151-0606-00			TRANSISTOR:SILICON,NPN	01295	EP8010
A15Q96	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q97	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K

A15 DEFLECTION AMPLIFIER(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A15Q239	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q249	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q296	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q411	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q496	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q1200	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15Q1201	151-0190-00			TRANSISTOR:SILICON,NPN	07263	S032677
A15R17	308-0242-00			RES.,FXD,WW:0.25 OHM,5%,5W	91637	RS2A-ER2500K
A15R25	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R26	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R28	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R34	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R35	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R42	307-0593-00			RES.,FXD,FOIL:0.25 OHM,5%	80009	307-0593-00
A15R43	308-0590-00			RES.,FXD,WW:0.25 OHM,5%,3W	91637	RS2B-ER2500J
A15R44	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R45	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R50	311-1244-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3386X-T07-101
A15R51	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72-28-0
A15R52	308-0590-00			RES.,FXD,WW:0.25 OHM,5%,3W	91637	RS2B-ER2500J
A15R54	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A15R55	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A15R57	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
A15R58	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
A15R60	308-0590-00			RES.,FXD,WW:0.25 OHM,5%,3W	91637	RS2B-ER2500J
A15R64	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A15R65	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A15R66	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
A15R67	311-1244-00			RES.,VAR,NONWIR:100 OHM,10%,0.50W	32997	3386X-T07-101
A15R68	315-0274-00			RES.,FXD,CMPSN:270K OHM,5%,0.25W	01121	CB2745
A15R69	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72-28-0
A15R71	308-0590-00			RES.,FXD,WW:0.25 OHM,5%,3W	91637	RS2B-ER2500J
A15R72	307-0593-00			RES.,FXD,FOIL:0.25 OHM,5%	80009	307-0593-00
A15R74	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R75	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R84	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R95	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R96	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R98	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R99	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R119	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R121	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R122	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	91637	MFF1816G34000F
A15R123	321-0104-00			RES.,FXD,FILM:118 OHM,1%,0.125W	91637	MFF1816G118R0F
A15R124	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	91637	MFF1816G34000F
A15R125	321-0104-00			RES.,FXD,FILM:118 OHM,1%,0.125W	91637	MFF1816G118R0F
A15R131	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
A15R133	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R134	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R135	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R139	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R141	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
A15R143	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R144	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A15R145	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A15R147	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R148	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535

A15 DEFLECTION AMPLIFIER(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A15R149	315-0134-00			RES.,FXD,CMPSN:130K OHM,5%,0.25W	01121	CB1345
A15R150	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72-28-0
A15R152	321-0127-00			RES.,FXD,FILM:205 OHM,1%,0.125W	91637	MFF1816G205R0F
A15R153	321-0206-00			RES.,FXD,FILM:1.37K OHM,1%,0.125W	91637	MFF1816G13700F
A15R162	321-0127-00			RES.,FXD,FILM:205 OHM,1%,0.125W	91637	MFF1816G205R0F
A15R163	321-0206-00			RES.,FXD,FILM:1.37K OHM,1%,0.125W	91637	MFF1816G13700F
A15R167	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72-28-0
A15R171	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
A15R173	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R174	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A15R175	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A15R177	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R178	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A15R179	315-0134-00			RES.,FXD,CMPSN:130K OHM,5%,0.25W	01121	CB1345
A15R181	315-0220-00			RES.,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
A15R183	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R184	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R185	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R192	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	91637	MFF1816G34000F
A15R193	321-0104-00			RES.,FXD,FILM:118 OHM,1%,0.125W	91637	MFF1816G118R0F
A15R194	321-0244-00			RES.,FXD,FILM:3.4K OHM,1%,0.125W	91637	MFF1816G34000F
A15R195	321-0104-00			RES.,FXD,FILM:118 OHM,1%,0.125W	91637	MFF1816G118R0F
A15R211	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A15R212	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A15R213	321-0236-00			RES.,FXD,FILM:2.8K OHM,1%,0.125W	91637	MFF1816G28000F
A15R214	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A15R215	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A15R216	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A15R217	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A15R218	321-0208-00			RES.,FXD,FILM:1.43K OHM,1%,0.125W	91637	MFF1816G14300F
A15R227	311-1239-00			RES.,VAR,NONWIR:2.5K OHM,10%,0.50W	73138	72X-76-0-252K
A15R228	311-1237-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	32997	3386X-T07-102
A15R229	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72-28-0
A15R233	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R235	321-0330-00			RES.,FXD,FILM:26.7K OHM,1%,0.125W	91637	MFF1816G26701F
A15R237	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R238	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
A15R245	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A15R247	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R248	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
A15R250	311-1241-00			RES.,VAR,NONWIR:100K OHM,10%,0.5W	32997	3386X-T07-104
A15R251	321-0285-00			RES.,FXD,FILM:9.09K OHM,1%,0.125W	91637	MFF1816G90900F
A15R252	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R253	321-0206-00			RES.,FXD,FILM:1.37K OHM,1%,0.125W	91637	MFF1816G13700F
A15R261	321-0286-00			RES.,FXD,FILM:9.31K OHM,1%,0.125W	91637	MFF1816G93100F
A15R262	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R263	321-0206-00			RES.,FXD,FILM:1.37K OHM,1%,0.125W	91637	MFF1816G13700F
A15R266	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A15R267	311-1241-00			RES.,VAR,NONWIR:100K OHM,10%,0.5W	32997	3386X-T07-104
A15R271	315-0134-00			RES.,FXD,CMPSN:130K OHM,5%,0.25W	01121	CB1345
A15R274	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A15R275	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	01121	CB4715
A15R282	315-0754-00			RES.,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
A15R283	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
A15R287	315-0113-00			RES.,FXD,CMPSN:11K OHM,5%,0.25W	01121	CB1135
A15R291	315-0202-00			RES.,FXD,CMPSN:2K OHM,5%,0.25W	01121	CB2025
A15R296	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035

A15 DEFLECTION AMPLIFIER(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A15R311	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A15R312	321-0277-00			RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A15R313	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A15R314	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A15R315	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A15R316	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A15R317	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A15R318	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A15R322	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72-27-0
A15R326	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72-27-0
A15R333	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R335	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R337	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A15R351	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
A15R361	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
A15R381	315-0754-00			RES.,FXD,CMPSN:750K OHM,5%,0.25W	01121	CB7545
A15R391	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A15R392	315-0432-00			RES.,FXD,CMPSN:4.3K OHM,5%,0.25W	01121	CB4325
A15R393	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	01121	CB2725
A15R411	315-0752-00			RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	01121	CB7525
A15R412	315-0242-00			RES.,FXD,CMPSN:2.4K OHM,5%,0.25W	01121	CB2425
A15R413	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R414	315-0682-00			RES.,FXD,CMPSN:6.8K OHM,5%,0.25W	01121	CB6825
A15R415	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
A15R423	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R424	311-1238-00			RES.,VAR,NONWIR:5K OHM,10%,0.50W	73138	72-27-0
A15R425	321-0330-00			RES.,FXD,FILM:26.7K OHM,1%,0.125W	91637	MFF1816G26701F
A15R426	311-1245-00			RES.,VAR,NONWIR:10K OHM,10%,0.50W	73138	72-28-0
A15R431	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R442	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
A15R443	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0.125W	91637	MFF1816G17401F
A15R444	321-0397-00			RES.,FXD,FILM:133K OHM,1%,0.125W	91637	MFF1816G13302F
A15R445	321-0334-00			RES.,FXD,FILM:29.4K OHM,1%,0.125W	91637	MFF1816G29401F
A15R446	321-0386-00			RES.,FXD,FILM:102K OHM,1%,0.125W	91637	MFF1816G10202F
A15R446	321-0373-00			RES.,FXD,FILM:75K OHM, 1%,0.125W	91637	MFF1816G75001F
	----- -----			(OPTION 31 ONLY)		
A15R447	321-0252-00			RES.,FXD,FILM:4.12K OHM,1%,0.125W	91637	MFF1816G41200F
A15R451	315-0114-00			RES.,FXD,CMPSN:110K OHM,5%,0.25W	01121	CB1145
A15R452	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R453	315-0304-00			RES.,FXD,CMPSN:300K OHM,5%,0.25W	01121	CB3045
A15R454	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R457	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R459	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R461	315-0114-00			RES.,FXD,CMPSN:110K OHM,5%,0.25W	01121	CB1145
A15R462	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R463	315-0304-00			RES.,FXD,CMPSN:300K OHM,5%,0.25W	01121	CB3045
A15R464	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R467	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R469	315-0104-00			RES.,FXD,CMPSN:100K OHM,5%,0.25W	01121	CB1045
A15R471	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R472	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A15R473	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A15R475	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A15R476	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A15R477	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A15R481	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R482	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545

A15 DEFLECTION AMPLIFIER(CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A15R483	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A15R485	315-0154-00			RES.,FXD,CMPSN:150K OHM,5%,0.25W	01121	CB1545
A15R486	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A15R487	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A15R491	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R492	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
A15R493	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A15R495	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
A15R497	315-0203-00			RES.,FXD,CMPSN:20K OHM,5%,0.25W	01121	CB2035
A15R1000	321-0304-00			RES.,FXD,FILM:14.3K OHM,1%,0.125W	91637	MFF1816G14301F
A15R1100	321-0371-00			RES.,FXD,FILM:71.5K OHM,1%,0.125W	91637	MFF1816G71501F
A15R1103	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R1105	315-0183-00			RES.,FXD,CMPSN:18K OHM,5%,0.25W	01121	CB1835
A15R1107	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R1108	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R1203	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A15R1213	321-0335-00			RES.,FXD,FILM:30.1K OHM,1%,0.125W	91637	MFF1816G30101F
A15R1314	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A15R1315	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A15R1415	321-0193-00			RES.,FXD,FILM:1K OHM,1%,0.125W	91637	MFF1816G10000F
A15U228	155-0154-00			MICROCIRCUIT,LI:CHANNEL SWITCH	80009	155-0154-00
A15U256	156-0317-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	34371	HA2-2625-5
A15U266	156-0317-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER	34371	HA2-2625-5
A15U293	156-0096-02			MICROCIRCUIT,LI:VOLTAGE COMPARATOR,SCRN	27014	LM311H/A+
A15U342	155-0152-01			MICROCIRCUIT,LI:GEOMETRY & FOCUS CORR	80009	155-0152-01
A15U353	156-0742-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	01295	LM318P3
A15U363	156-0742-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	01295	LM318P3
A15U373	156-0742-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	01295	LM318P3
A15U383	156-0742-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	01295	LM318P3
A15U393	156-0742-02			MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL	01295	LM318P3
A15U1002	156-0733-02			MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN	04713	SN74LS22IN/J
A15U1311	156-0072-02			MICROCIRCUIT,DI:MONOSTABLE MV,BURN-IN	01295	SN74121
A15VR136	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A15VR138	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A15VR186	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A15VR188	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A15VR210	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A15VR211	152-0166-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738
A15VR456	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755
A15VR458	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755
A15VR466	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755
A15VR468	152-0195-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	04713	SZ11755

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				A16 HIGH VOLTAGE & Z AXIS (OPTION 31 ONLY)		
A16	672-1000-00			CKT BOARD ASSY:HV & Z AXIS	80009	672-1000-00
A16A1	670-7264-XX			(NOT REPLACEABLE SEE A16)		
A16C25	281-0755-00			CAP.,FXD,CER DI:1.8PF,0.1%,500V	72982	314021C0K0189B
A16C35	290-0312-00			CAP.,FXD,ELCTLT:47UF,10%,35V	56289	150D476X9035S2
A16C36	283-0013-00			CAP.,FXD,CER DI:0.01UF,+100-0%,1000V	56289	33C29A7
A16C68	285-1137-00			CAP.,FXD,PLSTC:0.0047UF,10%,8000V	56289	430P472980
A16C111	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A16C112	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A16C128	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	72982	831-559E502P
A16C135	283-0013-00			CAP.,FXD,CER DI:0.01UF,+100-0%,1000V	56289	33C29A7
A16C136	283-0346-00			CAP.,FXD,CER DI:0.47UF,+80-20%,100V	72982	8131-M100F474Z
A16C138	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A16C139	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A16C141	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A16C167	283-0036-00			CAP.,FXD,CER DI:2500PF,+100-0%,6000V	71590	DA111-001B
A16C205	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A16C218	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V	72982	8035D9AADC1G470K
A16C239	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A16C242	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A16C261	283-0363-00			CAP.,FXD,CER DI:2.2PF,0.25%,2KV	72982	838-000C0K229C
A16C262	283-0342-00			CAP.,FXD,CER DI:6.5PF,0.5%,2000V	72982	808-536A659D
A16C305	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A16C313	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V	72982	8035D9AADC1G470K
A16C362	285-1137-00			CAP.,FXD,PLSTC:0.0047UF,10%,8000V	56289	430P472980
A16C427	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N210X7R0104K
A16C436	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	275C8
A16C455	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V	72982	3910BW509C142K
A16C456	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V	72982	3910BW509C142K
A16C472	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V	72982	3910BW509C142K
A16C513	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A16C523	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A16C534	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V	72982	8141N210X7R0104K
A16C541	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V	72982	8035D9AADX7R102K
A16C565	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V	72982	3910BW509C142K
A16C630	281-0797-00			CAP.,FXD,CER DI:15PF,10%,100V	72982	8035D9AADC0G150K
A16C637	290-0267-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	162D105X0035CD2
A16C641	290-0247-00			CAP.,FXD,ELCTLT:5.6UF,10%,6V	56289	162D565X9006CD2
A16C645	281-0797-00			CAP.,FXD,CER DI:15PF,10%,100V	72982	8035D9AADC0G150K
A16C651	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8005D9AABZ5U104M
A16C654	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V	72982	8005H9AADW5R471K
A16C665	285-1138-00			CAP.,FXD,PLSTC:0.01UF,10%,8000V	56289	430P558
A16C666	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V	72982	3910BW509C142K
A16C671	283-0280-00			CAP.,FXD,CER DI:2200PF,10%,2000V	56289	562CBA202EH222KA
A16C738	290-0267-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	162D105X0035CD2
A16C739	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A16CR18	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR128	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR131	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR135	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR137	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR171	152-0639-00			SEMICOND DEVICE:RECT,SI,10KV,10MA	52306	CX345
A16CR172	152-0639-00			SEMICOND DEVICE:RECT,SI,10KV,10MA	52306	CX345
A16CR237	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR238	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03

A16 HIGH VOLTAGE & Z AXIS(CONT)
(OPTION 31 ONLY)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A16CR239	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR240	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR344	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR345	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR415	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR448	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR449	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR463	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR478	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	07263	FDH5004
A16CR525	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR535	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR542	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR543	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR545	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR566	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL	80009	152-0107-03
A16CR578	152-0242-00			SEMICOND DEVICE:SILICON,225V,200MA	07263	FDH5004
A16CR621	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR622	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR623	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR624	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR723	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR724	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR739	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR745	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16CR746	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A16E278	119-0181-00			ARSR,ELEC SURGE:230V,GAS FILLED	80009	119-0181-00
A16E341	119-0759-00			ARSR,ELEC SURGE:145V,GAS FILLED	71482	CG145L
A16E551	119-0285-00			ARSR,ELEC SURGE:470VDC,+/-15V	74276	CG470L
A16F15	159-0064-00			FUSE,CARTRIDGE:1A,250V,10 SEC	75915	212001
A16J311	131-0608-00 ----- -----			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 3)	22526	47357
A16J411	131-0608-00 ----- -----			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 4)	22526	47357
A16J739	131-0608-00 ----- -----			TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 3)	22526	47357
A16L25	108-0422-00			COIL,RF:FIXED,82UH	80009	108-0422-00
A16Q15	151-0188-00			TRANSISTOR:SILICON,PNP	04713	SPS6868K
A16Q41	151-0469-00			TRANSISTOR:SILICON,NPN	80009	151-0469-00
A16Q116	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
A16Q118	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
A16Q119	151-0192-00			TRANSISTOR:SILICON,NPN,SEL FROM MPS6521	04713	SPS8801
A16Q221	151-0750-00			TRANSISTOR:NPN,SI,MPS-A44	04713	OBD
A16Q222	151-0749-00			TRANSISTOR:PNP,SI,MPS-A92	04713	OBD
A16Q237	151-0216-00			TRANSISTOR:SILICON,PNP	04713	SPS8803
A16Q426	151-0219-00			TRANSISTOR:SILICON,PNP	07263	S022650
A16Q435	151-0169-00			TRANSISTOR:SILICON,NPN	80009	151-0169-00
A16Q631	151-0347-00			TRANSISTOR:SILICON,NPN	56289	2N5551
A16Q632	151-0350-00			TRANSISTOR:SILICON,PNP	04713	SPS6700
A16Q633	151-0350-00			TRANSISTOR:SILICON,PNP	04713	SPS6700
A16Q634	151-0347-00			TRANSISTOR:SILICON,NPN	56289	2N5551
A16Q639	151-0223-00			TRANSISTOR:SILICON,NPN	04713	SPS8026
A16R8	321-0368-00			RES.,FXD,FILM:66.5K OHM,1%,0.125W	91637	MFF1816G66501F
A16R21	311-1914-00			RES.,VAR,NONWIR:TRMR,50K OHM,10%,0.50W	73138	72-202-0
A16R26	323-0452-00			RES.,FXD,FILM:499K OHM,1%,0.50W	75042	CECT0-4993F
A16R35	301-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.50W	01121	EB2405
A16R42	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A16R105	307-0104-00			RES.,FXD,CMPSN:3.3 OHM,5%,0.25W	01121	CB33G5

A16 HIGH VOLTAGE & Z AXIS(CONT)
(OPTION 31 ONLY)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A16R107	315-0100-02			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A16R115	311-1915-00			RES.,VAR,NONWIR:20K OHM,10%,0.50W	73138	72-196-0
A16R117	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W	01121	CB1005
A16R121	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
A16R122	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
A16R123	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W	01121	CB2225
A16R124	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A16R126	321-0332-00			RES.,FXD,FILM:28K OHM,1%,0.125W	91637	MFF1816G28001F
A16R127	321-0303-00			RES.,FXD,FILM:14K OHM,1%,0.125W	91637	MFF1816G14001F
A16R128	321-0363-00			RES.,FXD,FILM:59K OHM,1%,0.125W	91637	MFF1816G59001F
A16R129	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A16R130	321-0333-00			RES.,FXD,FILM:28.7K OHM,1%,0.125W	91637	MFF1816G28701F
A16R136	321-0408-00			RES.,FXD,FILM:174K OHM,1%,0.125W	91637	MFF1816G17402F
A16R137	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A16R173	302-0473-00			RES.,FXD,CMPSN:47K OHM,10%,0.50W	01121	EB4731
A16R174	302-0472-00			RES.,FXD,CMPSN:4.7K OHM,10%,050W	01121	EB4721
A16R205	301-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.50W	01121	EB3025
A16R216	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A16R217	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W	01121	CB2735
A16R218	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A16R224	315-0624-00			RES.,FXD,CMPSN:620K OHM,5%,0.25W	01121	CB6245
A16R225	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A16R226	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W	01121	CB3025
A16R227	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
A16R228	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A16R263	301-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.50W	01121	EB1055
A16R264	301-0514-00			RES.,FXD,CMPSN:510K OHM,5%,0.50W	01121	EB5145
A16R306	307-0104-00			RES.,FXD,CMPSN:3.3 OHM,5%,0.25W	01121	CB33G5
A16R307	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A16R308	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A16R312	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W	91637	MFF1816G24900F
A16R328	322-0621-00			RES.,FXD,FILM:900K OHM,1%,0.25W	75042	CEBT0-9003F
A16R329	322-0452-00			RES.,FXD,FILM:499K OHM,1%,0.25W	91637	MFF1421G49902F
A16R331	323-0450-00			RES.,FXD,FILM:475K OHM,1%,0.50W	75042	CECT0-4753F
A16R332	303-0303-00			RES.,FXD,CMPSN:30K OHM,5%,1W	01121	GB3035
A16R333	303-0303-00			RES.,FXD,CMPSN:30K OHM,5%,1W	01121	GB3035
A16R334	323-0393-00			RES.,FXD,FILM:121K OHM,1%,0.50W	91637	MFF1226G12102F
A16R336	301-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.50W	01121	EB1005
A16R337	302-0271-00			RES.,FXD,CMPSN:270 OHM,10%,0.50W	01121	EB2711
A16R342	302-0271-00			RES.,FXD,CMPSN:270 OHM,10%,0.50W	01121	EB2711
A16R358	304-0271-00			RES.,FXD,CMPSN:270 OHM,10%,1W	01121	GB2711
A16R378	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
A16R405	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W	01121	CB7515
A16R406	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W	01121	CB1225
A16R407	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	01121	CB1515
A16R408	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W	01121	CB2415
A16R409	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W	01121	CB1815
A16R415	311-1934-00			RES.,VAR,NONWIR:PNL,2K OHM,20%,0.50W	01121	15M906
A16R425	311-1934-00			RES.,VAR,NONWIR:PNL,2K OHM,20%,0.50W	01121	15M906
A16R431	311-1555-00			RES.,VAR,NONWIR:100K OHM,20%,0.5W	73138	91-77-0
A16R449	304-0271-00			RES.,FXD,CMPSN:270 OHM,10%,1W	01121	GB2711
A16R451	301-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.50W	01121	EB1025
A16R461	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A16R462	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W	01121	CB2265
A16R471	311-1933-00			RES.,VAR,NONWIR:PNL,5M OHM,10%,0.50W	01121	17M095
A16R472	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A16R477	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035

A16 HIGH VOLTAGE & Z AXIS(CONT)
(OPTION 31 ONLY)

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A16R501	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A16R502	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A16R503	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A16R504	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A16R511	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
A16R512	321-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.125W	91637	MFF1816G22101F
A16R521	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
A16R522	321-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.125W	91637	MFF1816G22101F
A16R524	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
A16R527	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A16R528	321-0408-00			RES.,FXD,FILM:174K OHM,1%,0.125W	91637	MFF1816G17402F
A16R529	321-0340-00			RES.,FXD,FILM:34K OHM,1%,0.125W	91637	MFF1816G34001F
A16R530	315-0360-00			RES.,FXD,CMPSN:36 OHM,5%,0.25W	01121	CB3605
A16R531	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W	01121	CB6805
A16R534	321-0177-00			RES.,FXD,FILM:681 OHM,1%,0.125W	91637	MFF1816G681R0F
A16R544	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W	01121	CB1525
A16R558	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A16R561	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	01121	CB1035
A16R605	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A16R625	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W	91637	MFF1816G40200F
A16R626	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A16R627	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
A16R628	315-0184-00			RES.,FXD,CMPSN:180K OHM,5%,0.25W	01121	CB1845
A16R630	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	01121	CB2215
A16R635	301-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.50W	01121	EB3335
A16R636	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A16R637	323-0318-00			RES.,FXD,FILM:20K OHM,1%,0.50W	91637	MFF1226D20001F
A16R646	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A16R647	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A16R648	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
A16R652	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W	01121	CB8235
A16R653	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	01121	CB3335
A16R657	302-0271-00			RES.,FXD,CMPSN:270 OHM,10%,0.50W	01121	EB2711
A16R659	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	01121	CB1025
A16R678	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
A16R705	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A16R715	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91-84-0
A16R716	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W	73138	91-84-0
A16R721	321-0243-00			RES.,FXD,FILM:3.32K OHM,1%,0.125W	91637	MFF1816G33200F
A16R722	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W	91637	MFF1816G66500F
A16R739	315-0225-00			RES.,FXD,CMPSN:2.2M OHM,5%,0.25W	01121	CB2255
A16R748	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W	01121	CB2045
A16R749	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	01121	CB1015
A16R759	307-0550-01			RES NTWK,FXD FI:HV DIVIDER	80009	307-0550-01
A16RV657	307-0638-00			RES,V SENSITIVE:18V,20%,0.5W	03508	MOV-V18ZA1
A16T51	120-1413-00			XFMR,PWR,SDN&SU:HV	80009	120-1413-00
A16TP778	214-0579-00			TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A16U315	156-0072-02			MICROCIRCUIT,DI:MONOSTABLE MV,BURN-IN	01295	SN74121
A16U605	156-0058-02			MICROCIRCUIT,DI:HEX INVRTR,SCREENED	80009	156-0058-02
A16U615	156-0381-02			MICROCIRCUIT,DI:QUAD 2-INP EXCL OR GATE	01295	SN74LS86
A16U616	156-0047-02			MICROCIRCUIT,DI:TPl 3 INP,NAND GATE	27014	DM7410NA+ OR JA+
A16U645	156-0067-13			MICROCIRCUIT,LI:OPNL AMPL,SELECTED	04713	MC1741CUDS
A16VR235	152-0282-00			SEMICOND DEVICE:ZENER,0.4W,30V,5%	04713	1N972B

Component No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
				CHASSIS PARTS		
A5001	119-0420-00			FILTER,RFI:6A,250VAC,400HZ	02777	F-11935-6
CR1005	152-0518-00			SEMICOND DEVICE:RECT,SI,50V,27A	80009	152-0518-00
CR1006	152-0518-00			SEMICOND DEVICE:RECT,SI,50V,27A	80009	152-0518-00
F5001	159-0149-00			FUSE,CARTRIDGE:4A,250V,SLOW-BLOW	71400	MDA 4 AMP
L1002	119-0971-00			COIL,TUBE DEFL:	80009	119-0971-00
Q1001	151-0415-00			TRANSISTOR:SILICON,NPN	04713	MJE1102
Q1002	151-0373-00			TRANSISTOR:SILICON,PNP	80009	151-0373-00
Q1003	151-0623-00			TRANSISTOR:SILICON,NPN	01295	T1P52
R5001	311-2114-00			RES.,VAR,NONWIR:PNL,10K OHM,20%,0.25W	01121	72J4G040R103M
T1001	120-1412-00			XFMR,PWR,SND&SU:LF	80009	120-1412-00
V1001	148-1005-00			RELAY,SOL STATE:250VAC,10A CONT,12VDC	90484	C1-120-PC-240
V1002	156-0277-00			MICROCIRCUIT,LI:VOLTAGE REGULATOR	07263	MICR0A7805UC
V5001	154-0845-00			ELECTRON TUBE:CRT,T4100-CWT,DVST	80009	154-0845-00

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
2-6	337-1981-04			1		SHLD,IMPLOSION:RED	80009	337-1981-04
-37.1	361-0953-01			1		SPCR,DEFL YOKE:2.05 X 1.184 ID X 1.475 OD	80009	361-0953-01
-47	650-0295-00			1		TUBE SHLD ASSY:	80009	650-0295-00
	----- -----			-		(FOR OTHER PARTS SHOWN ON THIS ILLUSTRATION SEE		
	----- -----			-		4114 SERVICE MANUAL,VOL. 2)		

THE RIGHT SCOPE AND PLUG-INS TO FIT YOUR GROWING MEASUREMENT NEEDS

Tektronix®
COMMITTED TO EXCELLENCE

THE TEK 5000 SERIES CONCEPT: CAPABILITY FOR TODAY, RECONFIGURABILITY FOR TOMORROW.

Get the most out of your equipment with Tek's modular approach.

Contained within the Tek 5000 Series is one of the broadest selections of measurement capabilities available including the new 5116 Color Oscilloscope. Even more impressive, however, is the Series' versatility: its plug-in design lets you reconfigure your equipment for a variety of measurements, or upgrade it as your needs progress.

Several oscilloscope mainframes plus many general-purpose and specialized plug-ins add up to a complete range of instruments for applications in product evaluation, mechanics, medicine, biophysics, and other disciplines.

Keep pace with the latest advances in speed and accuracy. A case in point: the 5D10 Waveform Digitizer plug-in turns any 5000 Series mainframe into a digital oscilloscope—with high performance at a low price. And, it enables color display capability in the 5116 mainframe.

You can choose from a wide selection of high-gain differential amplifiers designed for exacting measurements; a complete line of single, dual, and four-channel amplifiers for single to eight-channel acquisition; single, dual, and delayed sweep time bases that ensure more accurate measurements; high resolution displays; and special-purpose plug-ins that extend your 5000 Series scope to spectrum analysis, curve tracing, and sampling up to 1 GHz. There's even a blank plug-in kit for building your own special-purpose instrument module.

Select your mainframe for measurement basics. For versatile data storage. Or for connecting to instruments over the GPIB. You can choose from real time scopes, with single trace or up to eight-trace capability, and with bandwidth capability from 1 MHz to 1 GHz, depending upon plug-in.

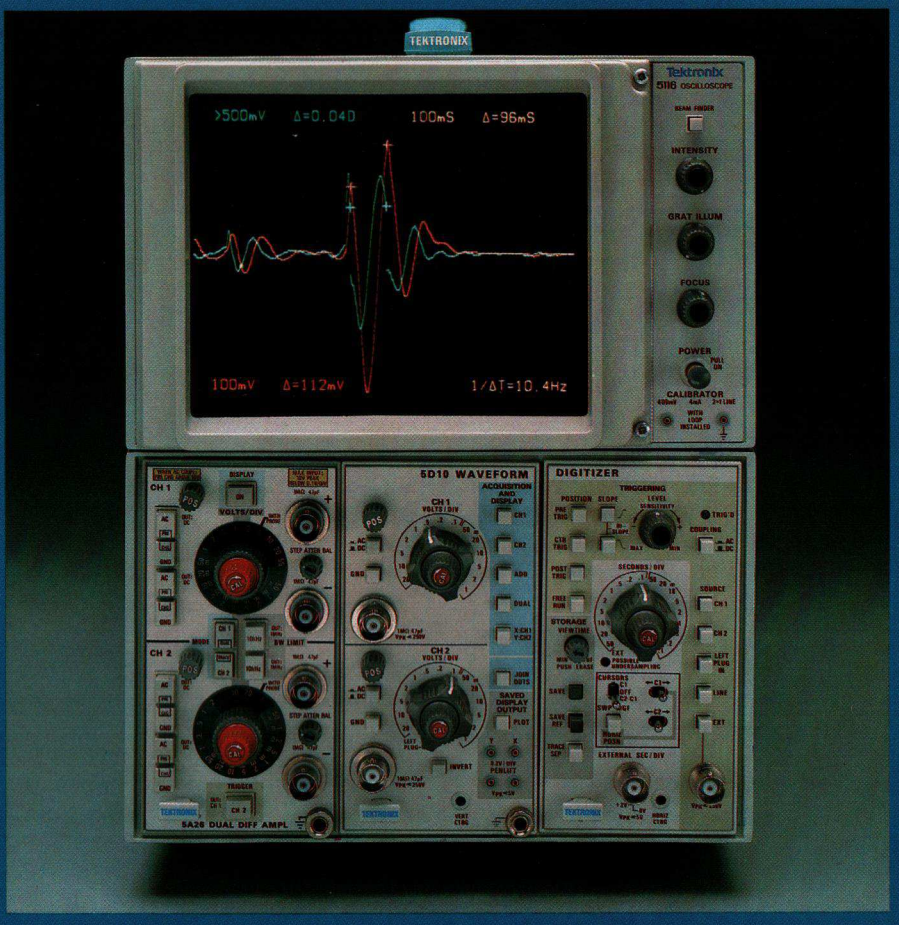
If your applications involve comparative low frequency measurements, choose from several bistable storage mainframes, including dual beam or split screen.

If you need to observe fast single-shot or low repetition rate signals, consider Tek's variable persistence storage. You can use its integrating effect to suppress random noise and simplify interpretation.

Finally, to store signals indefinitely and reexamine them in detail, your ideal choice may be a digital storage mainframe or waveform digitizer plug-in. Tek's new 5116 Color Oscilloscope offers the benefits of digital storage with color differentiation.

Remember too, that a 5000 Series digital storage mainframe can also connect you with the world of automated measurements through its standard GPIB capability.

Insurance for the future: you can add other 5000 Series mainframes, and continue to use your existing plug-ins. You can add either plug-ins or mainframes as you need them, always enhancing the capabilities of the instruments you already have.



The new 5116, combined with the Tek 5D10 Waveform Digitizer plug-in, creates high-resolution displays in up to three colors. It can substantially aid the viewability and clarify the evaluation of waveform traces.

5000 SERIES PLUG-IN OSCILLOSCOPE MAINFRAMES

Mainframe/Plug-in Module Recommendations at a glance

Use this quick-reference color key to select from among plug-ins recommended for the various mainframes.

Each mainframe is designated by a color as noted below.

5110/R5110

5440/R5440

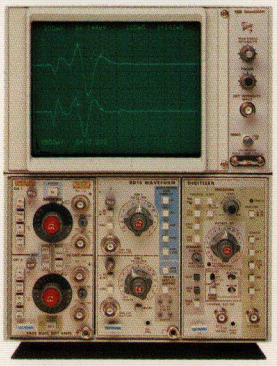
5223/R5223

5111A/R5111A

5113/R5113

5441/R5441

NON-STORAGE

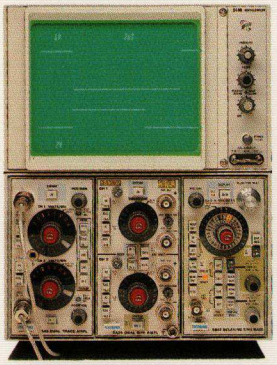


5110/R5110/5116*

2 MHz Bandwidth.
Large 6.5 inch CRT.
Three plug-in flexibility.
Optional Signal Outputs.

Applications:
Mechanical design testing.
Low-frequency electrical.
O.E.M. mainframe for custom plug-ins.

*With 5D10 plug-in, the 5116 is a digital storage oscilloscope with color display.

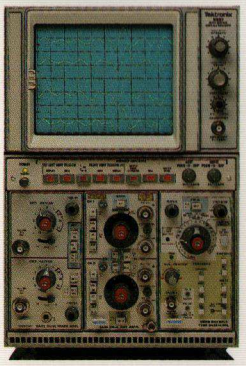


5440/R5440

50 MHz Bandwidth.
CRT Readout.
Large 6.5 inch CRT.
Three plug-in flexibility.
Bench to Rack Convertibility.

Applications:
Electrical Engineering.
Ultrasonics
Electrical component testing.

DIGITAL STORAGE

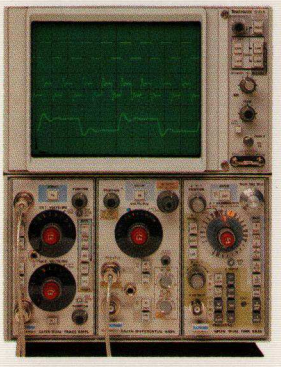


5223/R5223/5B25N

10 MHz Bandwidth real-time.
10 MHz Bandwidth repetitive store.
100 KHz Bandwidth single-shot store.
Bi-slope triggering.
Pre-trigger view.
10-Bit vertical resolution.
Stored X-Y display.
Roll mode (like a strip chart recorder).
X-Y recorder output.
GPIB interface (optional).

Applications:
Mechanical.
Biophysical (life sciences).
Electrical.

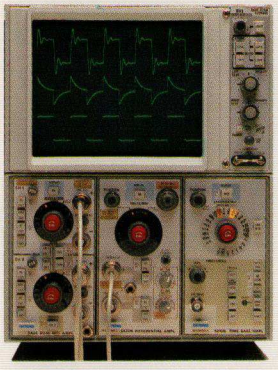
CRT STORAGE



5111A/R5111A

2 MHz Bandwidth.
Single beam storage.
Bistable split screen storage.
50 div/ms (Enhanced mode).
800 div/ms (Enhanced mode—Opt. 3).
View times up to 10 hours.

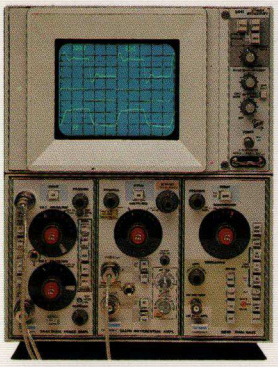
Applications:
Single shot events.
Mechanical.
Biophysical (life sciences).
Electrical.



5113/R5113

2 MHz Bandwidth.
Dual beam bistable storage.
Bistable split-screen storage.
20 div/ms stored writing speed.
Three plug-in flexibility.
View times up to 10 hours.

Applications:
Stimulus-response potentials.
Capturing two events simultaneously.



5441/R5441

50 MHz Bandwidth.
Variable persistence storage.
5,000 div/ms stored writing speed.
CRT Readout.
Three plug-in flexibility.
View times up to 5 min.

Applications:
Capturing High Speed transient or low repetitive rate events.
Spectrum Analysis from 0 to 100 KHz (5L14N).
Sampling to 1 GHz (5S14N).

CHOOSING YOUR 5000 SERIES SCOPE

Start by determining the general criteria your instrument mainframe must meet. What maximum bandwidth and rise time will you need? Will your application benefit by storage capability? Are you interested in evolving to automated measurement? What other features will be important to your work?

Then select the plug-ins that complement your mainframe selection, keeping in mind that you can add plug-ins as necessary to round out your total measurement capability.

Bandwidth and Rise Time. These are the most important factors to consider in choosing a Tek 5000 Series mainframe oscilloscope.

The frequency of the signals you're working with determines the scope system bandwidth you'll need to measure them accurately. For less than 3% error, your scope should be 3.33 times faster than the signal to be measured. That is, it should have a bandwidth of 3.33f MHz, where *f* is the frequency of your fastest signal (in MHz). Refer to *Figure 1* to determine bandwidth for other margins of error.

To capture the rise times accurate to within 2%, your scope system should have a rise time of about

SCOPE SELECTION CHART
For measuring sinewave amplitudes

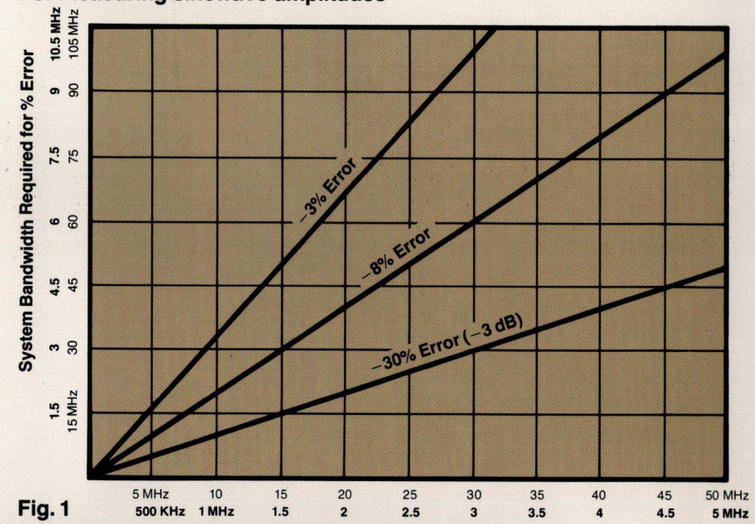


Fig. 1

Figures 1 and *2:* Determining Bandwidth and Rise Time.
Figure 3: Stored writing speed determines maximum frequency or fastest step response signal that can be displayed with a particular amplitude. Refer to this chart for help in determining the stored writing speed you'll require for your storage application.

RATIO OF RISE TIMES
(Instrument: test device)

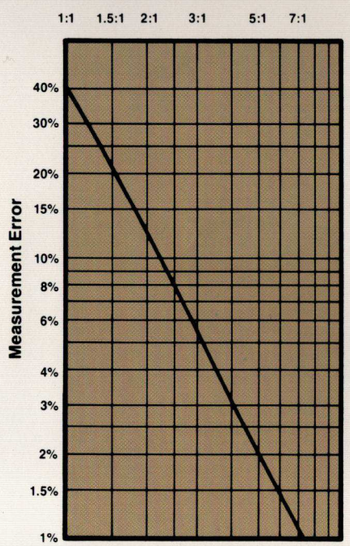


Fig. 2

CRT STORAGE PERFORMANCE
Step Rise Time

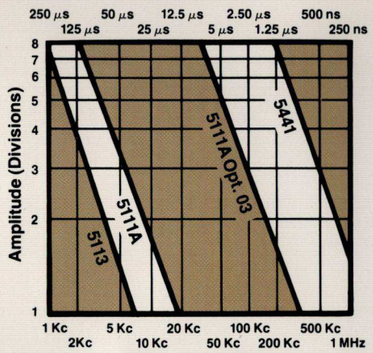


Fig. 3

t/5,where t is the fastest possible rise time (in nanoseconds). Refer to *Figure 2* to determine rise time requirements for other margins of error.

Frequency response of most Tektronix scopes is designed so that bandwidth and rise time of the instrument are related by the approximation:

$$T_r \text{ (ns)} = \frac{350}{BW \text{ (MHz)}}$$

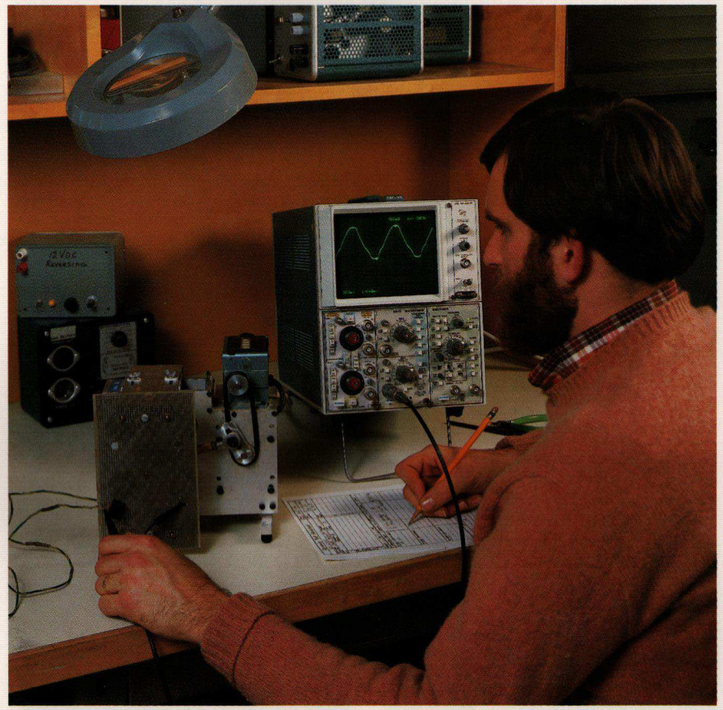
Conventional and storage technologies.

You can use conventional "real time" scopes, which are less expensive than storage scopes, for classroom, production line, or other applications not requiring waveform storage. Use conventional scopes to view repetitive signals greater than about 50 Hz, or if you wish to photograph the waveform of interest for permanent records.

However, for many applications storage is essential. For example, in suppressing noise or jitter, displaying low repetition rate or slowly varying signals, capturing transients or signal events, storage can be invaluable.

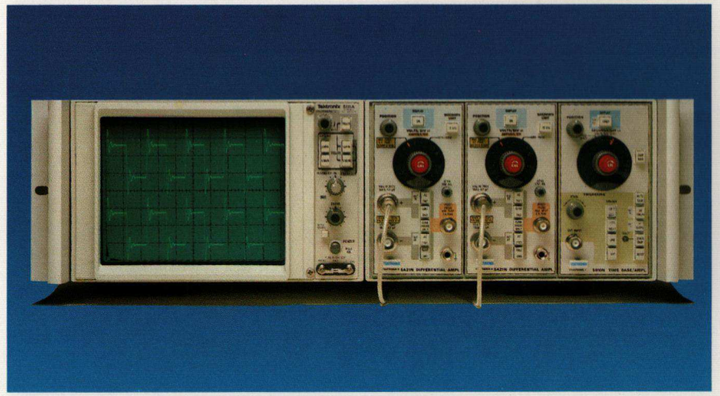
The 5000 Series offers three types of storage with each crt storage scope also operating in non-storage mode.

Variable persistence and *bistable* techniques store traces directly on



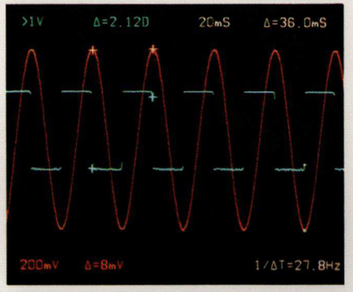
(Above) Tek's 5D10 Waveform Digitizer plug-in adds digital storage capability to 5000 Series scopes. Here the storage capability of the 5D10 is utilized in potentiometer life testing procedures, in which the pre-test trace of resistance is stored and compared against a trace made after the pot has been cycled a number of times.

(Left) Another application quick to take advantage of the 5000 Series' 5D10 Waveform Digitizer plug-in is eye research. In this experiment, microelectrodes are used to measure how animal cells respond to a given light source. The 5D10, in a rackmount 5000 Series scope, is used to record each cell's activity as the light source is varied. Eventually, the entire "receptive field" can be mapped to demonstrate patterns of cell response.



All Tek 5000 Series oscilloscope mainframes are available in rackmount configuration, as shown here, or as benchtop models.

In a typical dual channel application, the 5116's color display quickly distinguishes between each channel at every crossing point for the full amplitude over the display.



In a situation with unpredictable signals, typical of transducer measurements such as in structural resonance, the different color traces clearly show compatibility or phase difference.

the crt phosphor. With bistable storage, waveforms can be stored for several hours, and will stay bright and well-defined until erased. All 5000 Series bistable instruments allow you to store a reference signal for comparison with incoming signals. Select a 5100 Series bistable storage scope if you plan to view signals for long periods of time, store multiple, nonrecurring events, construct waveforms from slow, repetitive signals with fast step responses, capture signals over time for later review, or want to display a reference trace on one half of the CRT for comparison with an incoming trace on the other.

Variable persistence produces continuous gradations between the bright written waveform and the darker background of the CRT phosphor. The length of time a waveform can be stored is variable, up to 5 minutes at maximum writing speed and normal intensity. Its high contrast makes it a good choice for CRT photography.

Choose a 5400 Series variable persistence storage scope if you'll need to suppress random noise or flicker, compare repetitive signals, or produce bright, high-contrast displays of fast signals that recur at slow periodic rates.

Digital storage oscilloscopes digitize signals, including pre-trigger data, store the information in digital memory, and then display it immediately, or later upon command. Traces are reconstructed from digitized information so they can be recalled at any time, and stay bright and crisp for as long as necessary.

Pushbutton controls allow you to position and expand stored signals on the CRT. As the 5223 is GPIB-compatible, you can transmit stored signals over the IEEE-488 interface for documentation or processing.

Digital storage scopes are characterized in terms of *useful storage bandwidth** —the highest frequency sinewave that can be stored in a single sweep and clearly displayed—and *equivalent storage bandwidth,* which generally equals the scope's analog bandwidth.

Select the 5223 digitizing scope when your application requires a useful storage bandwidth of 100 kHz or an equivalent storage bandwidth of 10 MHz. Consider the 5110/5D10 combination when your application requires a useful storage bandwidth of 100 kHz.

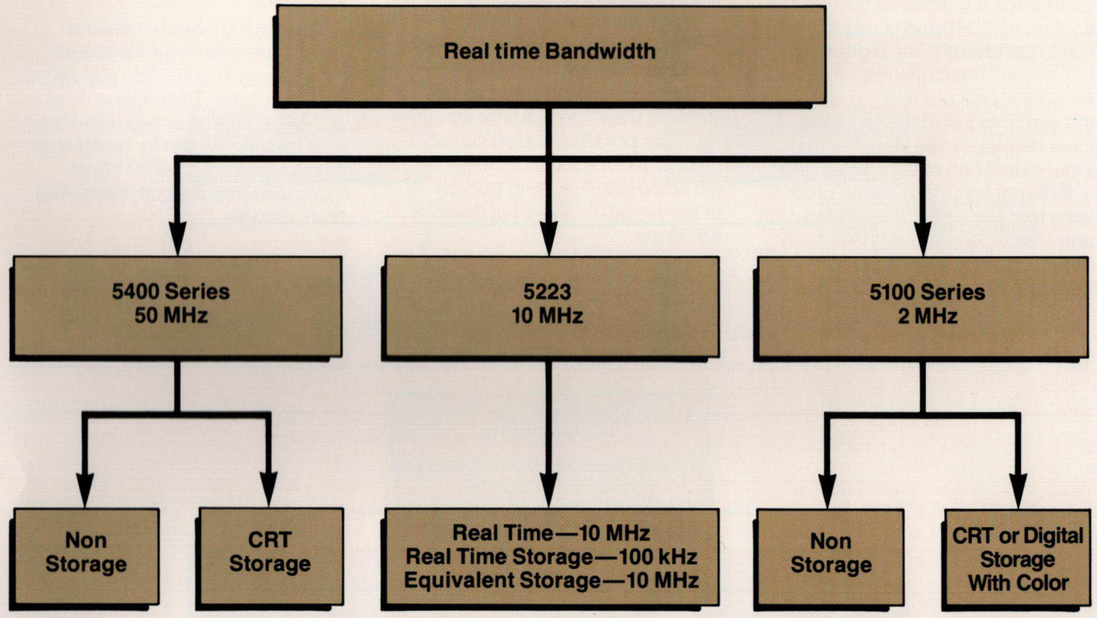
Finally, for the last word in display viewability, consider the color capability of Tek's new 5116. When coupled with the 5D10 plug-in, the 5116 lets you interpret and compare signals with new speed and confidence. Its crisp, three-color display can be especially helpful with non-repetitive, transducer-type measurements, or in clarifying test procedures with waveforms color-coded to probes and test points.

*For a full-scale sinusoidal signal, useful storage bandwidth is defined as:

$$USB\ (in\ MHz) = \frac{\text{Maximum Digitizing Rate}}{K}$$

where K equals approximately 25 for dot displays, 10 for vector displays, and 2.5 for interpolated displays.

SELECT THE RIGHT MAINFRAME



Two 5400 Series mainframes acquire signals of up to 50 MHz bandwidth, or, with the 5S14 sampling plug-in, as high as 1 GHz. You can choose between a single beam conventional model or one with variable persistence storage.

Both scopes feature CRT readout of plug-in scale factors (CRT readout available with all plug-ins except those whose model numbers end in *N*), three compartments for plug-ins, and bench or rackmount configurations. Most 5000 Series plug-ins are compatible with the 5400 Series instruments.

The 5223 Digitizing Oscilloscope captures repetitive events as fast as 10 MHz and single events to 100 kHz. You can use it to store 1016 bits of data—that is, 1016 unique points on a waveform—per vertical compartment.

The 5223 combines a high-quality display and pre-trigger signal manipulation with optional GPIB interface and conventional CRT storage capability. It is available in both benchtop and rackmount configurations.

Four 5100 Series mainframes acquire signals of up to 2 MHz. Two single beam, one dual beam, and one bistable, split-screen storage model all accommodate one horizontal and two vertical deflection plug-ins. They readily convert from bench to rackmount configuration.

You can select from more than 15 plug-ins for the 5100 Series, including a spectrum analyzer covering the zero to 100 kHz range; the general-purpose 5S14 1 GHz dual-trace sampler; and the 5D10 waveform digitizer and prerequisite for color capability on the 5116.

PLUG-IN SELECTION CRITERIA

Amplifiers: obtain the right range, without the noise. Sensitivity characterizes the input required to produce a defined deflection of a spot on the CRT, and is usually relative to bandwidth: The higher the bandwidth, the more noise the amplifiers pick up, and the stronger the signal required to produce a clear display. Noise in even the best input circuit can mask weak signals.

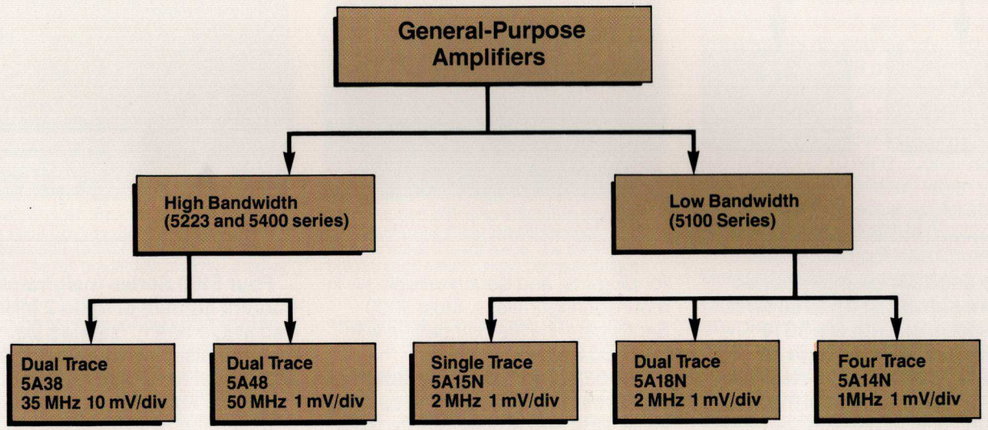
External noise can cause problems too: but 5000 Series differential amplifier plug-ins can significantly reduce the effects of external noise and common-mode signals.

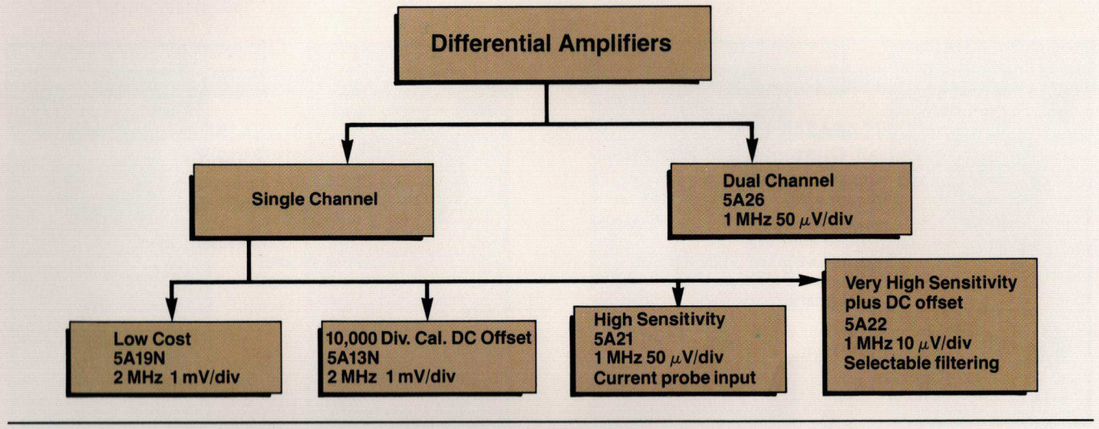
Multiple-input amplifiers allow you to display several signals simultaneously without disturbing connections to the oscilloscope.

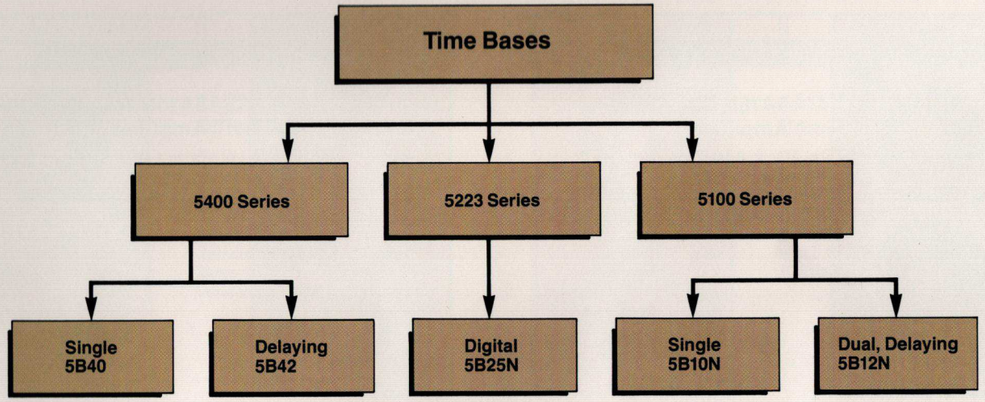
Time Bases: Achieve the most accurate measurements by matching sweep speed to rise time. To measure rise time as accurately as possible, a step signal should occupy most of the full vertical scale with the rising portion of the signal displayed at nearly a 45° slope.

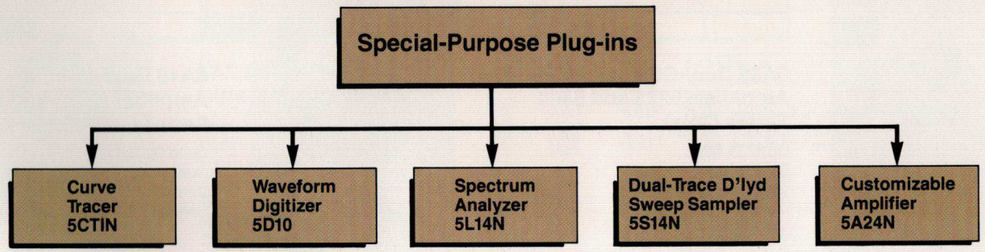
If you make rise time measurements to see whether limits are met or exceeded, you can usually compare a signal with a standard signal of known rise time, even with a sweep that provides a steep display, and provided the vertical deflection system rise time is adequate.

In delaying sweep measurements, use two linear calibrated time bases. The first lets you select the delay time. The second is usually set a decade or two faster than the delaying sweep for better resolution. This combination offers increased accuracy in measuring time intervals.





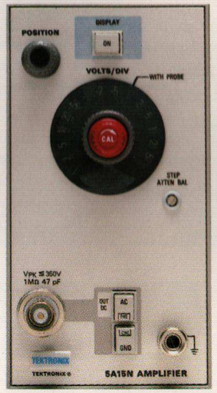




AMPLIFIER PLUG-INS

5A24N Low-Cost Customizable Amplifier

Dc to 2 MHz.
Easy to customize.
50 mV/div to 1 V/div continuously variable.
3⅜ x 2¾ inch soldering pad matrix.
Banana plug input.

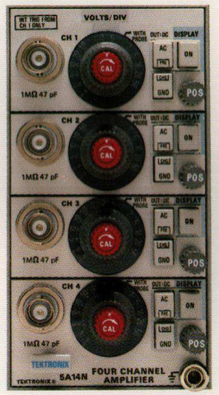


5A15N Single-Channel Amplifier

Dc to 2 MHz.
Single input.
1 mV/div to 5 V/div calibrated deflection factors.

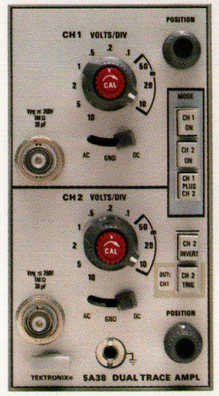
5A18N Dual-Channel Amplifier

Dc to 2 MHz.
Dual input.
1 mV/div to 5 V/div.
Selectable trigger source.



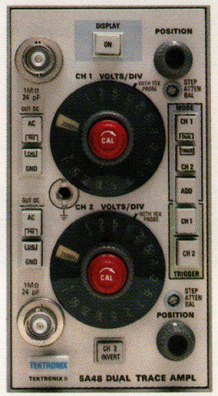
5A14N Four-Channel Amplifier

Dc to 1 MHz.
Four Input.
1 mV/div to 5 V/div.



5A38 Dual-Channel Amplifier (5223 and 5400 Series Only)

Dc to 35 MHz.
Dual inputs.
10 mV/div to 10 V/div.



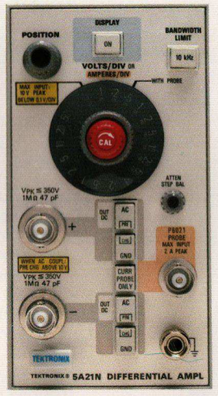
5A48 Dual-Channel Amplifier (5223 and 5400 Series Only)

Dc to 60 MHz.
Dual inputs.
10 mV/div to 10 V/div.
Selectable trigger source.

DIFFERENTIAL AMPLIFIER PLUG-INS

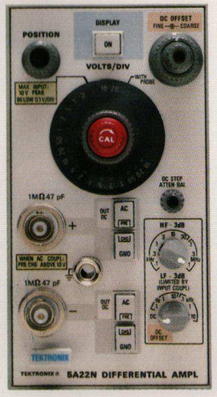
5A19N Low Cost Differential Amplifier

Dc to 2 MHz.
Single input.
1 mV/div to 20 V/div.
1000: 1 Cmrr.
Variable dc offset.
Banana plug input.



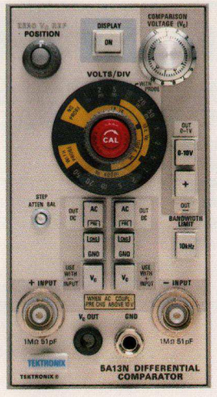
5A21N Single-Channel Differential/Current Amplifier

Dc to 1 MHz.
Single input.
High Sensitivity Voltage and Current Measurements.
50 μV/div to 5 V/div.
100,000: 1 Cmrr.
10 kHz Bandwidth limit switch.
0.5mA/div to 0.5 A/div with P6021 Current Probe.



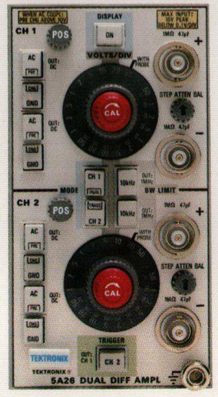
5A22N Single-Channel Differential Amplifier

Dc to 1 MHz.
Very High Sensitivity.
Single input.
10 μV/div to 5 V/div.
100,000: 1 Cmrr.
Selectable upper and lower rolloff filters.
Variable dc offset.



5A13N Differential Comparator Amplifier

Dc to 2 MHz.
Single input.
1 mV/div to 5 V/div.
10,000: 1 Cmrr.
Comparison voltage 0 to ± 10 V and 0 to ± 1 V.
10 kHz Bandwidth limit switch.



5A26 Dual-Channel Differential Amplifier

Dc to 1 MHz.
Dual inputs.
50 μV/div to 5 V/div.
100,000: 1 Cmrr.
Two 10 kHz Bandwidth limit switches.
Crt readout capability.

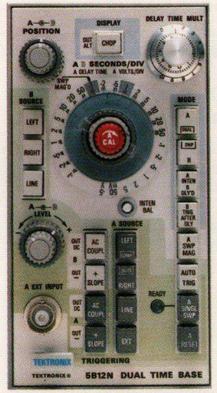
RECOMMENDED PROBES FOR 5000 SERIES AMPLIFIER PLUG-INS

Amplifier Plug-ins	Voltage Probe	Features	Order Number
5A14N 5A15N 5A18N	P6060	Full bw, low cost (not compatible with CRT readout).	010-6060-03
	P6062B	Full bw, switchable attenuation, ground reference button.	010-6062-13
5A13N 5A21N 5A22N 5A26	P6062B	Full bw, switchable attenuation, ground reference button.	010-0062-13
	P6101	Full bw, miniature. Modular construction simplifies repair.	010-6101-03
	P6055	Adjustable attenuation. will give up to 100,000: 1 CMRR when used in pairs. (5A21N, 5A22N and 5A26).	010-6055-01
5A38 5A48 5D10	P6105	Full bw, miniature. Modular construction simplifies repair.	010-6105-03
	P6062B	Switchable attenuation (full bandwidth in the 10X position) ground reference button.	010-6062-13
	P6101	Miniature, modular (reduced bandwidth, except 5D10)	010-6101-03

TIME BASE PLUG-INS

5B10N Single-Sweep Time Base/Amplifier

5 s/div to 1 μs/div.
X10 mag to 100 ns/div.
Triggering to 2 MHz.
Auto trigger.
50 mV/div and 500 mV/div calibrated external horizontal input.

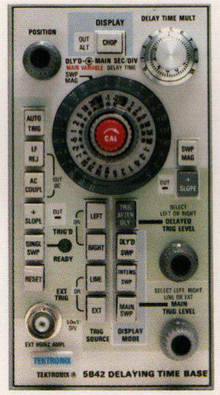


5B12N Single, Dual, or Delayed-Sweep Time Base

5 s/div to 1 μs/div.
X10 mag to 1 μs/div.
4 display modes: A sweep; B sweep; A intensified—B, delayed; dual sweep.
Auto trigger.
External horizontal input.

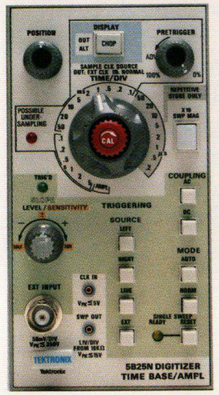
5B40 Low-Cost Time Base (5400 Series Only)

5 s/div to 0.1 μs/div.
X10 mag to 10 ns/div.
Triggering to 60 MHz.
External horizontal input.
Crt readout of sweep speed.



5B42 Dual Time Base (5400 Series Only)

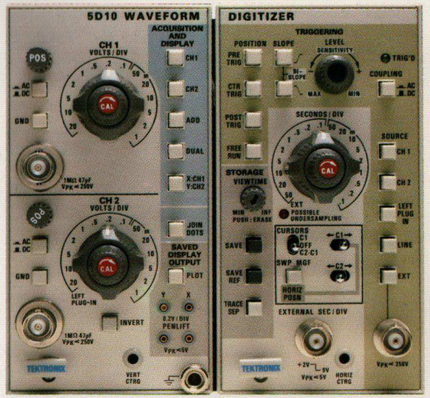
5 s/div to 0.1 μs/div.
X10 mag to 10 ns/div.
Triggering to 60 MHz.
Delayed Sweep.
External Horizontal Input.



5B25N Digital Time Base (5223 Only)

5 s/div to 0.2 μs/div.
Pretrigger.
Bi-slope Triggering.
Sampling rate of 1 MHz at 0.1 ms/div.
Repetitive Store.
External Clock Input.

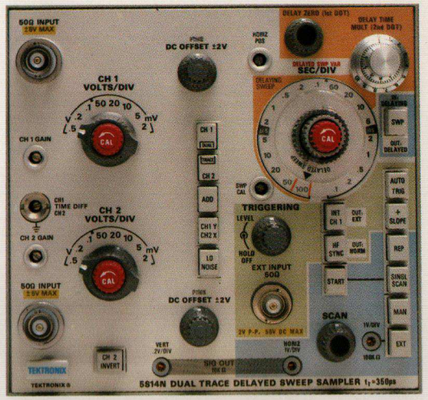
SPECIAL-PURPOSE PLUG-INS



5D10 Waveform Digitizer

Converts any 5000 Series mainframe into a digital storage scope.
Enables color display capability on the 5116 mainframe.
100 kHz Bandwidth single shot storage.
Crt readout of operational status.
Dual cursor measurements to 1%.
Dual channel 1 mV sensitivity.
Save reference waveforms.
X-Y recorder output.
Signal conditioning via left vertical plug-in.
Pre and post trigger viewing.

Applications:
Mechanical. Biophysical. Electrical.



5S14N Sampling Plug-in

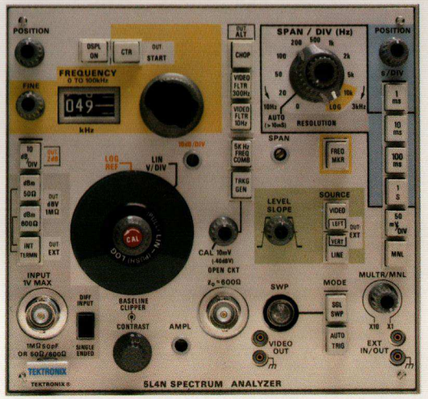
Sampling to 1 GHz Bandwidth.
Dual Trace.
2 mV/div to 0.5 V/div.
Delayed Sweep 100 ps/div to 100 μs/div.
Delaying Sweep 10 ns/div to 100 μs/div.
Two-dot Time Measurements.

Applications:
Very high frequency.
Repetitive signal measurements.
Electronic components.
Logic Circuits testing.
Magnetic peripherals.

5CT1N Curve Tracer Plug-in

Low-Cost, Semiconductor Curve Tracer.
Tests Semiconductor Devices to 0.5 W.
10 nA/div to 20 mA/div Vertical Deflection Factors.
0.5 V/div to 20 V/div Horizontal Deflection Factors.
Easy to Operate.

Applications:
Low power semiconductor.
Testing and matching.



5L4N Spectrum Analyzer Plug-in Low Cost

0 to 100 kHz Frequency Range.
10 Hz to 3 kHz Resolution Bandwidth.
Log and Linear Span Modes.

Applications:
Audio.
Mechanical.
Auto Resolution.

U.S.A., Asia, Australia, Central & South America, Japan
Tektronix, Inc.
P.O. Box 1700
Beaverton, Oregon 97075
For additional literature, or the address and phone number of the Tektronix Sales Office nearest you, contact:
Phone: (800) 547-1512
Oregon only: (800) 452-1877
Telex: (910) 467-8708
TLX: 151754
Cable: TEKWSGT

Europe, Africa, Middle East
Tektronix Europe B.V.
European Headquarters
Postbox 827
1180 AV Amstelveen
The Netherlands
Phone: (20) 471146
Telex: 18312-18328

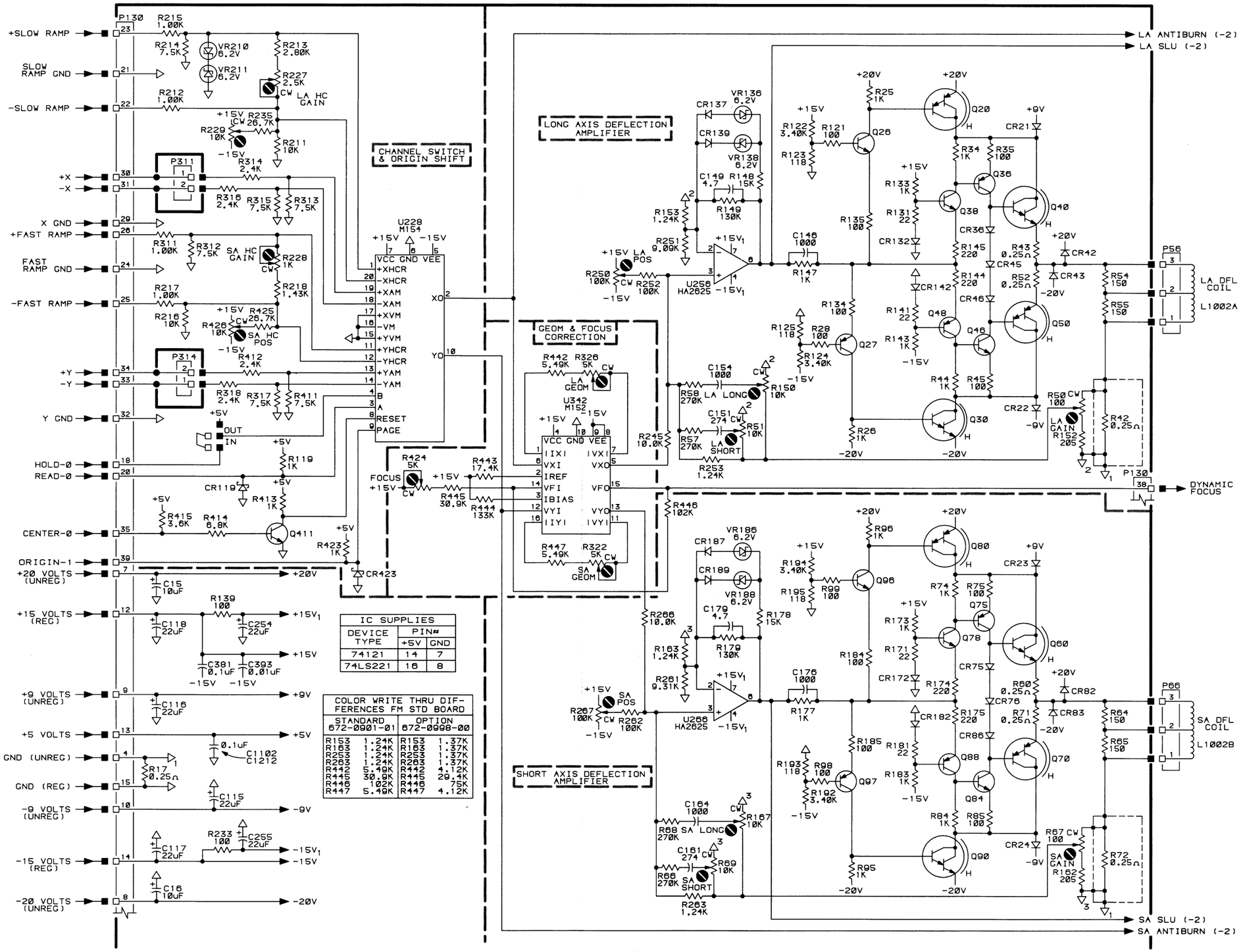
Canada
Tektronix Canada Inc.
P.O. Box 6500
Barrie, Ontario L4M 4V3
Phone: (705) 737-2700

Tektronix sales and service offices around the world:
Albania, Algeria, Angola, Argentina, Australia, Austria, Bangladesh, Belgium, Bolivia, Brazil, Bulgaria, Canada, Peoples Republic of China, Chile, Colombia, Costa Rica, Czechoslovakia, Denmark, East Africa, Ecuador, Egypt, Federal Republic of Germany, Fiji AWA New Zealand, Finland, France, Greece, Hong Kong, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Ivory Coast, Japan, Jordan, Korea, Kuwait, Lebanon, Malaysia, Mexico, Morocco, The Netherlands, New Zealand, Nigeria, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Qatar, Republic of South Africa, Romania, Saudi Arabia, Singapore, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Syria, Taiwan, Thailand, Turkey, Tunisia, United Arab Emirates, United Kingdom, Uruguay, USSR, Venezuela, Yugoslavia, Zambia, Zimbabwe.

Tektronix®
COMMITTED TO EXCELLENCE

2/84

52W-5119-1

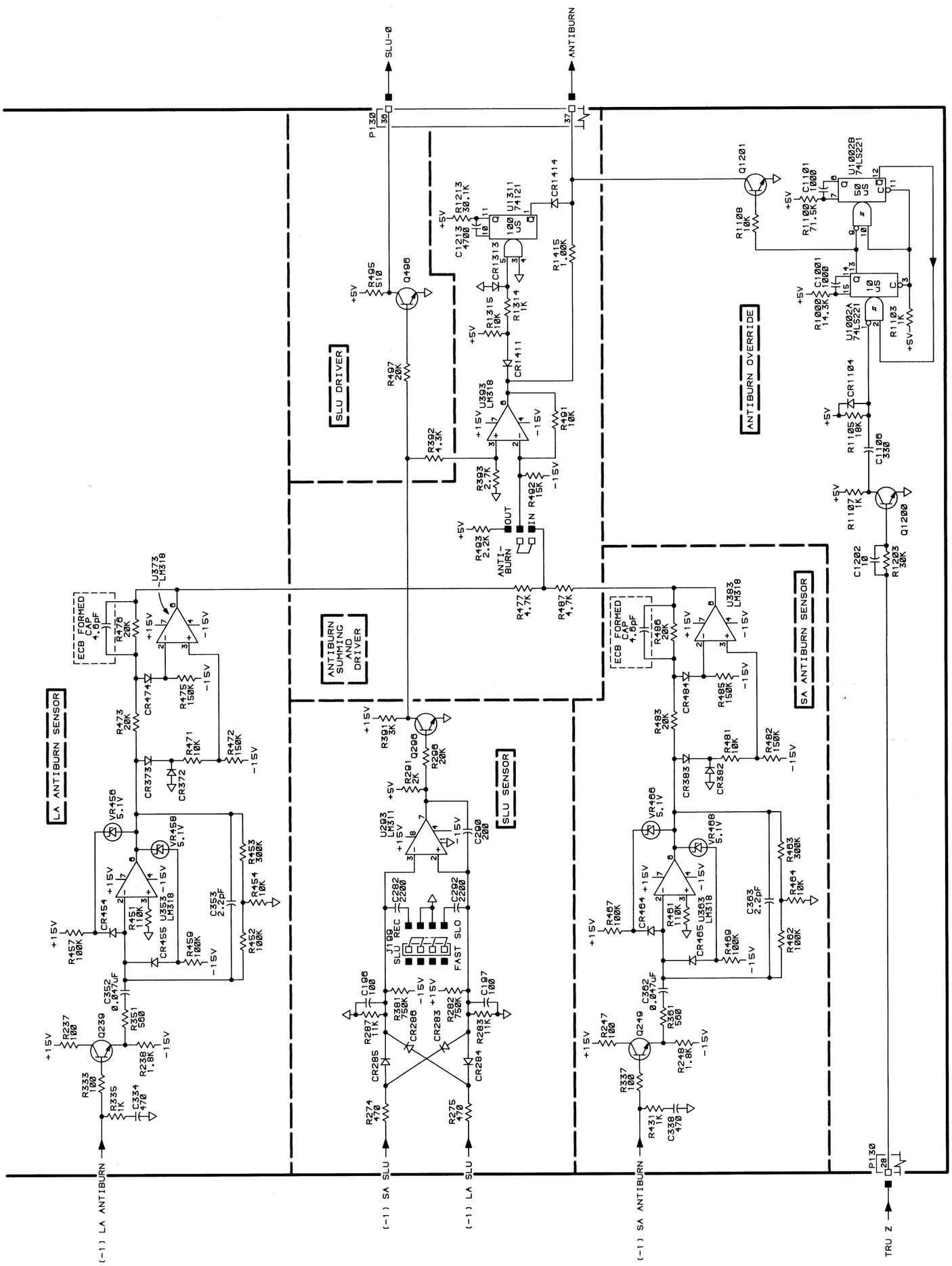


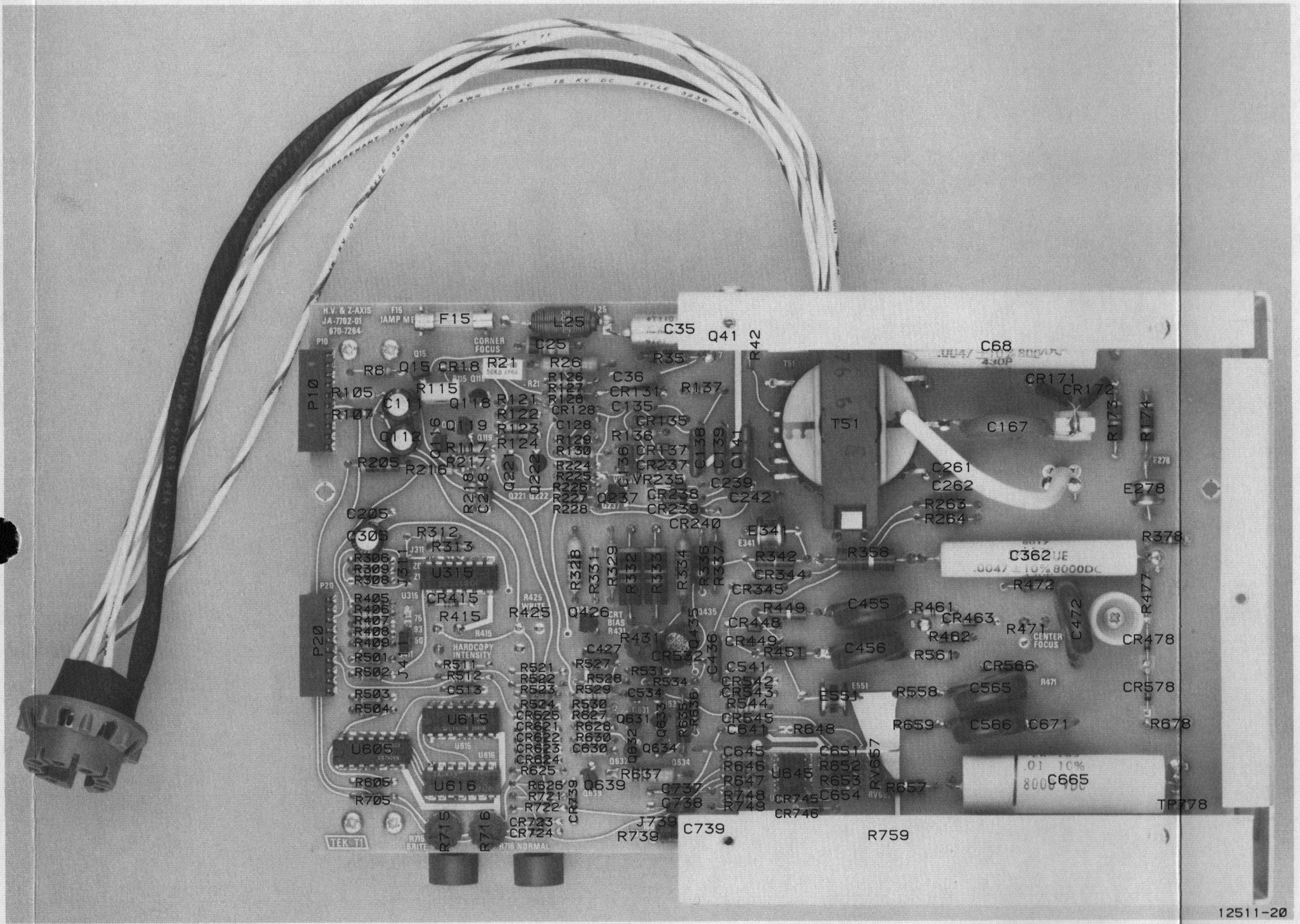
4114 OPT.31

@ 3818-49

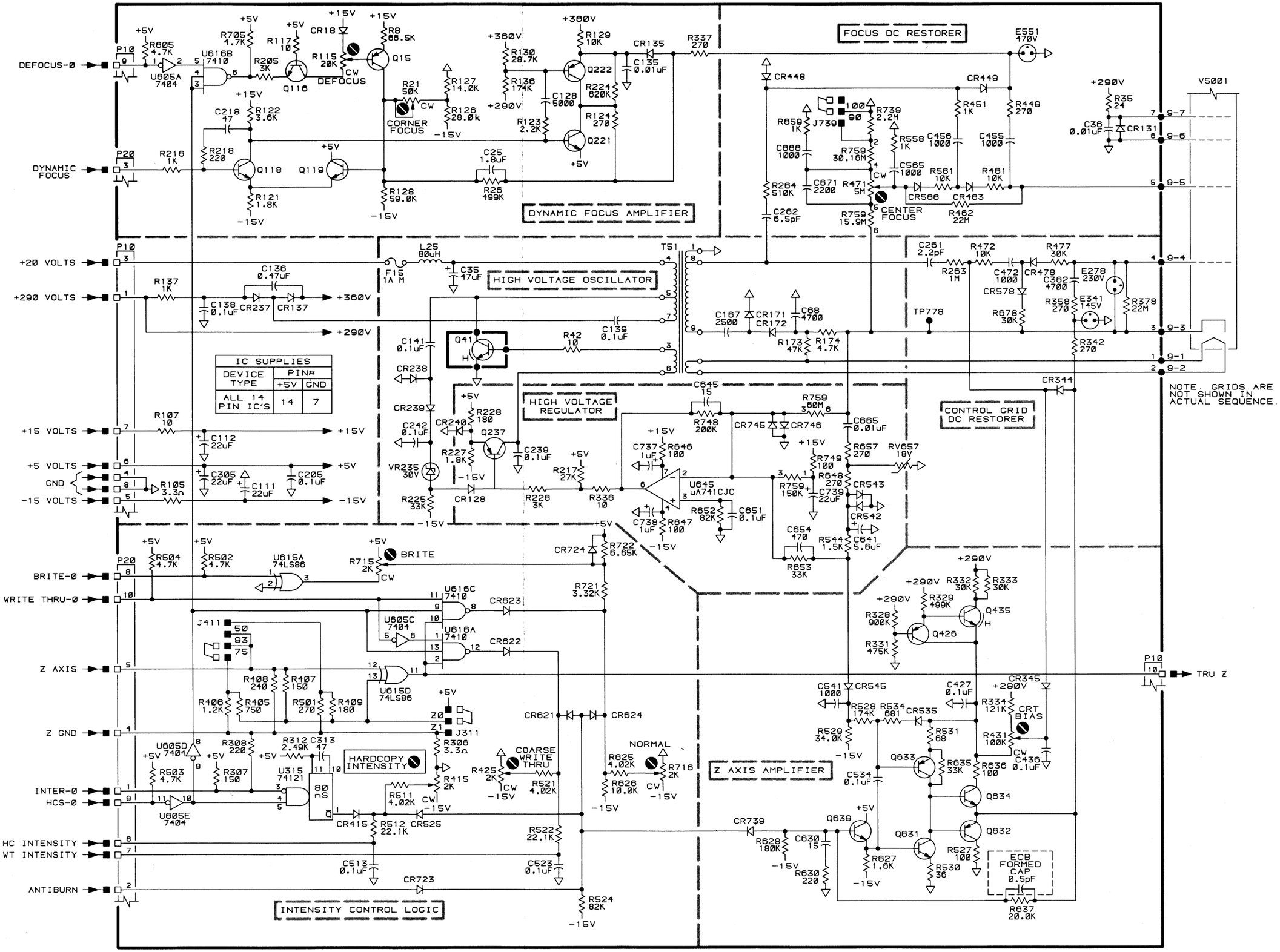
672-0998-00 DEFLECTION AMPL. BD. A15A1-1 (1 OF 2)

DEFLECTION AMPLIFIER 672-0998-00 A15-1


672-0998-00 DEFLECTION AMPL. BD. A15A1-2 (2 OF 2)
4114 OPT. 31
SLU-0
ANTIBURN
P130
SLU DRIVER
ANTIBURN OVERRIDE
ANTIBURN SUMMING AND DRIVER
LA ANTIBURN SENSOR
SA ANTIBURN SENSOR
SLU SENSOR
Q496
Q1201
Q1200
Q239
Q249
Q200
U373 LM318
U393 LM318
U353 LM318
U363 LM318
U293 LM311
U1311 74121
U1002A 74LS221
U1002B 74LS221
J199 SLU REC
FAST SLO
ANTI-BURN
(-1) LA ANTIBURN
(-1) SA SLU
(-1) LA SLU
(-1) SA ANTIBURN
TRU Z
P130



High Voltage and Z-Axis (672-1000-00) Component Locations.



4114 OPT.31

@ 3818-51

672-1000-00
670-7264-00 HIGH VOLTAGE & Z AXIS BD. A16-1
(1 OF 1)

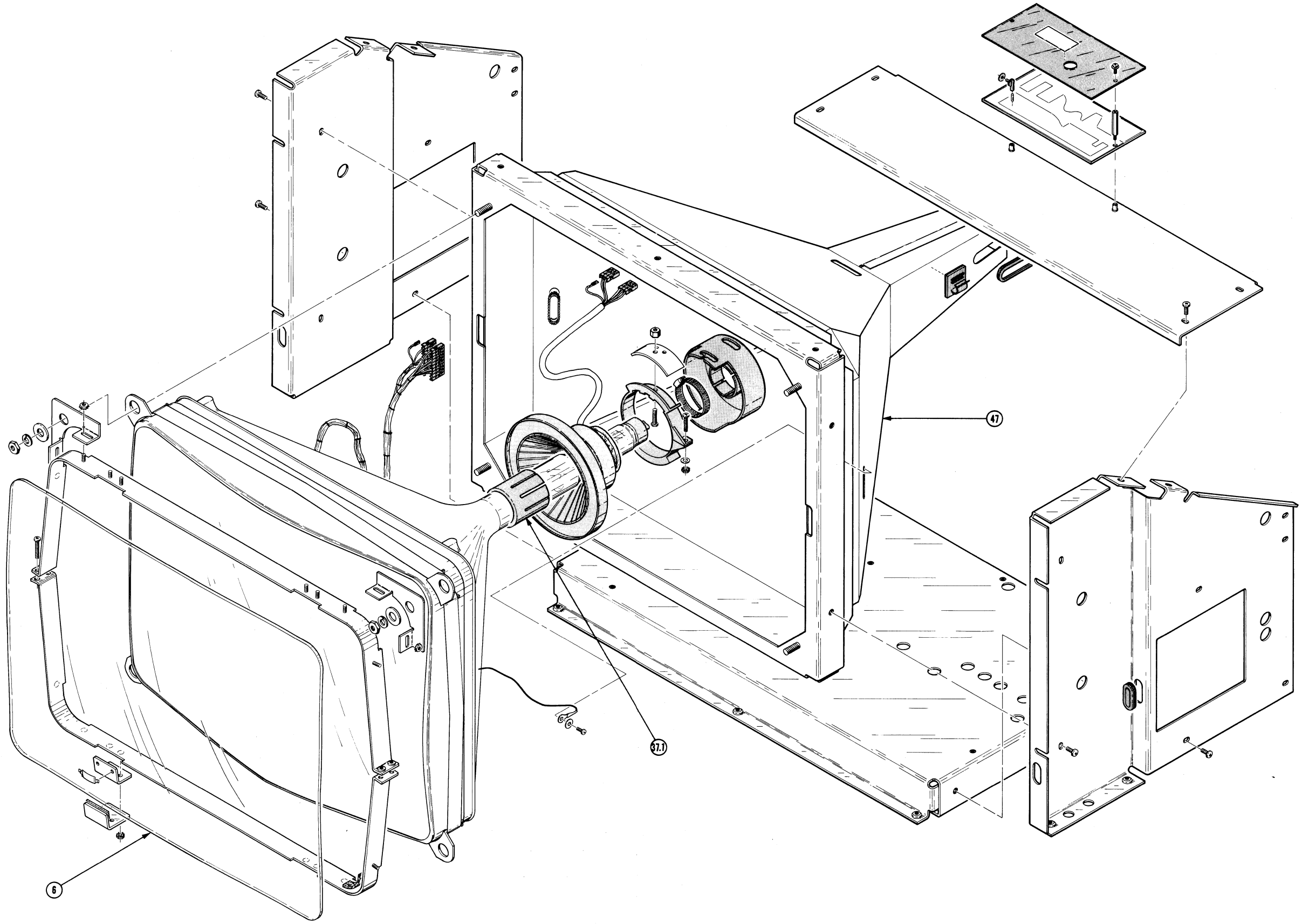
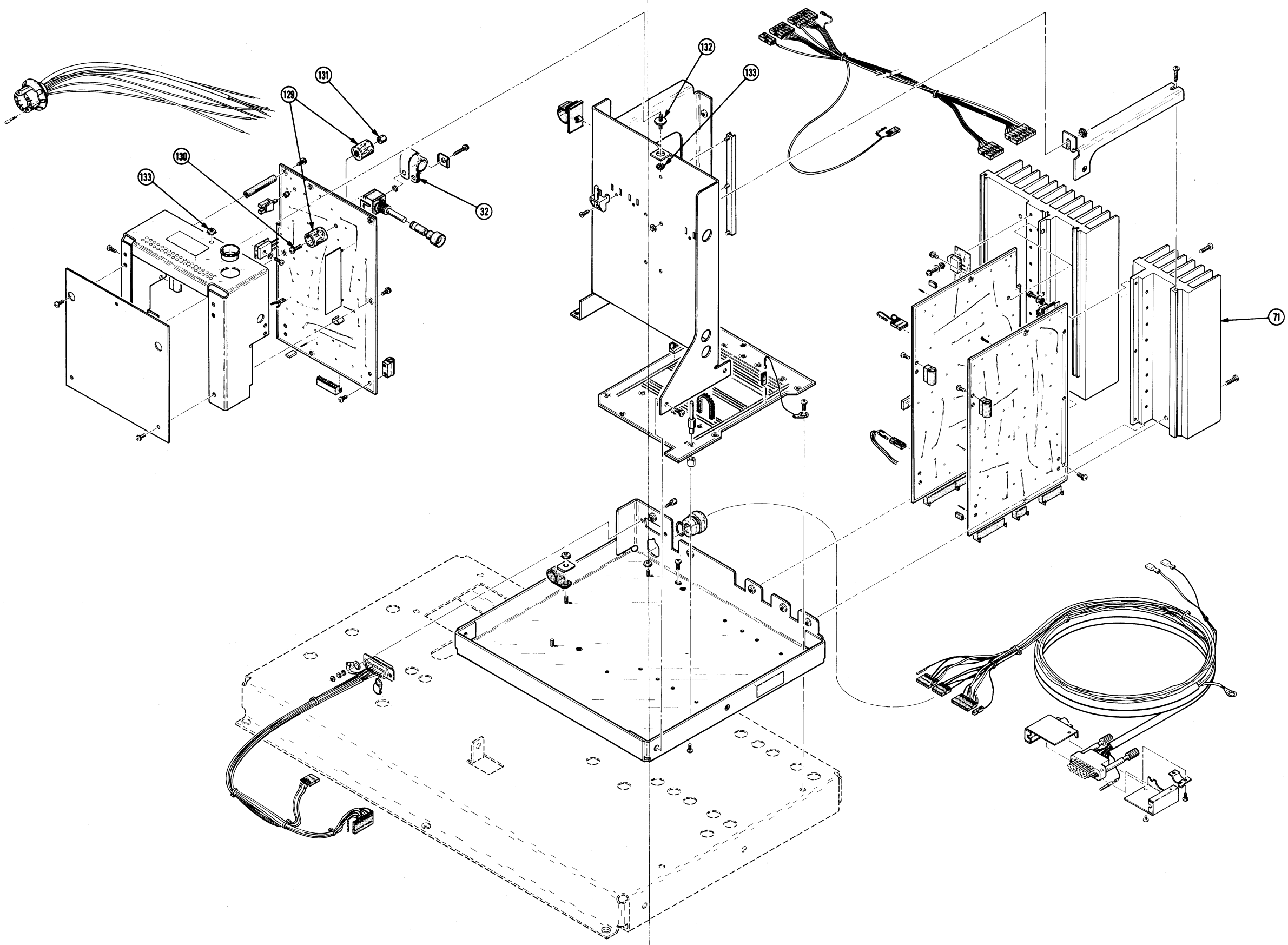

47
37.1
6

FIG. 3 INTERCONNECT MODULE



@

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
3-32	343-0004-00			1		. . CLAMP,LOOP:0.312 INCH DIAMETER,PLSTC	95987	5-16-6B
-71	214-2508-01			1		. HEAT SINK,ELEC:CIRCUIT BOARD,AL	80009	214-2508-01
-129	348-0744-00			2		BUMPER,PLASTIC:POLYSULFONE,NATURAL	80009	348-0744-00
						(ATTACHING PARTS)		
-130	211-0198-00			1		SCREW,MACHINE:4-40 X 0.438 PNH,STL POZ	77250	OBD
-131	361-0041-00			1		POST,ELEC-MECH:4-40 X 0.25 XO.375 INCH L	80009	361-0041-00
						- - - * - - -		
-132	129-0951-00			1		SPACER,POST:0.595 L W/6-32 INT THD,STL	80009	129-0951-00
-133	210-0457-00			2		NUT,PL,ASSEM WA:6-32 X 0.312 INCH,STL	83385	OBD
	-----	-----		-		(FOR OTHER PARTS SHOWN ON THIS ILLUSTRATION SEE		
	-----	-----		-		4114 SERVICE MANUAL,VOL. 2)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
4-2.1	407-2822-00			1		BRACKET,ANGLE:RESISTORS,LEFT,AL	80009	407-2822-00
						(ATTACHING PARTS)		
-2.2	211-0507-00			1		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
						- - - * - - -		
-17	407-2818-00			1		BRACKET,CAP:ALUMINUM	80009	407-2818-00
						(ATTACHING PARTS)		
-18	211-0507-00			1		SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
-18.1	210-0457-00			1		NUT,PL,ASSEM WA:6-32 X 0.312 INCH,STL	83385	OBD
						- - - * - - -		
-23	----- -----			1		TRANSFORMER:(SEE T1001 REPL)		
-24	212-0511-00			4		. SCREW,MACHINE:10-32 X 3" LONG,HEX HD STL	83385	OBD
-25	212-0547-00			4		. SCREW,MACHINE:10-32 X 4.750,HEX HD,STL,CD	83385	OBD
-26	210-0805-00			2		. WASHER,FLAT:0.204 ID X 0.438 INCH OD,STL	12327	OBD
-27	166-0434-00			4		. SPACER,SLEEVE:MYLAR	80009	166-0434-00
-36	214-3241-00			1		SPRING,HLCPS:0.4 ID X 0.875 L	52833	45-00021-015
-68	348-0730-00			1		GROMMET,PLASTIC:BLACK,U SHAPE,0.262 ID	80009	348-0730-00
-96	441-1630-00			1		CHASSIS,TERM:LOW VOLTAGE POWER SUPPLY	80009	441-1630-00
	----- -----			-		(FOR OTHER PARTS SHOWN ON THIS ILLUSTRATION SEE		
	----- -----			-		4114 SERVICE MANUAL,VOL. 2)		

STANDARD ACCESSORIES

	061-2511-00			1		MANUAL,TECH:INTERIM,INSTRUCTION	80009	061-2511-00

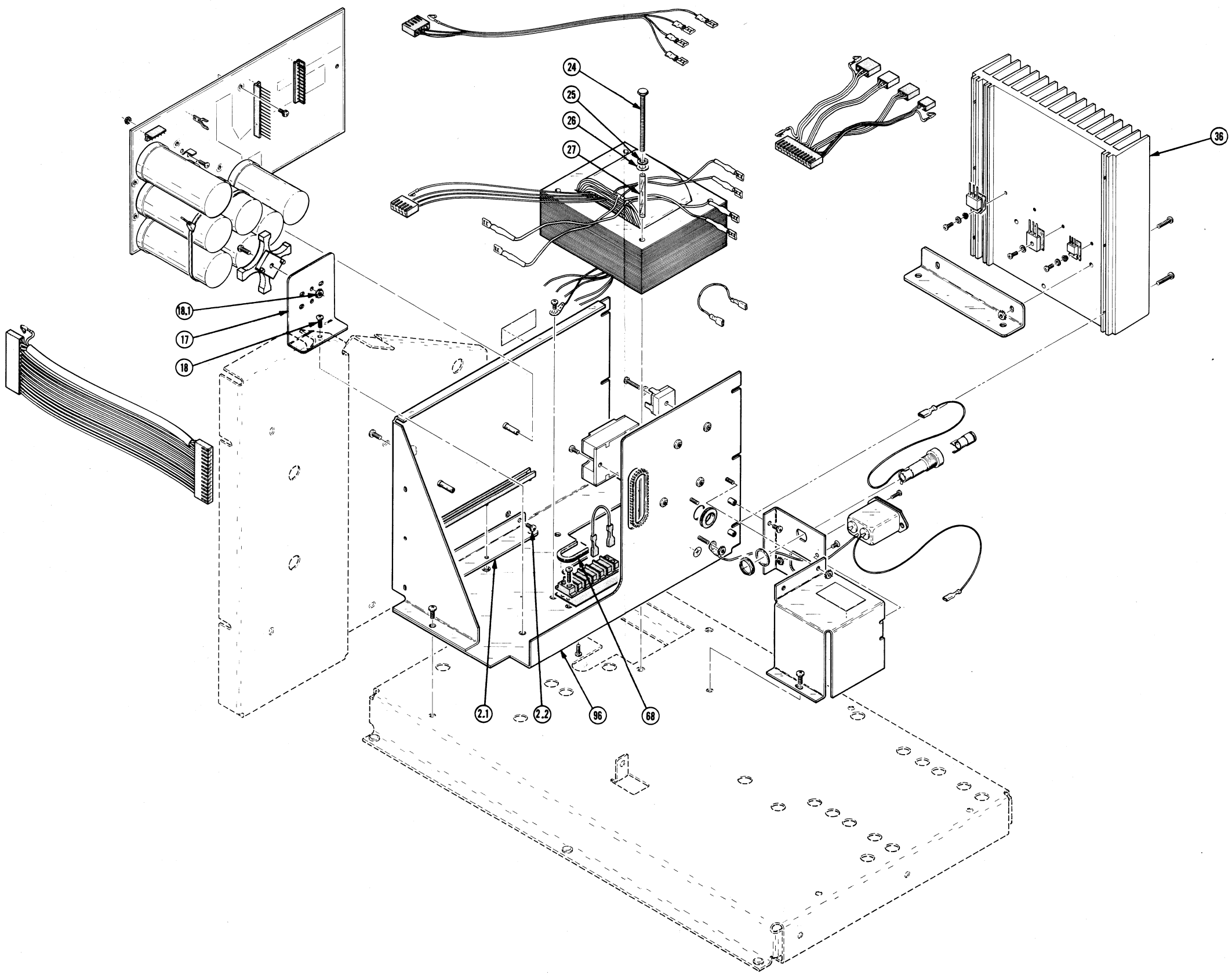


FIG. 4 DISPLAY POWER SUPPLY

Section 7

DIAGRAMS AND SCHEMATICS

Symbols and Reference Designators

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

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

Resistors = Ohms (Ω).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

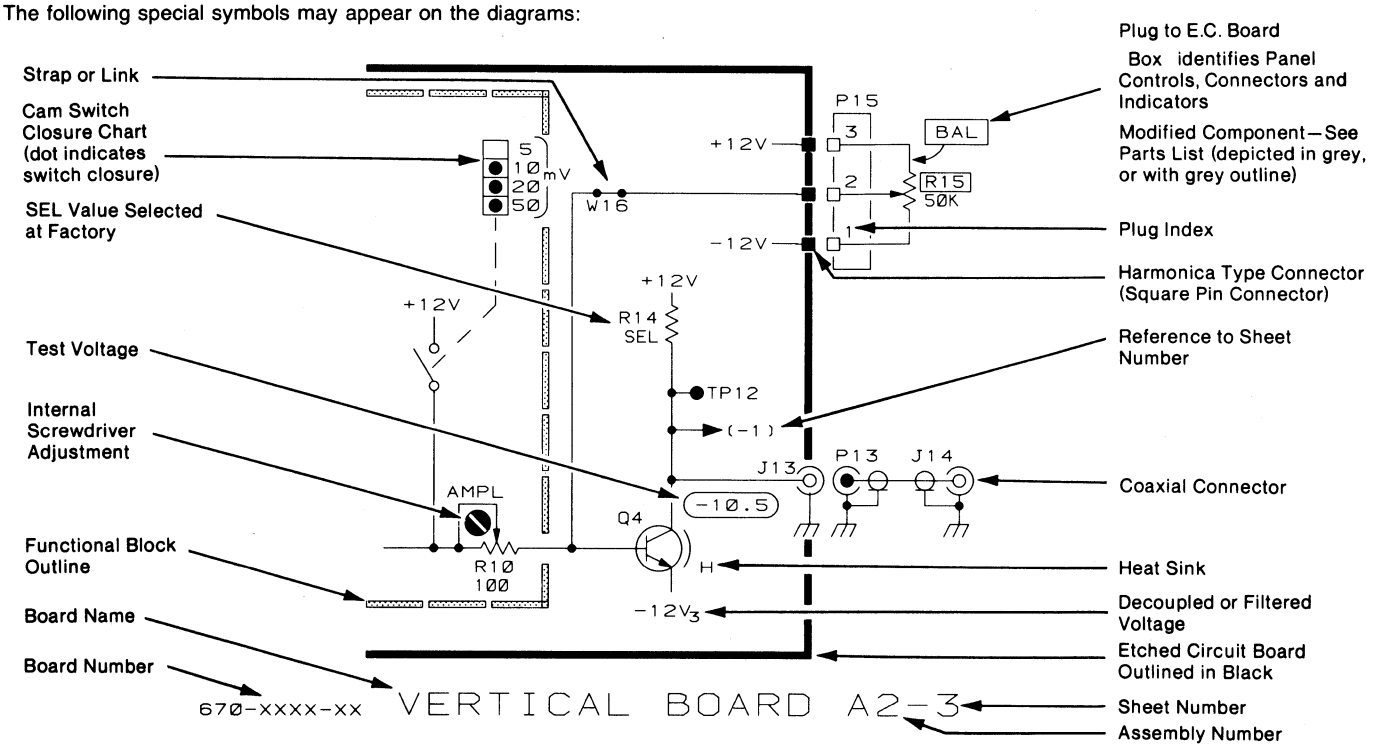
Abbreviations are based on ANSI Y1.1-1972. Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc., are:

Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

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

A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap, Ferrite bead	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols may appear on the diagrams:



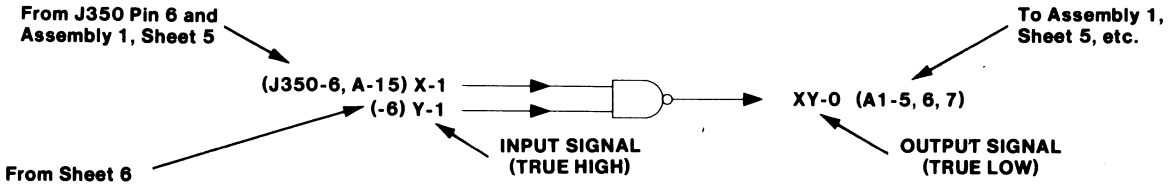
1. True High and True Low Signals

Signal names on the schematics are followed by -1 or a -0. A TRUE HIGH signal is indicated by -1, and a TRUE LOW signal is indicated by -0.

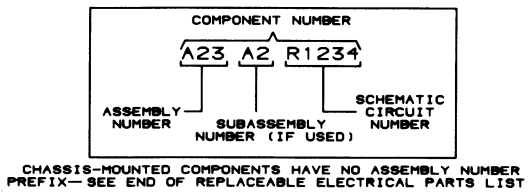
SIGNAL -1 = TRUE HIGH
SIGNAL -0 = TRUE LOW

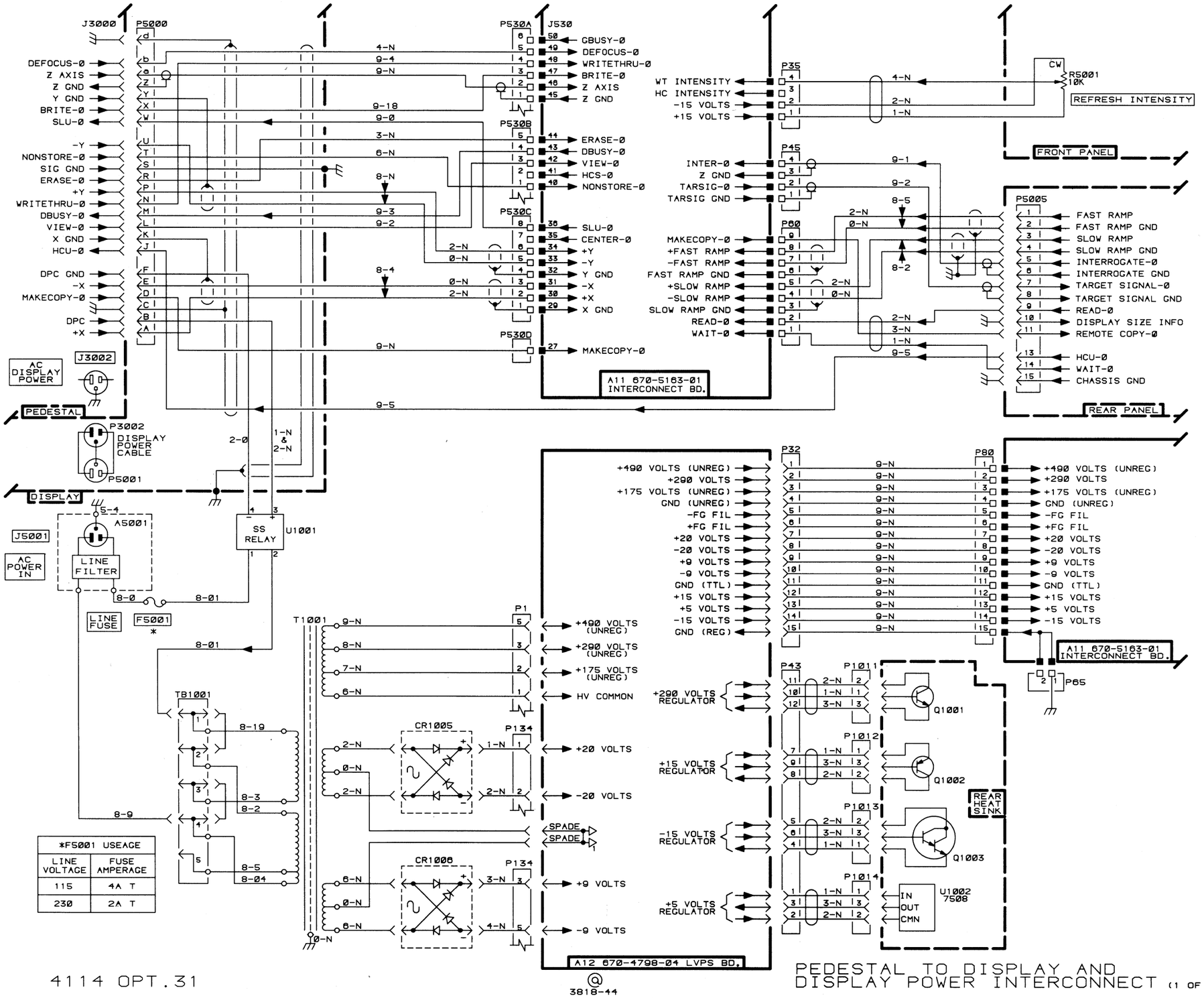
2. Cross-References

Schematic cross-references (from/to information) are included on the schematics. The "from" reference only indicates the signal "source," and the "to" reference lists all loads where the signal is used. All from/to information will be enclosed in parentheses.



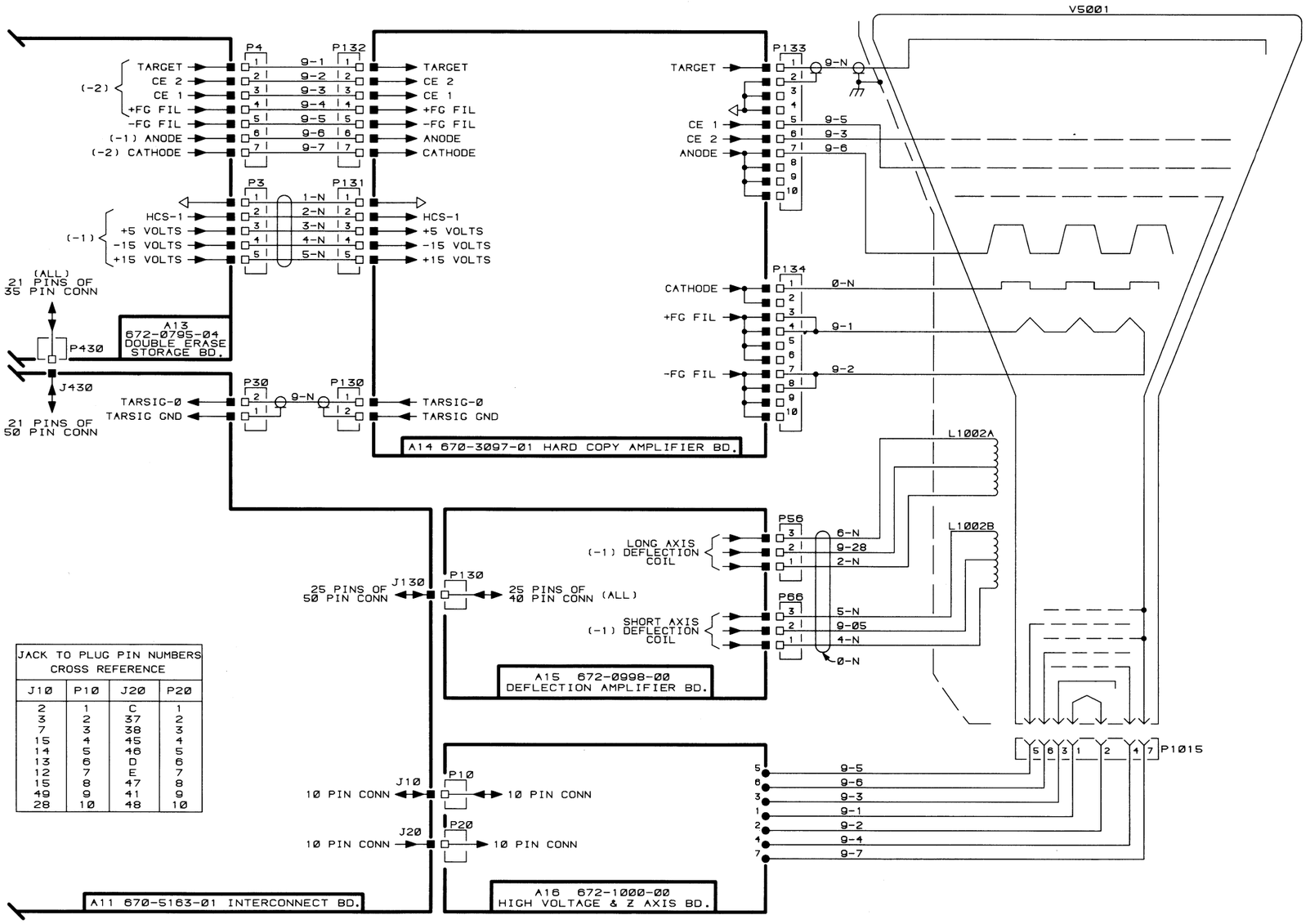
3. Component Number Example





4114 OPT.31

PEDESTAL TO DISPLAY AND DISPLAY POWER INTERCONNECT (1 OF 1)

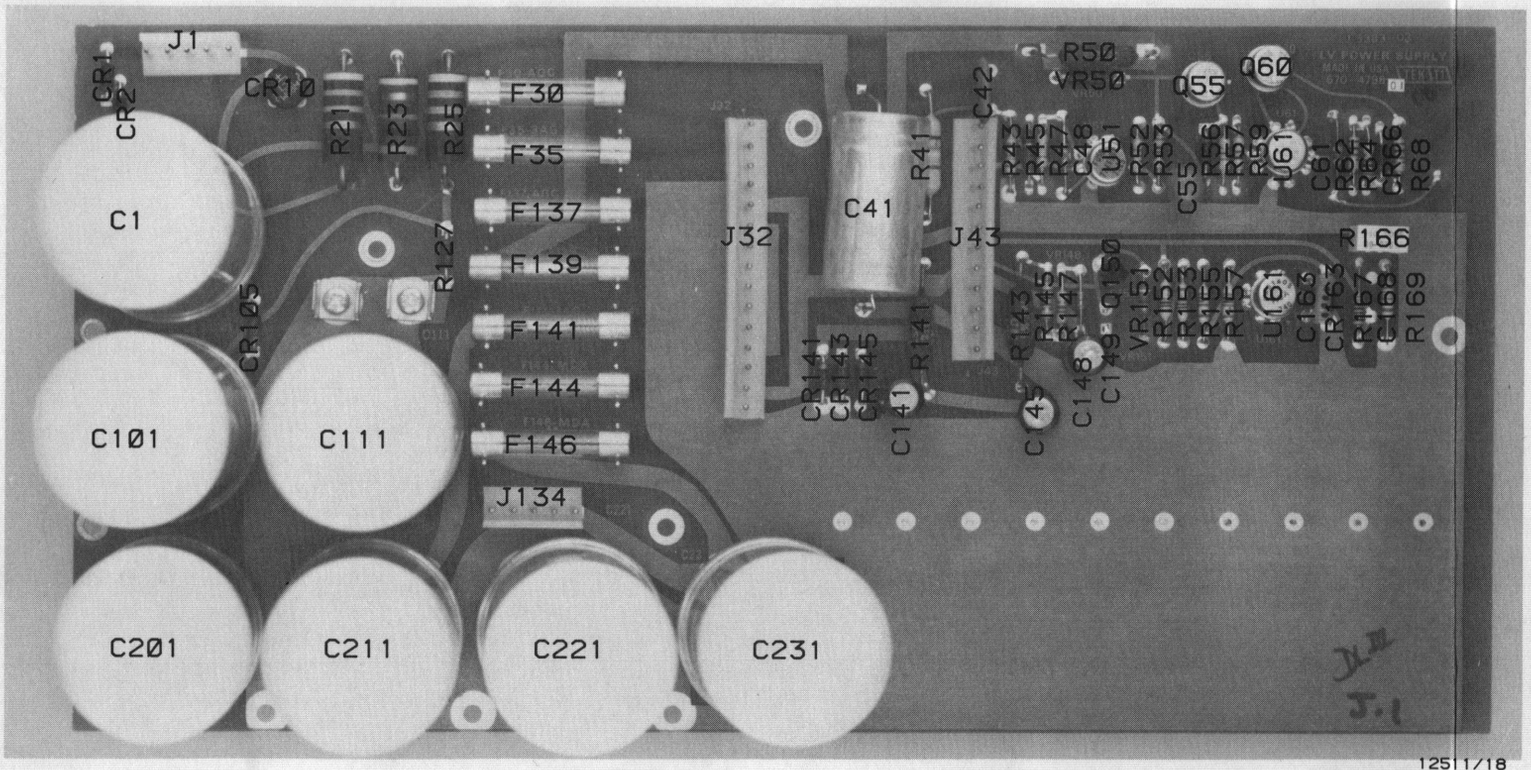


JACK TO PLUG PIN NUMBERS CROSS REFERENCE			
J10	P10	J20	P20
2	1	C	1
3	2	37	2
7	3	38	3
15	4	45	4
14	5	46	5
13	6	D	6
12	7	E	7
15	8	47	8
49	9	41	9
28	10	48	10

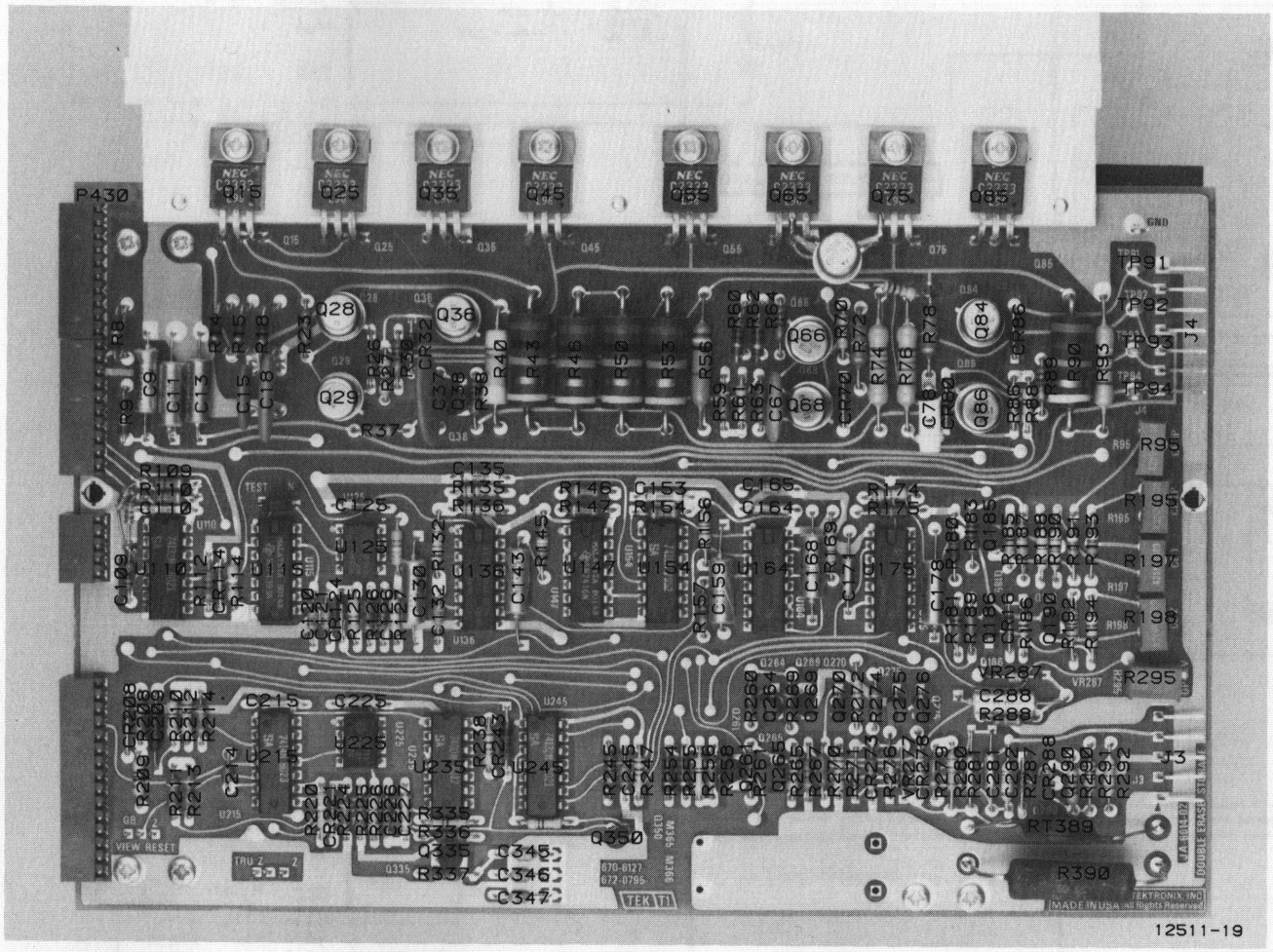
4114 OPT.31

3818-46

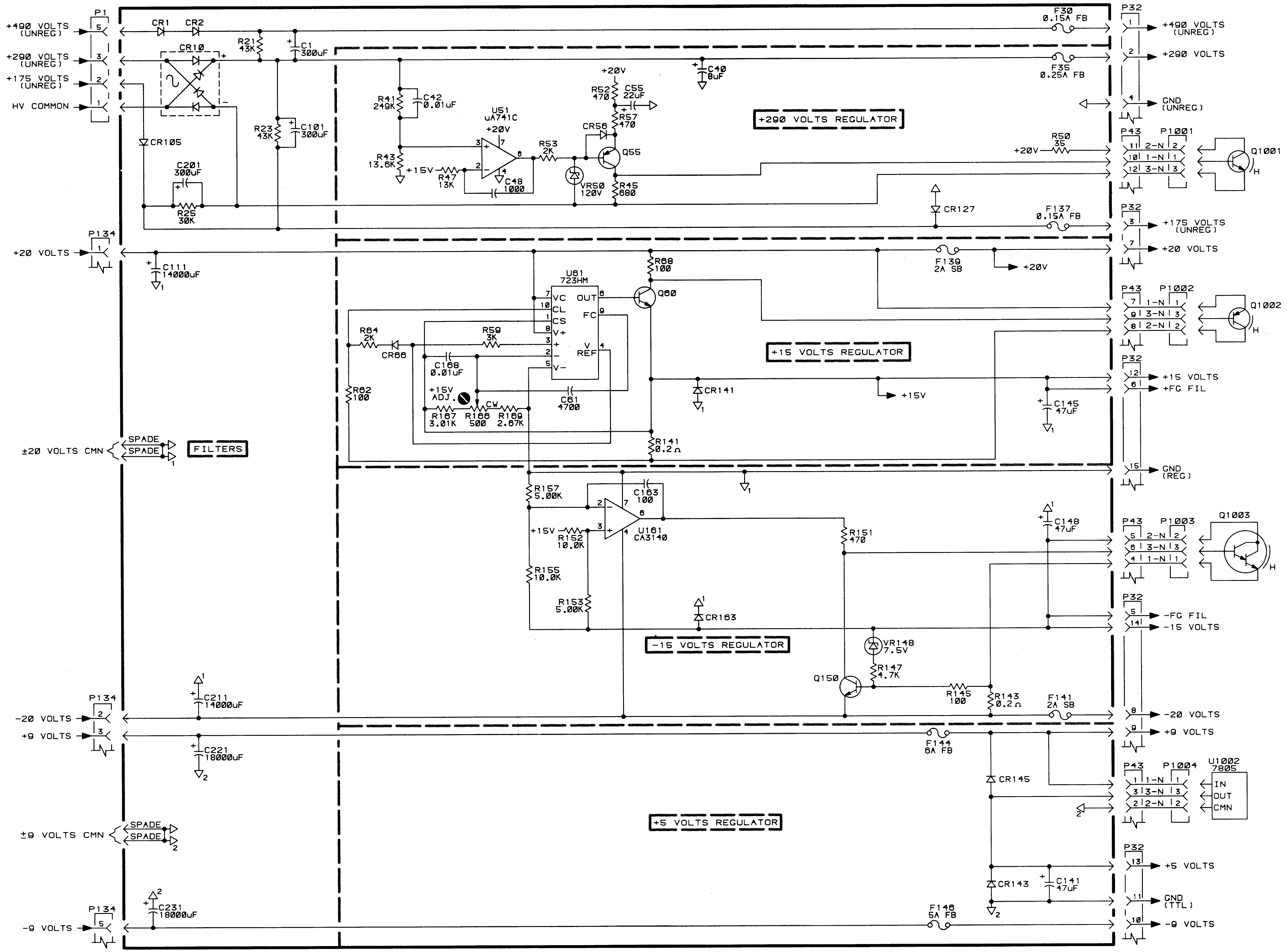
CRT INTERCONNECT (1 OF 1)



Low Voltage Power Supply (670-4798-04) Component Locations.



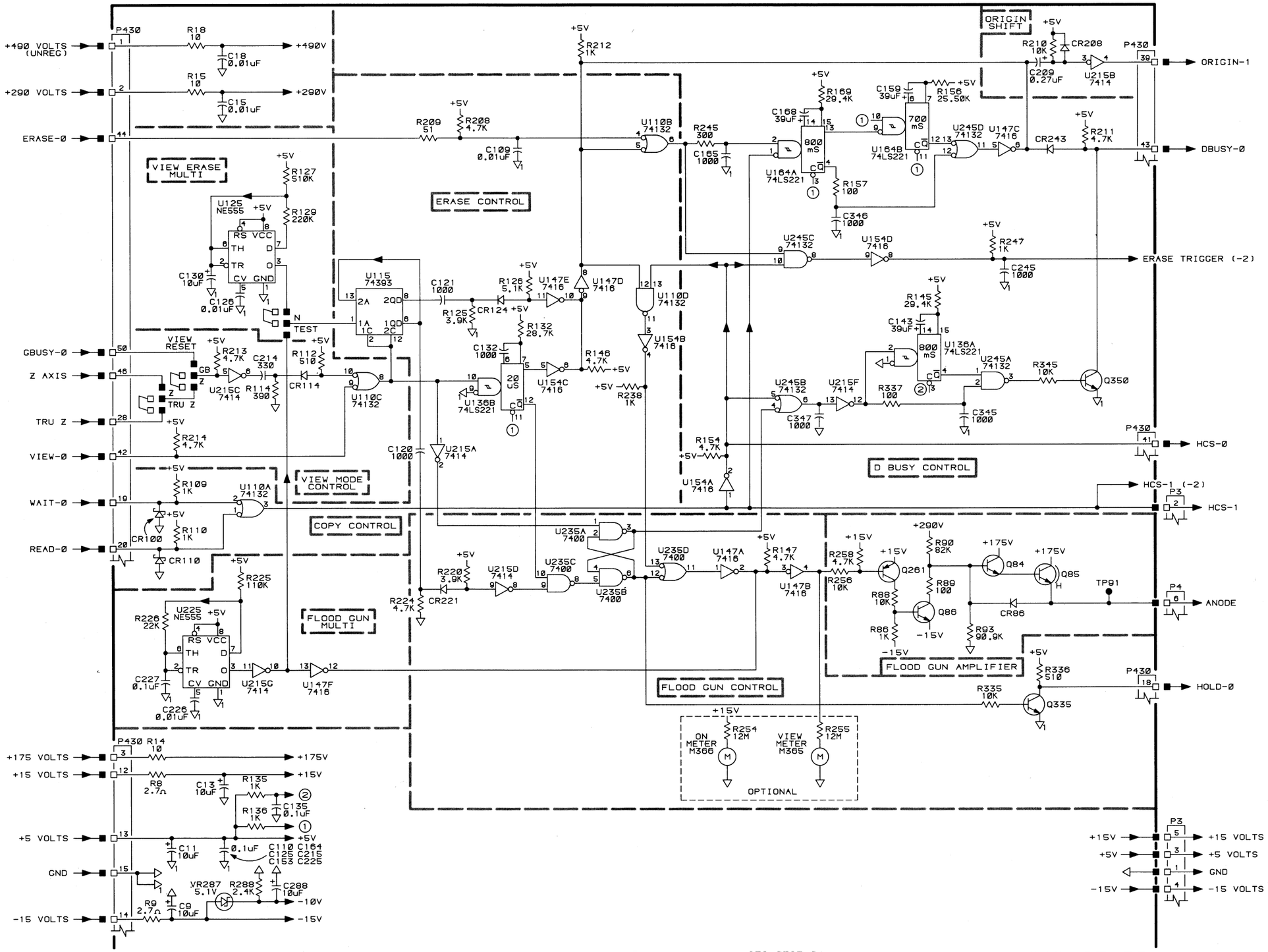
Double Erase Storage (672-0795-04) Component Locations.



4114 OPT.31

@ 3818-45

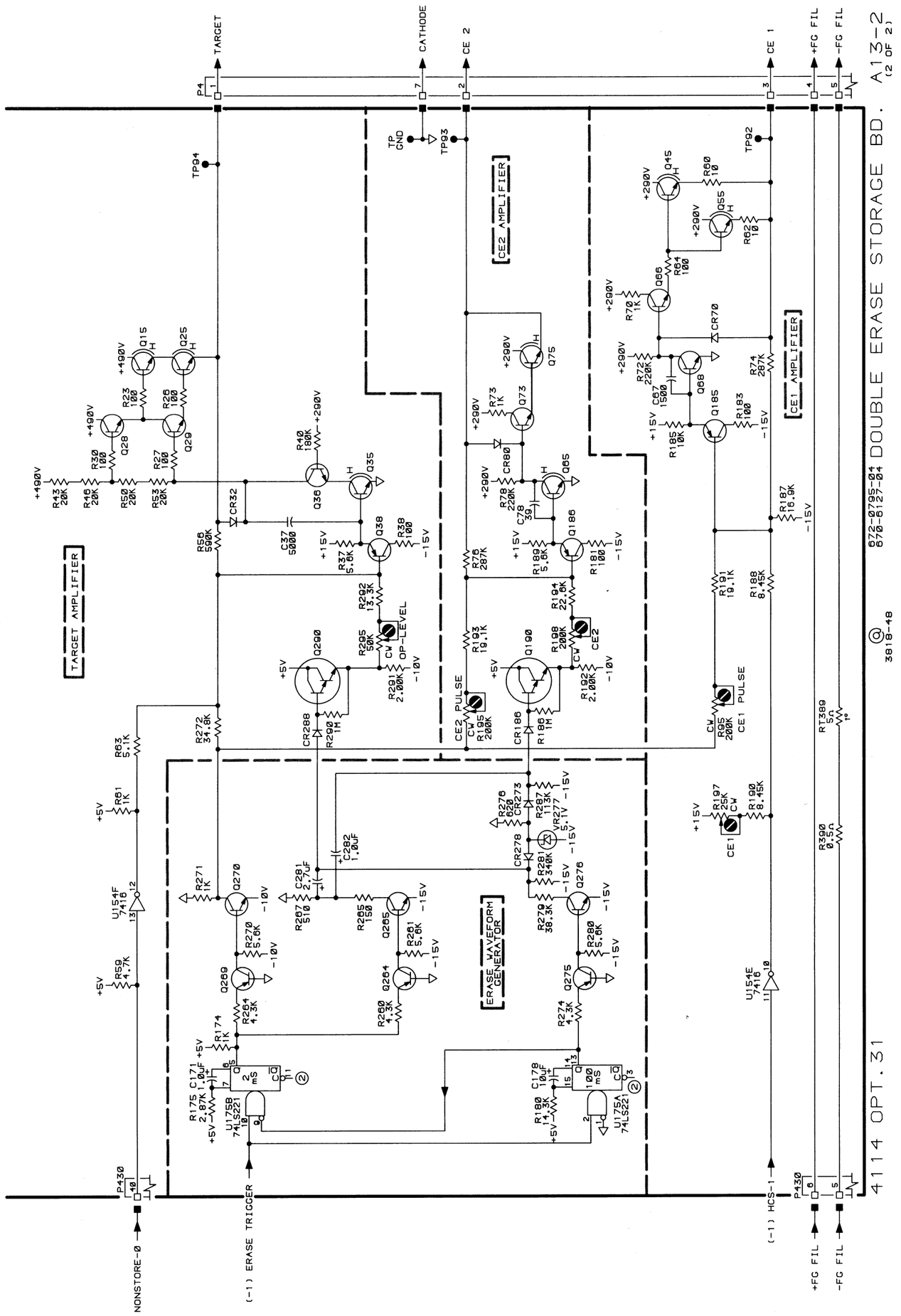
670-4798-04 LOW VOLTAGE POWER SUPPLY BD. A12-1
(1 OF 1)

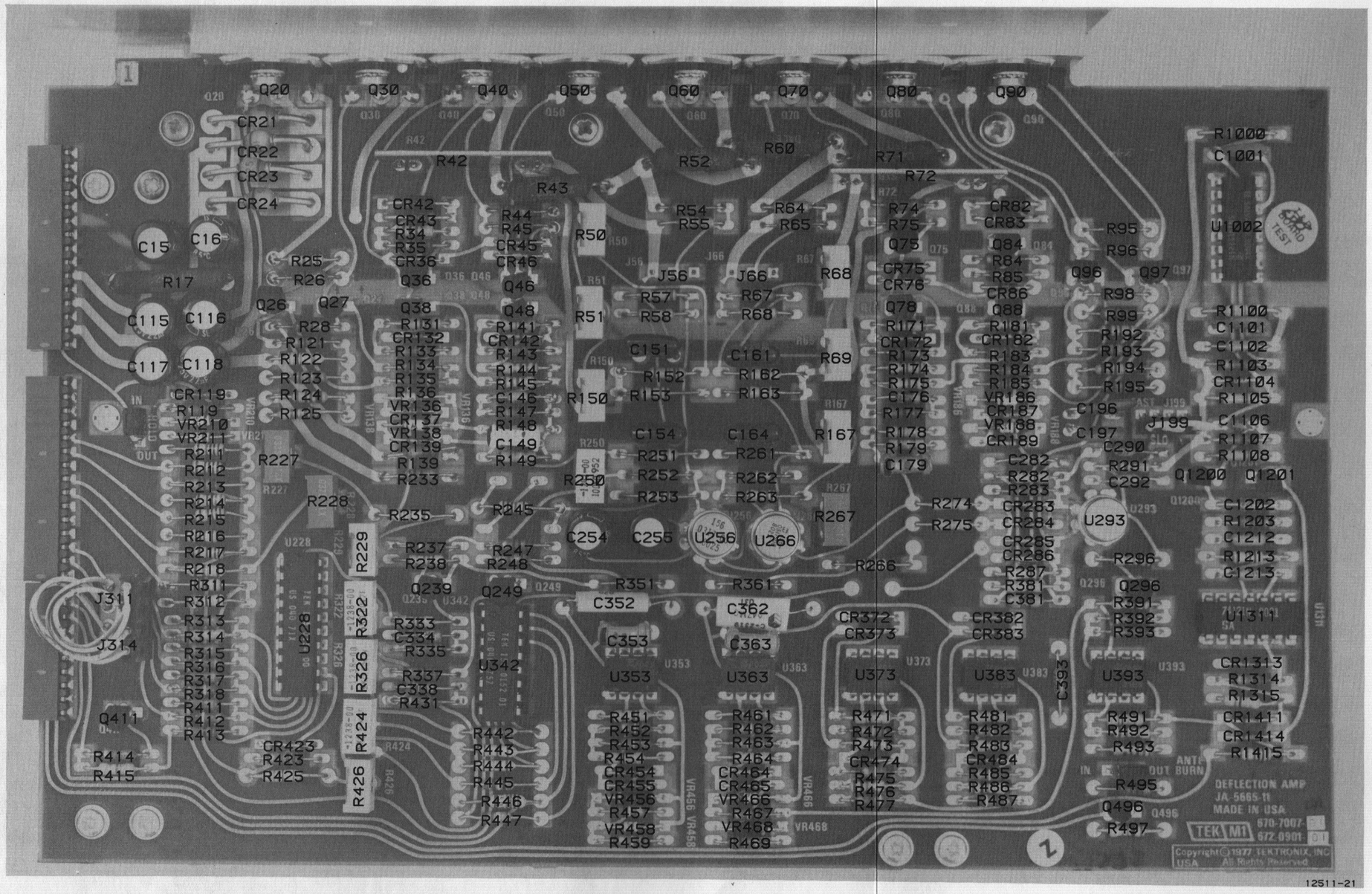


4114 OPT.31

@ 3818-47

672-0795-04
670-6127-04 DOUBLE ERASE STORAGE BD. A13-1
(1 OF 2)


672-0795-04 DOUBLE ERASE STORAGE BD. A13-2
670-8127-04 (2 OF 2)
3818-48
4114 OPT. 31
TARGET
CATHODE
CE 2
CE 1
+FG FIL
-FG FIL
P4
TP GND
TP93
TP94
TP92
TARGET AMPLIFIER
CE2 AMPLIFIER
CE1 AMPLIFIER
ERASE WAVEFORM GENERATOR
CE2 PULSE
CE1 PULSE
CE2
CE1
OP-LEVEL
NONSTORE-0
(-1) ERASE TRIGGER
(-1) HCS-1
P430
U175B 74LS221
U175A 74LS221
U154F 7418
U154E 7416
RT389 5Ω



Deflection Amplifier (672-0998-00) Component Locations.

Section 8

SUMMARY

GENERAL

This section points out the major differences of the Option 31 Display Module versus the standard 4114 Display Module. Detailed descriptions of the differences and similarities can be found throughout the manual; the following paragraphs contain references in parentheses to the sections which contain more detail.

Summary

This manual is a supplement to the 4114 service manual, Volumes 1 and 2. More information on using this manual and other related manuals is found in Section 1.

Option 31 is easily identified by its only distinguishing external feature, a rose-colored filter (Section 1).

Changes made for a Option 31 exist solely in the display module of the 4114. The Option 31 Display Module is completely compatible with the 4114 pedestal with no mechanical or electrical changes to the pedestal (Section 1).

The 4114 Option 31 crt uses a mixture of two phosphor colors, red and green, on the inner face of the crt, whereas a standard 4114 only uses one color of phosphor (Sections 1, 2, and 3).

Option 31 writes in two colors, green in Storage mode and yellow to orange-red in Refresh mode. Not all Option 31 displays will refresh in the same exact color (Section 1).

The Option 31 crt is a 100-degree deflection crt, is shorter in length than the standard 4114 (although the face dimensions are the same), and requires more current to operate. Option 31 is not field-installable (Section 1).

Option 31 has four circuit boards that are different from those in a standard 4114; three contain minor changes. The fourth board (the High Voltage and Z-Axis board) has a different circuit board layout (Sections 1, 2, 3, and 4).

Although different, the circuit boards are functionally the same as the 4114 standard circuit boards and require no new or different signals (Section 3 and Appendix A).

The phosphor specifications, display power specifications, and strap options (only on the High Voltage and Z-Axis board) are different than those discussed in the 4114 service manual (Section 2).

The Option 31 display has a different adjustment procedure than the standard 4114 display because of the different layout of the High Voltage and Z-Axis board. This is because of strap settings and the different reference numbers of the adjustments (Section 4).

The mechanical removal/replacement procedures are the same as for a standard 4114. Mechanical differences include a different shield and shorter crt (Section 5).

Appendix A

4114 DISPLAY INTERCONNECTING SIGNALS

This appendix is included as a troubleshooting aid in locating defective boards and components. These signals represent signals that are internal to both the standard 4114 and Option 31 Display Modules. These signals can be found on the schematics in this manual and in the 4114 service manual; the "Source; Destination: column specifies the schematics on which each signal appears.

Schematics A8-1, 2, 3, 4 and A9-1, 2, 3, 4, 5 are the Display Controller board and Vector Generator board schematics respectively. They are not found in this manual but can be found in Volume 2 of the 4114 service manual.

Signal Name	Source; Destination	Description
ANODE	A18-1; A19-1	Passes through a current-limiting resistor in the Hard Copy Amplifier board to the anode of the crt.
ANTIBURN	A14-2; A17-1	Made up from LA and SA ANTIBURN signals on schematic. If positive, decreases the Z-Axis amplifier drive, reducing the crt writing beam intensity. Goes positive when deflection approaches zero velocity.
BRITE-0	A8-4; A17-1	A TTL low from the Display Controller activates BRITE Intensity, adjustable by R415 in the Intensity Control Logic. In combination with low level on DEFOCUS-0, the BRITE-DEFOCUS mode is useful for displaying wide vectors and merging dots on wide characters. If DEFOCUS-0 is allowed to go high, the writing mode is BRITE-FOCUS, usable for medium-large characters.

Signal Name	Source; Destination	Description
CATHODE	A18-2; A19-1	Ties cathode of crt to ground.
CE1 & CE2	A18-2; A19-1	The collimation electrodes, CE1 and CE2, are electronic lenses that cause a uniform Flood Gun beam pattern over the target.
CENTER-0	A15-1; A14-1	When low, inhibits and resets the operation of the Origin Shift Counter. (Not used in the 4114 pedestal; reserved for future use.)
DBUSY-0	A18-1; A8-1,-2,-3,-4	When low, indicates that the display is busy in Hold mode, erasing the screen, or in Hard Copy operation. This line states that the display is busy and cannot accept further information until brought out of one of these modes.
DEFOCUS-0	A8-4;A17-1	When low, the focus of the crt writing beam is reduced, producing a slightly wider trace (defocused). When high, the writing beam is focused. The use of the DEFOCUS-0 signal line allows a focused or defocused crt writing beam when used in combination with WRITE-THRU, BRITE, and NORMAL (see the 4114 service manual).
DISPLAY SIZE INFO	REAR PANEL CONNECTOR (J5005); HARD COPY UNIT	Tied to ground (logical low). When tied low, it informs the Hard Copy Unit that it is scanning a 19-inch display.
DPC	A9-2; A15-1	Display Power Control. Causes display ac power to be turned on. 10 mA at +9 to +12 V.

Signal Name	Source; Destination	Description
DYNAMIC FOCUS	A14-1; A17-1	This signal modifies the focus electrode voltage to maintain a consistently focused writing beam over the display screen.
ERASE-0	A8-2; A18-1	Initiates the erase cycle in the storage board circuits. Erases the crt. Must be greater than 2 us. A READ-0 or WAIT-0 signal prevents erasure during hard copy operation.
ERASE TRIGGER	A18-1; A18-2	Internal to Double Erase Storage board schematic. Triggers the crt to erase via ERASE-0 line.
FAST RAMP	HARD COPY UNIT; A14-1	$\pm$ FAST RAMPs on schematics. Analog deflection voltage from the HCU which controls the vertical deflection during the hard copy scan.
FG FIL	A16-1; A19-1	Flood Gun filaments ($\pm$ FG FIL on schematic) of crt. Driven by $\pm$ 15 volts from low voltage power supply.
GBUSY	A8-4; A18-1	View Reset strap option between GBUSY and Z-AXIS. Optional signal that can be used to reset the View-Erase Counters. A 100 ns or greater pulse is required. (A VIEW-0 signal will also reset the View-Erase Counter.)

Signal Name	Source; Destination	Description
HC INTENSITY	HARD COPY UNIT; A17-1	Hard Copy Intensity. Controls the crt writing beam intensity by adjustment of R415 (Hard Copy Intensity adjustment).
HCS-0	A18-1; A17-1	Hard Copy Scan. Enables operation of Hard Copy circuitry. HCS-0 is asserted by either READ-0 or WAIT-0 (from the Hard Copy Unit) going low. Initiates crt scan by the HCU.
HCS-1	A18-1; A18-2 and A19-1	Inverted HCS-0. Enables operation of Hard Copy circuitry. Refer to the HCS-0 signal.
HCU-0	HARD COPY UNIT; A8-2	Informs the Display Controller that the Hard Copy Unit is capable of accepting a MAKE COPY-0 request.
HOLD-0	A18-1; A14-1	Strap option on Deflection Amplifier board; operational in the IN position. Connects the channel switch to a separate set of inputs that are connected to ground when Hold mode is initiated. The grounded inputs prevent beam deflection and assure minimum deflection amplifier power dissipation during Hold mode.
INTER-0	HARD COPY UNIT; A17-1	This is the hard copy interrogate pulse from the Hard Copy Unit (HCU). As a result the crt writing beam is pulsed (100 ns pulse width) and a target information signal, TARSIG-0, is developed.

Signal Name	Source; Destination	Description
MAKE COPY-0	A8-2; HARD COPY UNIT	Caused by Display Controller or Hard Copy Switch going low. Initiates a hard copy cycle (makes a copy). Requires ground closure of TTL low > 1 ms.
NON-STORE-0	A9-2; A18-2	When low, causes reduced target voltage; permits the crt writing beam to write without storing. (Not used in 4114 Option 31 or 4114. Reserved for later use.)
ORIGIN-1	A18-1; A14-1	During erase cycle from Storage board, triggers the Origin Shift Counter on the Deflection Amplifier board to shift the axes slightly on the next page of screen written data. This feature enhances crt screen life.
READ-0	HARD COPY UNIT; A18-1 and A14-1	Develops HCS-0 and HCS-1 in the Copy Control section. READ-0 causes the Channel Shift and Origin Shift to use the the SLOW and FAST RAMP signals (also from the HCU) to provide LA and SA outputs from the Deflection Amplifier.
REMOTE COPY-0	A8-2; HARD COPY UNIT	Caused by Display Controller switch going low. Initiates a Hard Copy cycle (makes a copy). A direct line from the MAKE COPY-0 signal, which acts as a reference for the Hard Copy Unit (informs the HCU that it is being triggered from a source remote to the HCU).
SLOW RAMP	HARD COPY UNIT; A14-1	$\pm$ SLOW RAMPs on schematics. Analog deflection voltage from the HCU which controls the horizontal deflection during the hard copy scan.

Signal Name	Source; Destination	Description
SLU-0	A14-2; A8-3,-4	Indicates a temporary wait for the Display Controller while the deflection circuits are lagging the deflection inputs and establishing the new deflection position.
TARGET	A18-2; A19-1	Voltage established at the inside face of the crt.
TARSIG-0	A19-1; HARD COPY UNIT	Target signal. Display information signal from the target sent to the Hard Copy Unit when a hard copy is being made. Goes low when the scan crosses a written area on the crt screen.
TRU Z	A17-1; A18-1 and A14-2	Represents the true Z-Axis (always active high). Turns on crt writing beam depending on the status of the Intensity Control Logic section. Overrides antiburn circuitry in the first few microseconds of operation, due to the time lag of the antiburn circuitry, so as not to blank out any beginning information. (See also Z-AXIS signal definition.)
VIEW-0	A8-1; A18-1	Resets the View-Erase Counters. (GBUSY or Z-AXIS will also do this, depending on the placement of the View-Reset strap.)
WAIT-0	HARD COPY UNIT; A18-1	Remains low until the display screen has been scanned. (Applies only to a Hard Copy Unit with multiplexer option.)

Signal Name	Source; Destination	Description
WRITE-THRU-0	A8-4; A17-1	Selects WRITE-THRU INTENSITY CONTROL (R425-Coarse Write-Thru) and disables NORMAL and BRITE INTENSITY controls.
WT INTENSITY	A15-1; A17-1	Controls the WRITE-THRU INTENSITY by R425 adjustment (see WRITE-THRU-0).
X+	A9-5; A14-1	+X,-X on schematic. X-axis input to Display Module.
Y+	A9-5; A14-1	+Y, -Y on schematic. Y-Axis input to the Display Module.
Z-AXIS	A9-5; A18-1 and A17-1	Strap option in Intensity Control Logic for active low or active high. Strap option in View Mode Control for Z-AXIS or TRU Z. Second strap option in View Mode Control (View Reset strap option). This option causes the Z-AXIS to reset the View-Erase Counters (GBUSY or VIEW-0 will also do this). True signal turns on the crt writing beam depending upon the status of the Intensity Control Logic section. Also can be strapped to accept either TTL state (high or low) input signal.

Tektronix®
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

PRODUCT 4114 Option 31 COLOR ENHANCED REFRESH

CHANGE REFERENCE C1/781

MANUAL PART NO. 061-2511-00

DATE 7-17-81

EFF ALL SN

TEXT CHANGES

Pages 2-1 through 2-6, 4-1, 4-2, 4-5, 4-6, 4-21, 4-22, 4-27 through 4-30, A-1 throu A-7.

REMOVE ABOVE PAGES AND REPLACE WITH ATTACHED. PAGES 2-5 and 2-6 ARE NEW.

THIS IS A PAGE REPLACEMENT PACKAGE.

The area of change is marked
by a change bar in the margin.

1. Remove the appropriate pages from your manual and insert the attached pages.

2. Update Manual Revision Status page i in the front of your manual to indicate the new revision letter, date revised, and which pages were revised. You will find this information, centered, at the bottom of each replacement page. (This update is for your information only.)

3. Keep this cover sheet in the Change Information section at the very back of your manual for a permanent record.

Section 2

CHARACTERISTICS

GENERAL INFORMATION

This section contains the specifications, strap settings, and other operating considerations which are unique for Option 31.

THE OPTION 31 CRT AND DISPLAY MODULE

The Option 31 crt, like the 4114 standard, is a bistable storage crt. It can display information two ways, by storing or not storing an image. The Option 31 crt stores in the same color (green) as the standard crt, but writes in a second color when in Refresh mode. This color is a bright yellow to orange-red color, hence the designation "Color Enhanced Refresh."

The Option 31 display uses the same analog and digital signals from the Vector Generator board (in the pedestal) to drive the deflection circuitry that the standard "one-color" crt uses. The only connections that the Option 31 Display Module has with the pedestal are the ac power cord and the cable which connects to J3000 (pedestal) and contains the control signals from the Vector Generator board.

The Display Module circuitry is contained on five circuit boards plus an Interconnect board.

The only external control on the Display Module is the REFRESH INTENSITY control.

SPECIFICATION CHANGES

Table 2-1 lists differences between the standard 4114's specifications and those for a 4114 equipped with Option 31. All other specifications remain unchanged and apply to the Option 31 display (including deflection requirements, graphics specifications, physical characteristics, J3000 rear connections, and all hard copy signals at J5005).

Table 2-1

STANDARD VS. OPTION 31 SPECIFICATIONS

Specification	4114	4114 Option 31
Phosphor Type	P1	A mixture of red and green phosphors for color enhanced refresh.
Power Consumption; 115 V at 60 Hz; full internal load	220 W	240 W
Maximum Running Line Current; 120 V Connection	2.6 A	2.8 A

STRAP SETTINGS

There are 13 strap settings which exist in the Option 31 Display Module. Table 2-2 lists the strap settings and the boards on which these straps are located.

Table 2-2

STRAP SETTINGS

Strap Settings	Normal Operational Settings
Deflection Amplifier Board	
X-Y interchange/polarity	Determined by yoke position
Hold IN/OUT	IN
Antiburn IN/OUT	IN
SLU-0 recovery time FAST/SLO	FAST
Storage Board	
Erase TEST/N	N
View Reset Z/TRU Z	TRU-Z
View Reset Z/GBUSY	GB
High Voltage and Z-Axis Board	
Z-Axis polarity Z-1/Z-0	Z-0
CRT deflection 90/100	100
Z-Axis input impedance 75/93/50	50

Table 2-2 (cont.)

STRAP SETTINGS

Strap Settings	Normal Operational Settings
High Voltage and Z-Axis Board (cont.)	
Write-Thru Defocus Strap (J611)	Jumpered between pins 2 and 3 (this is the DEFOCUS setting).
J511 (Hard Copy Intensity)	Jumpered between pins 1 and 2 (this is the LOCAL setting).
J512 (Write-Thru Intensity)	Jumpered between pins 2 and 3 (this is the REMOTE setting).

The settings on the Deflection Amplifier and Storage boards remain in the same positions as for a standard 4114. For a more complete description of these strap settings, see the 4114 service manual (Volume 1) under "Strap Options."

NOTE

The X-Y interchange is determined by yoke position (see "Rotating the Crt 180 Degrees" in the 4114 service manual).

Option 31 requires six different strap settings, all located on the High Voltage and Z-Axis board. A description of each strap, its function, and its proper setting follows.

Selecting Z-Axis Input Polarity

CAUTION

The 4114 Option 31 uses a factory setting of Z-0 in order to be fully compatible with the pedestal. If the strap is set in the wrong position, circuit damage may result. THIS SETTING MUST NEVER BE CHANGED.

This strap setting is the same as both straps on the standard 4114 High Voltage and Z-Axis board, but has been reduced to only one strap on the High Voltage and Z-Axis board for Option 31. The Display Module is designed to accept either a low or high true TTL signal. To accomplish this, a strap (labeled Z-1 and Z-0) on the High Voltage and Z-Axis board is set to choose which true level of Z is used by the Display Controller. If a low true TTL signal is used for Z, the strap must be set in the Z-0 position. The writing beam then turns off when the Z-Axis input signal rises to at least +2 volts and turns on with a signal of less than +0.8 volts. Conversely, if a high true TTL signal is used for Z, the strap must be set in the Z-1 position. The writing beam then turns on when the Z-Axis input signal rises to at least +2 volts and turns off with a signal of less than +0.8 volts.

Selecting the 90/100 strap

This strap selects between a 90-degree deflection crt and a 100-degree deflection crt. If the strap is left in the 90 position when a 100-degree deflection crt is used, there may not be enough range on the Center Focus adjustment to adequately focus the crt. Conversely, the same is true if the strap is in the 100 position when a crt with a 90-degree deflection factor is used.

Option 31 has this strap set in the 100 position.

Selecting the 75/93/50 Strap

This strap selects a matching input impedance of 50, 93, or 75 ohms to match different driving sources. This is accomplished by adding resistors in parallel in order to get the matching input impedance as determined by the strap setting.

Option 31 uses a factory setting of 50 in order to match impedances with the pedestal. For maximum performance, THIS SETTING MUST NOT BE CHANGED.

Defocus Strap (J611)

This strap is used for defocusing the write-thru writing beam. By defocusing the writing beam slightly, it makes the beam easier to see and more distinguishable from the stored display lines. With this strap set to the defocus setting, the write-thru beam will remain defocused until the strap setting is changed. With the strap set to the focus position, the beam will be defocused by use of the DEFOCUS-0 control line. See Figure 2-1 for the proper strap setting.

The factory setting is defocused (the strap is set between pins 2 and 3).

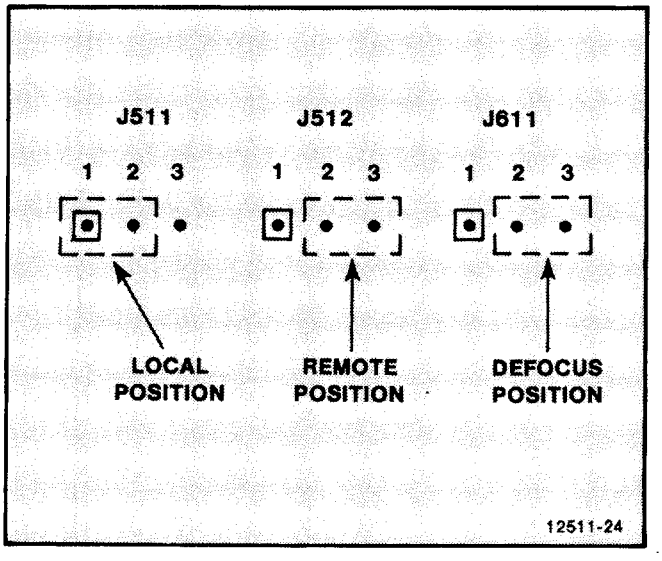


Figure 2-1. Defocus and Remote/Local Strap Settings.

Remote/Local Write-Thru Intensity Strap (J512)

This strap must be jumpered between pins 2 and 3, allowing the front panel REFRESH INTENSITY control to work. If the jumper is placed between pins 1 and 2, the REFRESH INTENSITY control is disabled and the Coarse Write-Thru adjustment (on the High Voltage and Z-Axis board) becomes the only Write-Thru Intensity adjustment.

The factory setting for option 31 is jumpered between pins 2 and 3 (see Figure 2-1).

Remote/Local Hard Copy Intensity Strap (J511)

With this strap jumpered between pins 2 and 3, a remote hard copy intensity adjustment can be connected to the Interconnect board. With the jumper set between pins 1 and 2, the HC INTENSITY line is locally terminated and the HC INTENSITY adjustment (on the High Voltage and Z-Axis board) becomes the only adjustment.

The factory setting for Option 31 is jumpered between pins 1 and 2 (see Figure 2-1).

Section 3

THEORY OF OPERATION

INTRODUCTION

This section supplements the theory of operation section of the 4114 service manual (Volume 1). The differences are few since the Option 31 boards perform the same functions, use the same external signals, and create the same internal signals as the standard 4114.

The 4114 service manual describes the circuitry in blocks as they are labeled on the schematics. This should provide sufficient information for the servicing technician to isolate a specific block of circuitry as the problem area. The technician should then be able to locate the defective component.

There are two points concerning the theory of operation that need to be remembered:

- There has been no deletion of functional blocks or additions of functional blocks on the Option 31 schematics. There has, however, been one block on the High Voltage and Z-Axis Board that has had a name change; the function of the HIGH VOLTAGE SUPPLY block on the standard 4114 schematic is the same as the HIGH VOLTAGE REGULATOR on the Option 31 High Voltage and Z-Axis board.

- All schematics in Section 7 of this manual are labeled with the same numbers as the corresponding schematics in the standard service manual. For example, the High Voltage and Z-Axis schematic is labeled as A16-1 in the 4114 service manual, and the High Voltage and Z-Axis schematic is labeled as A16-1 in this manual. This provides ease of reference between the two manuals. When referring to the schematics, use the schematics located in Section 7 of this manual. These are the schematics that have component changes.

GENERAL INFORMATION ON INTERNAL CHANGES

The theory of operation section in the 4114 service manual (Volume 1) for the display is completely accurate in describing the theory of operation of the 4114 Option 31 Display Module. All block diagrams can be used. All component references (such as reference to Q80 and Q90 on the Deflection Amplifier board) are the same on the Option 31 schematics.

The 4114 Option 31 has a few internal changes. The crt requires about 25% more current to operate. Consequently, the circuit boards are modified slightly to compensate for this current increase. One resistance value is changed on the Storage board, some transistors and resistance values are changed on the Deflection Amplifier board, the Low Voltage Power Supply is modified slightly (to provide slightly higher maximum output currents), and the High Voltage and Z-Axis board is a different board layout than the 4114 standard. Functionally, however, the two instruments are the same.

Section 4

ADJUSTMENT PROCEDURE

GENERAL INFORMATION

The adjustment procedure for the 4114 Option 31 display is virtually the same as for the standard 4114 display. There are no new adjustments or patterns used, since the circuit boards are functionally the same, and most of the specifications are the same (for the specifications that have changed, see Section 2 of this manual).

However, because the High Voltage and Z-Axis board is different (the circuit board is a new layout), the referencing numbers for the potentiometers are different and their board locations are different. See Figure 4-1.

Rather than attempt to change what is no longer correct for Option 31, the adjustment procedure is repeated here with the necessary changes inserted. This is done so that references to another manual do not have to be made while following this adjustment procedure.

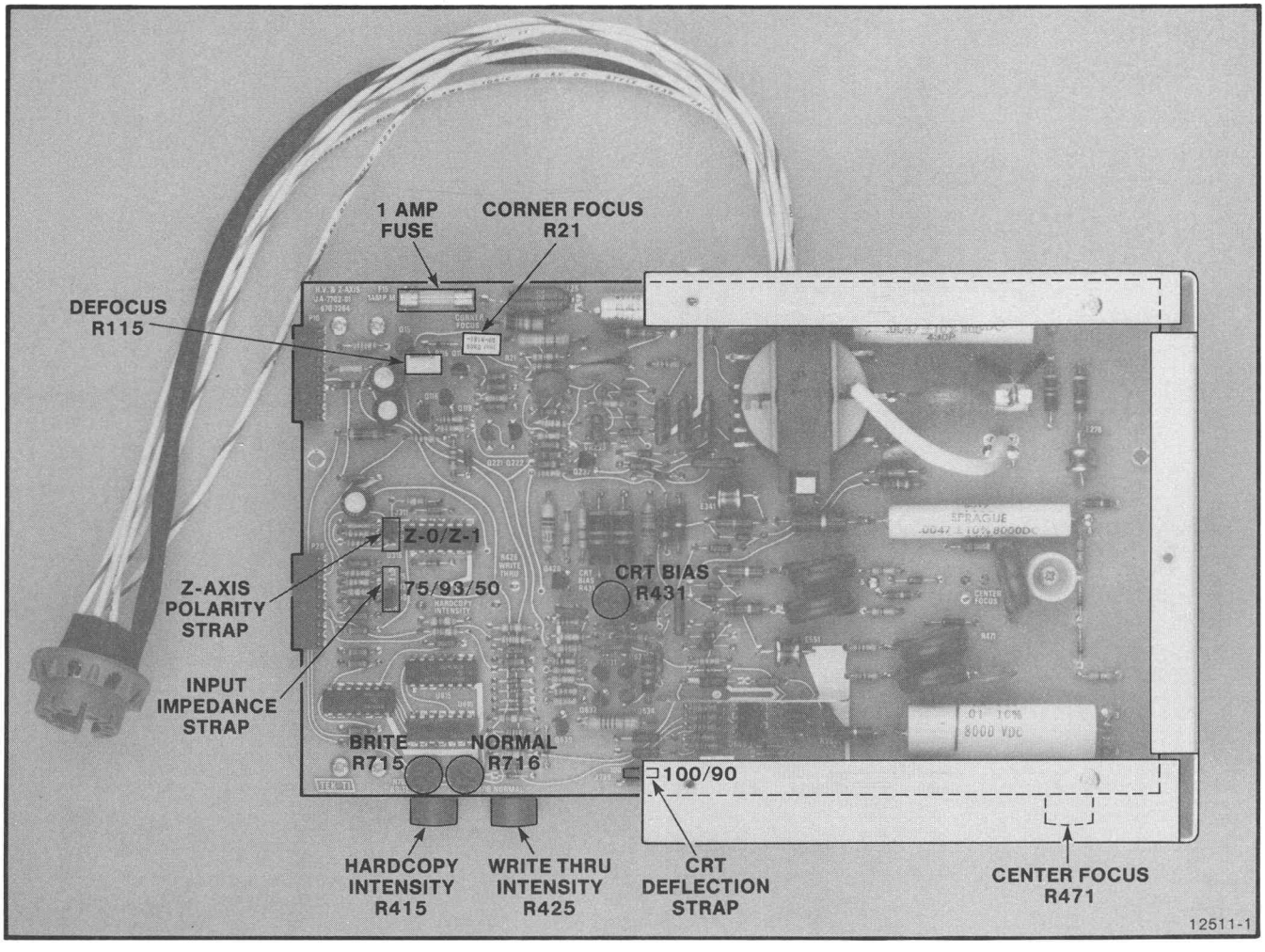


Figure 4-1. High Voltage and Z-Axis Board Strap Settings and Adjustments.

INSPECTION AND ADJUSTMENT-INTRODUCTION

The following adjustment procedure adjusts the 4114 Option 31 Display Module for optimum performance. This procedure is also used to check the performance specifications of the display. For continued optimum performance, check -- and adjust if necessary -- every 1000 hours of operation or every twelve months (if the 4114 is used infrequently).

NOTE

In order to adjust the instrument the cabinet cover and front panel must first be removed (see cabinet cover and front panel removal and installation in the 4114 service manual).

Test Equipment Required

- Oscilloscope (TEKTRONIX 465 or equivalent). Dual trace with a vertical defection factor of at least 5 mV per division, and a sweep rate of at least 10 ns per division. Bandwidth from dc to 100 MHz.
- Digital Voltmeter (TEKTRONIX DM 501 or equivalent). Range -30 V to +600 V with at least 0.1% accuracy. Measurement to -6400 V with 1% accuracy (if no divide-by-10 high voltage probe is used).
- Power Module (TEKTRONIX TM 503 or equivalent). Used if a TEKTRONIX DM 501 Digital Multimeter is used.
- TEKTRONIX 4631 Hard Copy Unit. Used for adjusting copy-making circuitry which must be adjusted if the 4114 Option 31 is used with a Hard Copy Unit.
- High Voltage Probe. Divide-by-10 test probe used in measuring the high voltage supply (divide-by-100 or divide-by-1000 probes can also be used in measuring this voltage if the reading on the DVM (Digital Voltmeter) is adjusted accordingly).

- Adjustment Tools. Non-conductive. One screwdriver at least 10.0 inches in overall length, one at least 5.0 inches in overall length, and a third 1.0 to 2.0 inches in length.

- Set of hand tools for hardware adjustment checks. Should include nutdrivers, screwdrivers, etc.

Performance Conditions

The following conditions must be met before the 4114 display characteristics and performance specifications are valid:

- The display must be adjusted at room temperature (68 to 86 degrees Farenheit or 20 to 30 degrees Celsius).

- The Display must have power applied for at least 20 minutes.

INSPECTION PROCEDURE

WARNING

Hazardous voltages are present in the 4114 circuitry. Always use proper servicing techniques to avoid being injured or killed. Only qualified service technicians should perform the following inspection procedure. Also, before doing this inspection procedure, DISCONNECT THE POWER CORD AND WAIT 60 SECONDS. Failure to do so may result in injury or death.

1. **Check** for loose, damaged, or improperly mounted hardware.

2. **Make sure** that circuit boards are installed in the correct slots.

3. **Make sure** that board level numbers are correct and that circuit modifications are installed correctly.

4. **Check** the crt and shield for foreign material and scratches.

5. **Make sure** the crt ground straps are screwed tightly to the chassis.

6. **Check** all wiring and harmonica connectors for proper installation.

7. **Check** edge connectors and Interconnect board pins for damage.

8. **Check** the crt filter for proper installation; also, make sure that the ground clips are securely fastened.

9. **Make sure** that the crt socket is properly connected.

10. **Check** the strap settings on the High Voltage and Z-Axis board. Make sure that the Z-Axis jumper is set to the Z-0 position (inner position), the 90/100 jumper is set to the 100 position (lower position), and that the 75/93/50 jumper is set to the 50 position (outer position). Also, make sure that the board has a 1 A fast blow fuse in place.

11. **Perform** the following checks on the Low Voltage Power Supply (LVPS) board. Check the cables from the power supply to the Interconnect board for defects. Make sure that all wiring is fastened securely. Make sure that the line fuse is securely seated. Also, make sure that the following fuses have the correct ratings and are installed properly. The location of these fuses is shown in Figure 4-2.

F30	.15 A fast
F35	.25 A fast
F137	.15 A fast
F139	2.00 A fast
F141	2.00 A fast
F144	6.00 A slow
F146	5.00 A slow

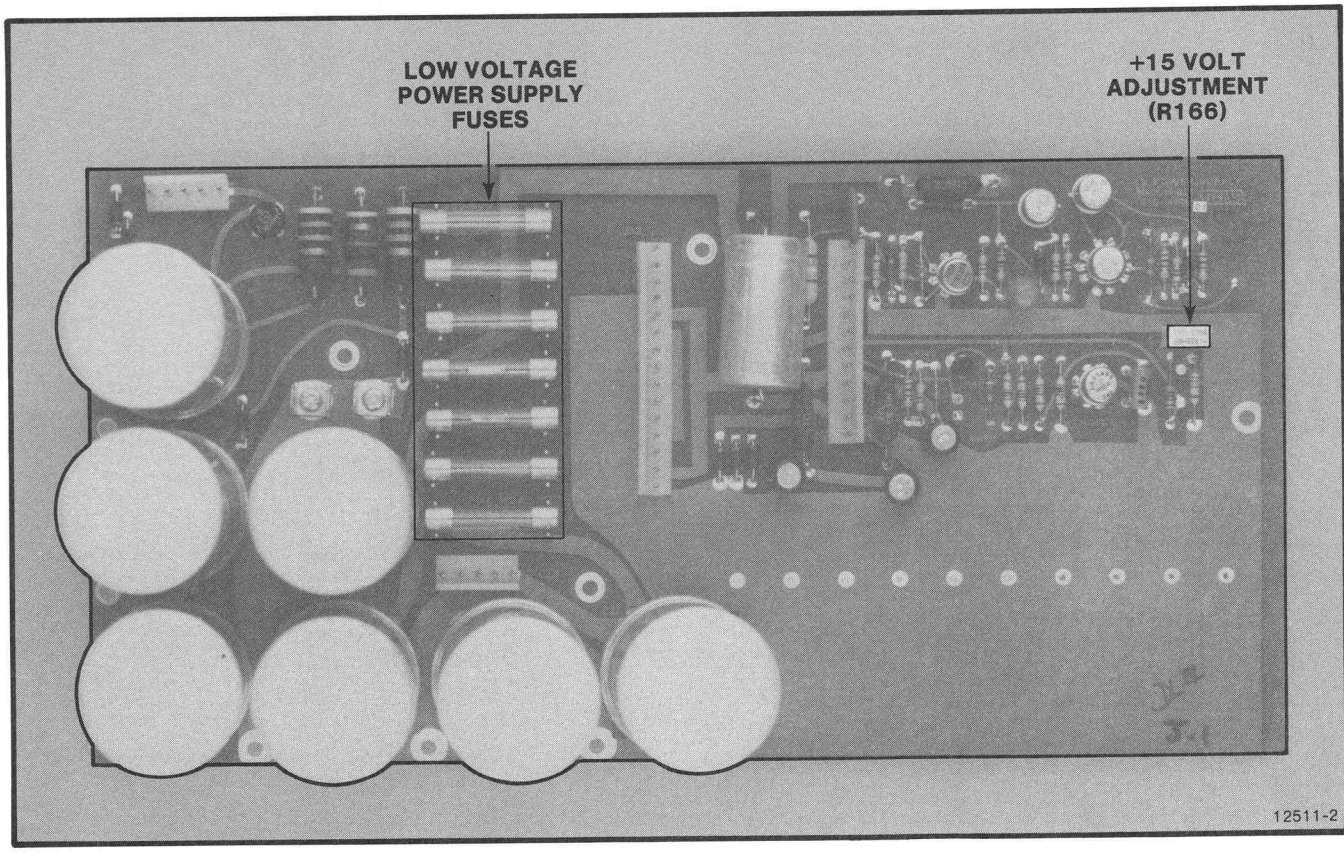


Figure 4-2. Low Voltage Power Supply Fuses and Adjustments.

12. **Check** the strap settings on the Storage board. Make sure that the VIEW RESET jumper is set to the GB (lower) position and also that the Z-TRU-Z jumper is set to the TRU-Z (lower) position. Set the NORMAL/TEST jumper to the "N" (top) position. Figure 4-3 shows the location of these straps.

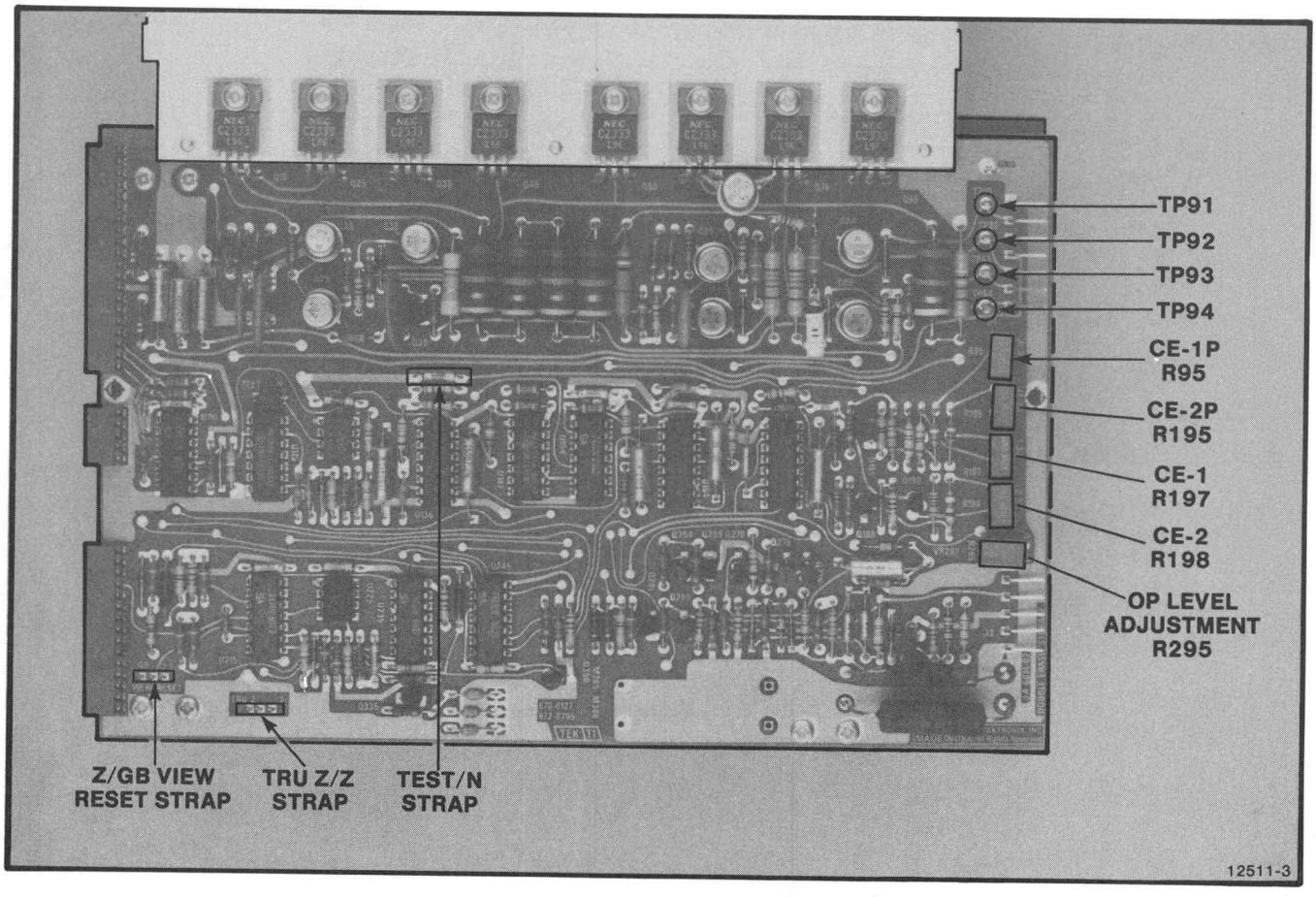


Figure 4-3. Storage Board Adjustments, Straps and Test Points.

13. **Set** the ANTIBURN jumper to the IN (lower) position on the Deflection board. Check the J311 and J314 straps for proper installation. Make sure that the J199 four-pin jumper is set to the FAST position. And make sure that the Hold mode jumper is set to the IN position (toward the rear). Figure 4-4 shows the Deflection board straps and jumpers.

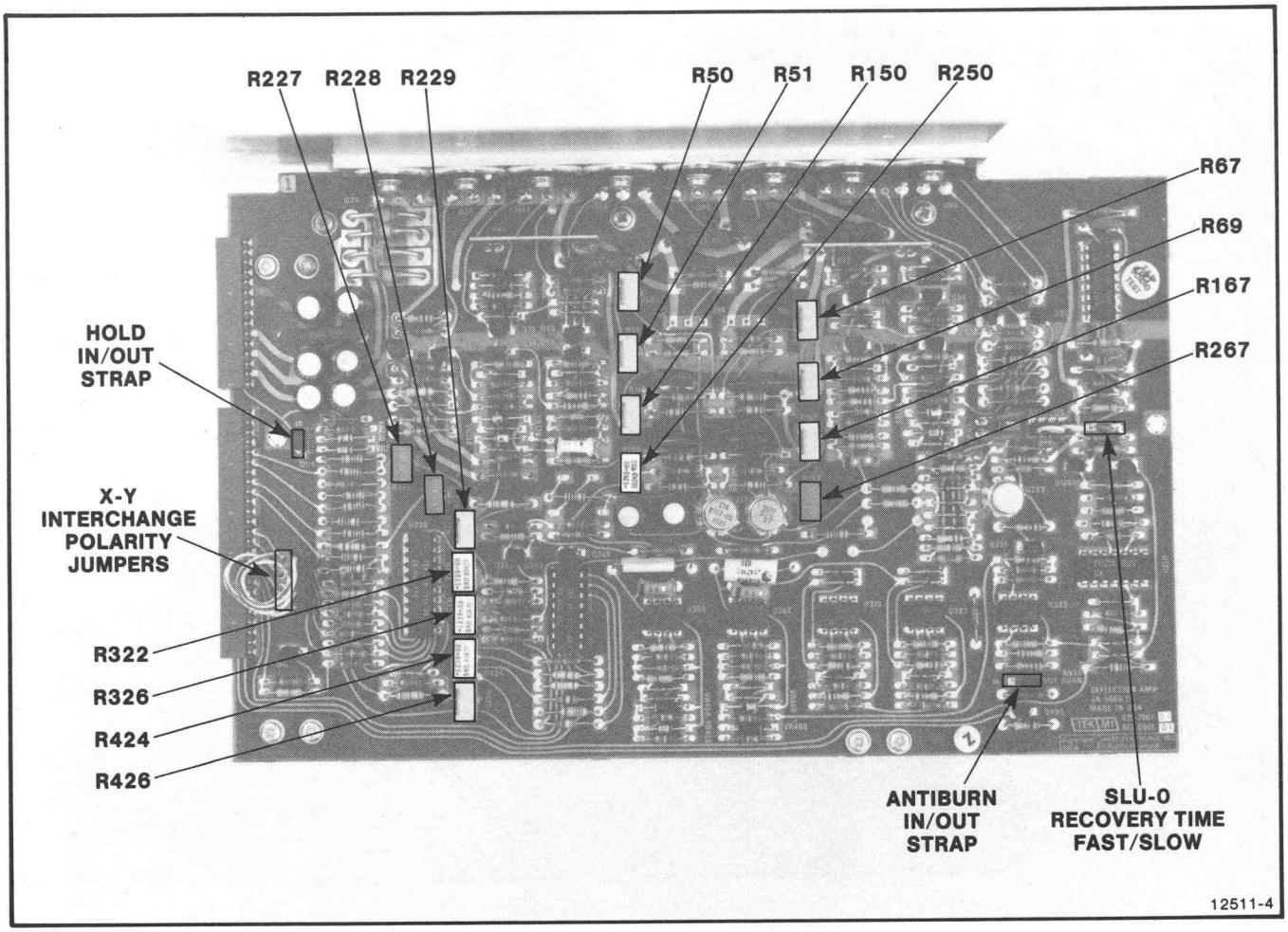


Figure 4-4. Deflection Amplifier Board Adjustments, Straps, Jumpers, and Test Points.

14. **Make sure** that the harmonica plugs are correcly installed on the Hard Copy board, and that no parts are shorted together. Also, make sure that the Danger Warning is in place on the plastic shield. Check the attaching screws for secureness.

ADJUSTMENT PROCEDURE

WARNING

Hazardous voltages are present in the 4114 circuitry when the power is on. Always use proper servicing techniques to avoid being injured or killed. Only qualified service technicians should perform the following adjustment procedure.

Low Voltage Power Supply

1. **Connect** the terminal power cord to the ac voltage source.

2. **Turn** the 4114 terminal POWER switch on.

CAUTION

Observe the crt for the first minute to insure that the beam does not remain in one spot with high intensity for more than a few seconds. This would cause a permanent deterioration of the crt phosphor in that spot. If a bright spot appears, turn off the 4114 immediately.

3. **Erase** the crt by pressing the PAGE key.

4. **Connect** the digital voltmeter probe to the +15 V test point on the Interconnect board. The voltage test points on the Interconnect board are all located in the rear left-hand corner of the board. For a more precise location of these test points, refer to the Interconnect Board Component Location photograph in the schematic section of the 4114 service manual.

5. **Adjust** R166 (at the upper right of LVPS board) for a reading of +14.97 to +15.03 V.

6. **Check** the +5 V test point on the Interconnect board for a reading of 4.80 to 5.20 V.

7. **Check** the remaining voltage test points on the Interconnect board for the following values:

Test Point	Value
-15 V (regulated)	-14.85 V to -15.15 V
+12 V (unregulated)	no tolerance (about +9 V)
-12 V (unregulated)	no tolerance (about -9 V)
+20 V (unregulated)	no tolerance
-20 V (unregulated)	no tolerance
+175 V (unregulated)	no tolerance
+290 V (regulated)	+287.0 V to +293.0 V
+490 V (unregulated)	no tolerance

8. **Set up** the oscilloscope -- 0.5 V/div, 10 us /div, ac coupled -- and check to see that the following ripple voltages are within range. These are measured at the same Interconnect board test points that the dc voltages were measured at.

Test Point	Value
+15 V (regulated)	5 mV p-p max
-15 V (regulated)	5 mV p-p max
+5 V (regulated)	10 mV p-p max
+12 V (unregulated)	1.5 V p-p max
-12 V (unregulated)	1.5 V p-p max
+20 V (unregulated)	1.2 V p-p max
-20 V (unregulated)	1.2 V p-p max
+175 V (unregulated)	7.0 V p-p max
+290 V (regulated)	100 mV p-p max
+490 V (unregulated)	5 V p-p max

High Voltage Check

WARNING

The following measurement involves a potentially lethal voltage. Use extreme care when making this measurement.

Use the 10X high voltage probe of the digital voltmeter to check Pin 3 of the crt for a reading of -570.0 V to -630.0 V (the actual voltage is -5700 V to -6300 V).

Storage Board Adjustments

CAUTION

The $\pm$X and the $\pm$Y signals from the Vector Generator board should be checked if the 4114 pedestal is not adjusted prior to adjusting the Display Module. If these signals are not correct, the crt patterns which follow will not be positioned on the crt correctly. The $\pm$X signals should range from +5.00 V to -5.00 V and the $\pm$Y signals should range from +3.75 V to -3.75 V (see the Vector Generator board adjustment procedure in the standard 4114 service manual).

All the test points and adjustments on the Storage board are located across the top edge of the Storage board. See Figure 4-3.

1. **Set** the digital voltmeter to 1 Vdc.
2. **Connect** the digital voltmeter probe to TP 91 (the flood gun anode).
3. **Check** for a voltage of 142.5 V to 157.5 V.

4. **Connect** the digital voltmeter probe to TP 94.

NOTE

Overhead lighting may affect how bright the crt seems to the viewer during the following adjustment.

5. **Adjust** R295 (the OP LEVEL adjustment -- at the top edge of the Storage board) so that the crt gets bright but does not store.

6. **Note** this voltage as the OP Level voltage.

7. **Remove** the digital voltmeter probe from TP 94 and connect it to TP 93 (CE-2).

8. **Adjust** R198 (the CE-2 adjustment -- at the top edge of the Storage board) so that the flood gun pattern is within 1/16-inch from the crt target edge, that is, the edge of the phosphor.

9. **Note** this voltage (this is the CE-2 voltage). Then remove the probe from TP 93 and attach it to TP 92.

10. **Adjust** R197 (the CE-1 adjustment -- at the top edge of the Storage board) to illuminate the target background uniformly. Make sure the corners of the crt screen are at the same level of brightness as the center.

11. **Check** for oscillation in the background illumination. If background oscillation is present, readjust CE-1. CE-1 is typically 5 to 10 V higher than CE-2. Note that there may be some interaction between R196 and R197.

12. **Connect** the digital voltmeter probe to TP 91 (the flood gun anode).

13. **Press** the PAGE key. This should erase the screen.

14. **Make sure** that the flood gun anode voltage does not change during an erase of the screen.

Storage Board Erase Waveforms

1. **Set** the oscilloscope as follows:

   - o V/div to 50V/div
   - o time/div adjustment to 0.1 sec/div
   - o Source to channel 1 (using 10X probe)
   - o Trigger Mode to "Normal"
   - o Trigger level to "+"
   - o ac/GND/dc to dc

WARNING

Always disconnect the ac power cord AND wait at least 60 seconds before moving the test jumper on the Storage board or moving ANY jumpers on ANY boards. The capacitors on the Low Voltage Power Supply board discharge to a safe level in 60 or more seconds. It is a good idea to monitor the +490 or +290 V supplies with the DVM as they are discharging as a added safety measure before touching the boards to remove the jumpers.

2. **Disconnect** the ac power cord and wait at least 60 seconds before continuing.

3. **Remove** the test jumper (on the bottom of the Storage board) from the "N" position and place the jumper in the "TEST" position. The jumper may be left in the TEST position while making oscilloscope waveform checks on the Storage board but must be moved back to the "N" position when making voltage checks with the digital voltmeter. If the jumper is not used in the "TEST" position, the crt screen must be erased for each waveform check.

4. **Reconnect** the ac power cord and turn the 4114 on.

5. **Note** that the crt goes into Hold mode and erases every three seconds.

6. **Set** the oscilloscope trigger mode to "AUTO".

7. **Adjust** the oscilloscope vertical positioning so that ground reference is lined up with the second graticule line from the bottom of the oscilloscope screen.

8. **Set** the trigger mode to "NORMAL".

9. **Connect** the oscilloscope probe to TP 94.

10. **Refer** to the target erase waveform (Figure 4-5) and do the following:

    a. Verify that the second positive-going ramp (c) is between 600 and 900 ms long.

    b. Verify that the most negative portion of the waveform falls between 0 V and +25 V.

    c. Verify that the pulse height (a) is 135 V to 165 V above the OP level. For example, if the OP level is 150 V, the pulse height must be between 285 V and 315 V.

11. **Set** the oscilloscope time/div adjustment to 20 ms/division.

12. **Observe** the first ramp, shown as (b) in Figure 4-5.

13. **Refer** to Figure 4-6, which shows the first ramp of the target erase waveform in more detail.

    a. Verify that the time between pulses is 85 ms to 115 ms.

    b. Verify that the ramp time is a minimum of 65 ms. Also make sure that the end of the ramp is not less than 80% of the OP Level value. For example, if the OP Level is 150 V, the end of the first ramp should not fall below 120 V (0.8 x 150 V).

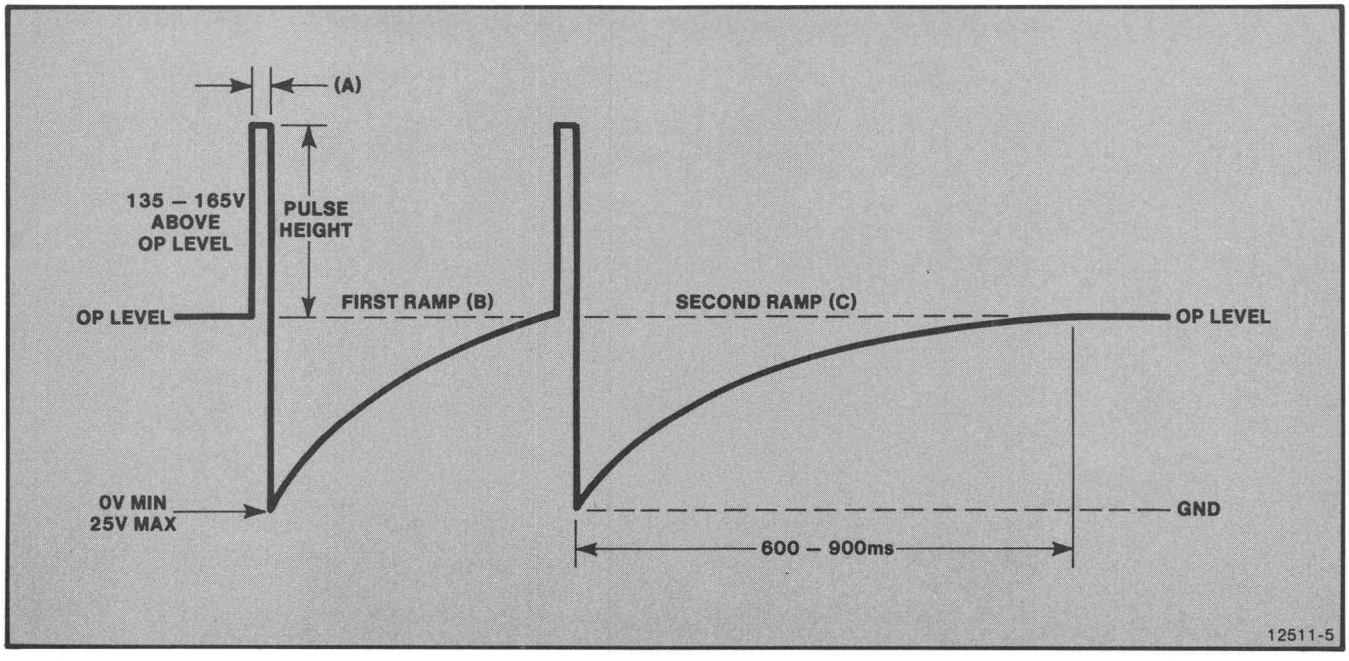


Figure 4-5. Target Erase Waveform.

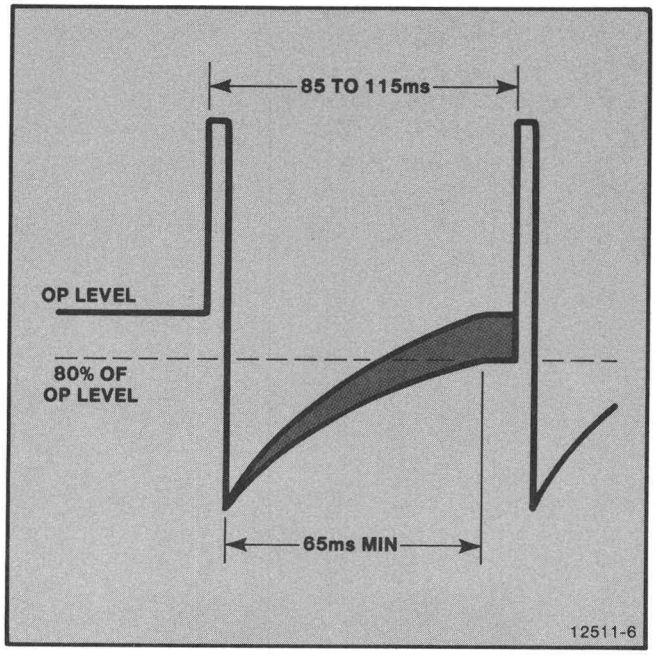


Figure 4-6. First Ramp of Target Erase Waveform.

14. **Set** the oscilloscope time/div adjustment to 0.5 ms/div.

15. **Adjust** the oscilloscope so that the OP LEVEL trace is at the center of the oscilloscope graticule.

16. **Observe** the pulse waveform shown in Figure 4-7. This waveform is also indicated as (a) in Figure 4-5.)

17. **Verify** that the pulse, as measured from half way up its rising and falling edges, has from 1.7 ms to 2.3 ms pulse width. (This check measures both positive pulses).

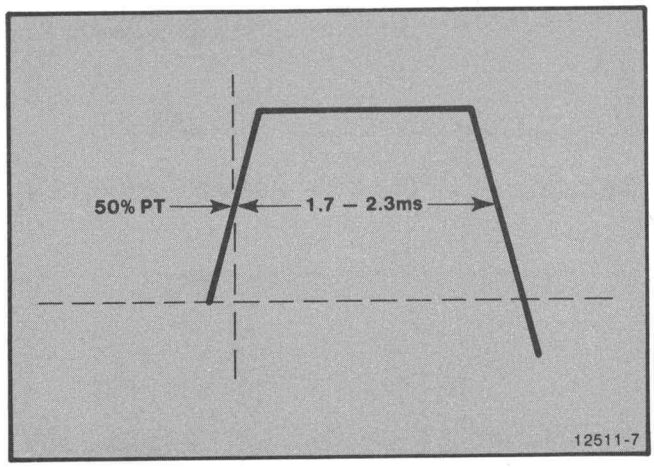


Figure 4-7. Target Erase Pulse Waveform.

18. **Connect** the oscilloscope probe to TP 93.

19. **Set** the oscilloscope time/div adjustment to 50 ms/division.

20. **Do** the following using the waveform in Figure 4-8:

    a. Verify that the first ramp time is greater than 70 ms. Also, make sure that the end of the ramp is at least 75% of the CE-2 level. For example, if the CE-2 level is 60 V, the end of the first ramp should not fall below 45 V (0.75 x 60 V).

b. Verify that the second ramp is 70 to 120 ms long.

c. Verify that the beginning of both ramps is between 0 V and +15 V.

d. Verify that the time between pulses is 85 ms to 115 ms.

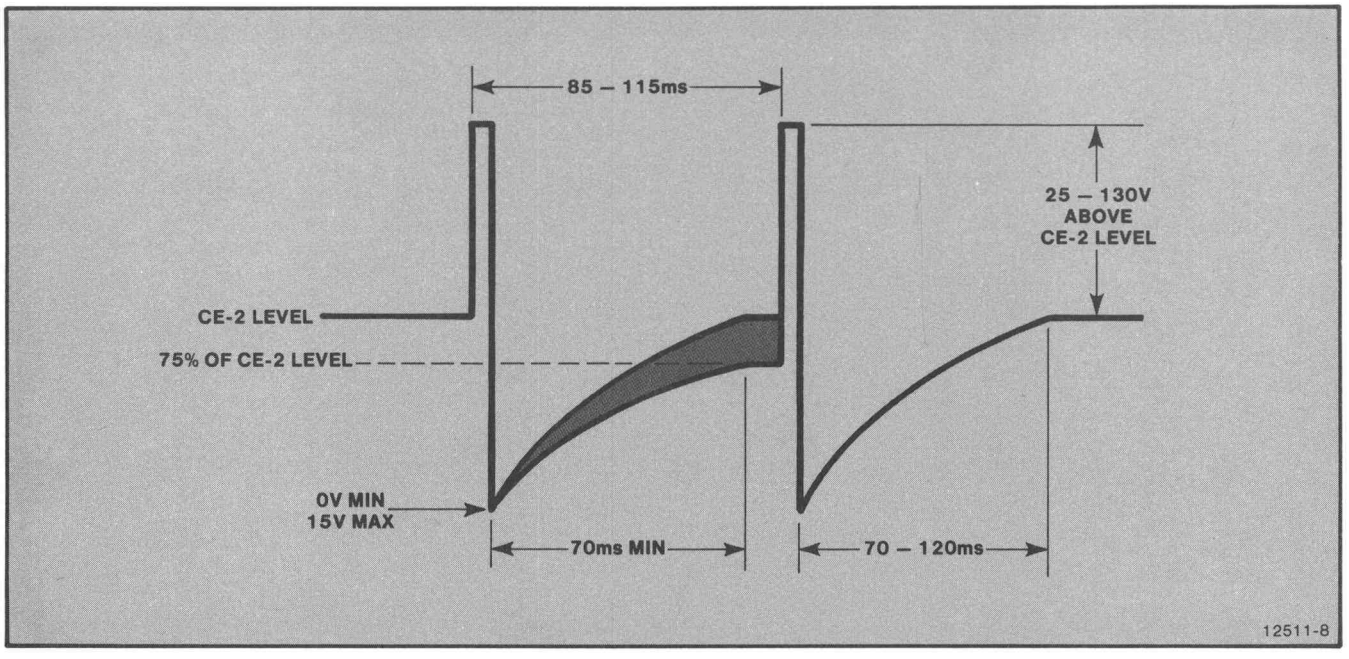


Figure 4-8. CE-2 Waveform.

21. **Connect** the oscilloscope probe to TP 92.

22. **Set** the oscilloscope time/div adjustment to 20 ms/division.

23. **Observe** the waveform in Figure 4-9 and make sure that the time from the beginning of the first pulse to the beginning of the second pulse is 85 to 115 ms.

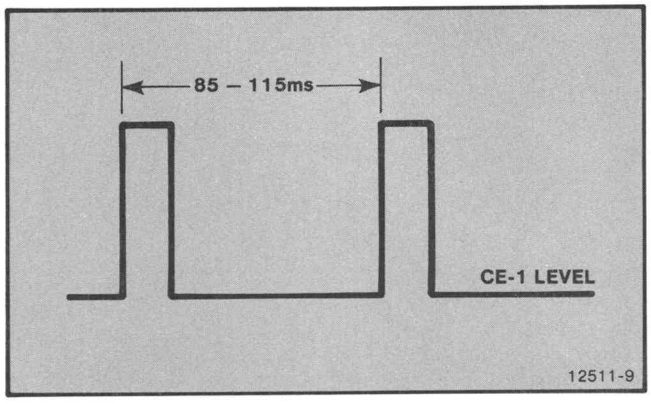


Figure 4-9. CE-1 Waveform.

24. **Adjust** R95 (CE-1 pulse control, on the top edge of the Storage board) while erasing the crt and observe the edges of the crt for full coverage. Usually, the erase covers the full screen when R95 is turned fully clockwise or very close to fully clockwise. If no change is noticed during this adjustment, leave R95 adjusted at 90% clockwise.

25. **Adjust** R195 (the CE-2 pulse control, at the top edge of the Storage board) while erasing. At the same time, make sure that the erase extends fully to the corners of the screen.

NOTE

The OP LEVEL, CE-1, and CE-2 adjustments interact. Because of this, slight readjustment of the OP LEVEL, CE-1 level, CE-2 level, and CE-2 pulse may be required to make the crt screen look right. Readjust if necessary for proper background appearance, full screen target coverage, and full screen erasing.

26. **Turn** off the 4114, disconnect the ac power cord, and wait 60 seconds before continuing.

WARNING

Always disconnect the ac power cord and wait at least 60 seconds before moving the test jumper on the Storage board or moving ANY jumpers on ANY of the boards. The capacitors on the Low Voltage Power Supply board discharge to a safe level in 60 seconds or more. As an added safety measure, it is a good idea to watch the +490 or the +290 V supplies discharge using the DVM while the display is unplugged.

27. **Remove** the test jumper from the "TEST" position and reinstall it in the "N" position.

28. **Reconnect** the ac power cord and apply power to the 4114.

Flood Gun Anode

1. **Connect** the oscilloscope probe to TP 91 on the Storage board.

2. **Set** the oscilloscope time/div adjustment to 2 ms/division.

3. **Press** the PAGE key. This restarts the Hold mode timer.

4. **Verify** that the terminal enters Hold mode 90 and 135 seconds after pressing the PAGE key.

5. **Refer** to the waveform in Figure 4-10 while the crt is in Hold mode.

a. Verify that the positive pulse is 12% to 16% of the period of the waveform. This represents a duty cycle of 12% to 16%. It may be easier to see if the time/division on the oscilloscope is taken out of the calibrated position and the positive and negative transitions of the waveform are aligned with the graticule of the oscilloscope. The period of the waveform, however, must have a real time of 8.3 to 12.5 ms.

b. Verify that the most negative part of the waveform is -15 V.

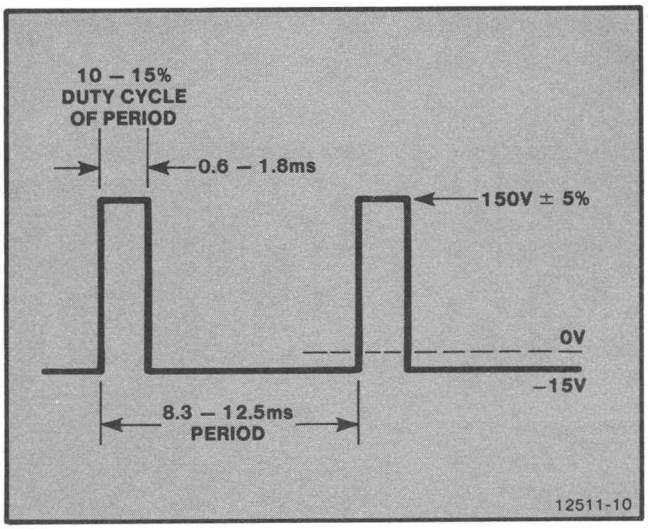


Figure 4-10. Flood Gun Anode Waveform.

6. **Connect** the digital voltmeter probe to Pin 43 (DBUSY) on the Interconnect board. (Refer to the Interconnect Board Component Location photograph in the schematic section of the 4114 service manual.)

7. **Check** for less than 0.8 V (TTL low) during Hold mode.

8. **Remove** the oscilloscope probe from the Storage board.

Grid Bias

WARNING

Always disconnect the ac power cord and wait at least 60 seconds before moving the ANTIBURN strap on the Deflection Amplifier board or moving ANY jumpers on ANY of the boards. The capacitors on the Low Voltage Power Supply board discharge to a safe level in 60 seconds or more. As an added safety measure, it is a good idea to watch the +490 or the +290 V supplies discharge using the DVM while the display is unplugged.

1. **Disconnect** the ac power cord and wait 60 seconds before continuing.

2. **Change** the ANTIBURN strap on the Deflection Amplifier board from the "IN" position to the "OUT" position.

3. **Reconnect** the ac power cord and reapply power to the 4114.

4. **Use** the cursor for the following adjustments.

NOTE

For the location of the following High Voltage and Z-Axis board adjustments, Figure 4-1 in the beginning of this section may be helpful.

5. **Adjust** R431 (the CRT BIAS adjustment, in the middle of the High Voltage and Z-Axis board) slowly clockwise until a low intensity dot appears in one corner of the cursor. Retrace lines will also appear in an area around the cursor.

6. **Adjust** R471 (Center Focus adjustment, on the upper right of the High Voltage and Z-Axis board) for a sharp, focused dot.

7. **Adjust** R431 until the dot just disappears. Erase the display if the dot stores while making the CRT BIAS adjustment.

8. **Measure** the voltage at the upper end of C438 (lower right side of the High Voltage and Z-Axis board) with the digital voltmeter and adjust R431 counterclockwise until the reading increases by +5 V.

9. **Disconnect** the ac power cord and wait at least 60 seconds before continuing.

10. **Change** the ANTIBURN strap from the "OUT" position to the "IN" position.

11. **Reconnect** the ac power cord and reapply power to the 4114.

Normal Intensity

1. **Connect** the oscilloscope probe to the top of R637 (the 20K resistor near the center of the High Voltage and Z-Axis board).

2. **Set** the oscilloscope V/div adjustment to 10 V/division and the time/div adjustment to 2 ms/division.

3. **Hold** down a character key in order to repeat the key.

4. **Adjust** R716 to 40 V measuring from the top of the small pulses to the top of the large pulses. See Figure 4-11.

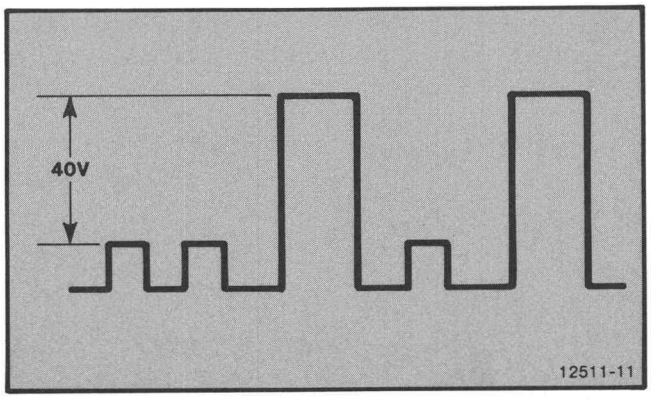


Figure 4-11. Normal Intensity Waveform.

Origin Shift

Press PAGE eight times and watch the cursor move down and to the left seven times. The eighth time it returns to the upper right (adjusting the REFRESH INTENSITY control may make the cursor easier to see).

Self Test Patterns

The rest of the adjustment procedure uses patterns that are stored in ROMs in the 4114 pedestal. Whenever these patterns are needed, use the following procedure to display the appropriate pattern on the crt screen.

1. **Press** the SELF TEST button and hold it in. This button is located on the front of the pedestal, below the keyboard, to the left of the MASTER RESET button.

2. **Press** the MASTER RESET button and then release it. The keyboard LED lights come on and go off as different parts of circuitry are tested.

3. **Check** that keyboard LED lights have begun to "cycle," then release the SELF TEST button. The 4114 bell sounds at the start of the Self Test key check.

4. **Press** and hold the CONTROL and C keys at the same time until the keyboard lights acknowledge that the keys have been pressed, and then release them. This displays a general "menu," which is a list of Self Test routines.

5. **Select** Display from this menu. This displays a second menu of the patterns to be used in adjusting the screen.

Self Test has the following "commands" which can be used at any point in the Adjustment Self Test procedure.

- CONTROL C. Displays the general menu.
- CONTROL D. Displays the current menu.
- CONTROL E. Exits from the current routine.
- SPACE BAR. Repeats the current pattern.

Once the display "menu" has been called from memory, it is not necessary to repeat the rest of the Self Test in order to get the patterns needed for the Display Module adjustment. Simply use CONTROL D to get back to the display "menu," and select the desired test pattern from this menu. In the rest of the adjustment procedure (such as in the SLU-0 test section, which calls for displaying the X COMP pattern using the Self Test), go back only to the display menu using CONTROL D and do not repeat the previous part of the Self Test.

Frequency Compensation

1. **Display** the X COMP pattern using the Self Test procedure. (Adjusting the REFRESH INTENSITY control may make this pattern easier to see.)

2. **Adjust** R51 and R150 on the Deflection Amplifier board so that only one line can be seen. See Figure 4-12.

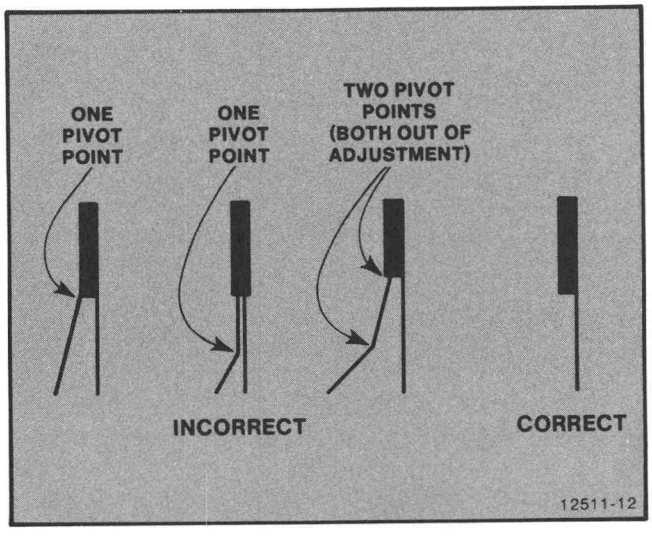


Figure 4-12. Frequency Compensation Pattern.

3. **Display** the Y COMP pattern using the Self Test procedure.

4. **Adjust** R69 and R167 on the Deflection Amplifier board so that only one line can be seen. Again refer to Figure 4-12.

Gain, Positioning, and Geometry (Including Yoke Adjustment)

NOTE

The following part of the adjustment procedure requires that the Display Controller and Vector Generator boards have been adjusted. If they have not been previously adjusted prior to starting the adjustment procedure for the display and they are far out of adjustment, it may not be possible to check accurately for gain, positioning, and geometry. To adjust these boards, see the respective adjustment procedures located in the 4114 service manual.

1. **Display** the GAIN pattern using the Self Test procedure. Note that this pattern alternates between Storage and Write-Thru modes if the SPACE BAR is pressed.

2. **Adjust** the REFRESH INTENSITY control (on the bezel) so that the lines do not store in Refresh mode.

3. **Adjust** the yoke using a 5/16-inch nut driver. Loosen the yoke adjustment nut and rotate the yoke so that the center vertical line is equidistant from both the left and right edges of the chassis. For example, if the top of the center vertical line is 9.85 inches from the right-hand side of the chassis, the bottom of the same center vertical line should also be 9.85 inches from the right edge of the chassis. Conversely, the top and bottom measurements from the left edge of the chassis should be the same. Since the chassis is mechanically square, the vertical line should now be lined up square in relation to the chassis.

4. **Adjust** R250 (the Long Axis Positioning control, at the bottom right of the Deflection Amplifier board) and R50 (the Long Axis Gain control, at the bottom left of the Deflection Amplifier board) so that the midpoint of the left and right vertical display lines is the same distance from the left and right edges of the crt screen (or crt filter).

5. **Adjust** R267 (the Short Axis Positioning control, at the top right of the Deflection Amplifier board) and R67 (the Short Axis Gain control, at the top left of the Deflection Amplifier board) so that the midpoint of the top and bottom horizontal lines is the same distance from the top and bottom of the crt screen (or crt filter).

6. **Adjust** R326 (the Long Axis Geometry control, at the lower center of the Deflection Amplifier board) for the straightest top horizontal line.

7. **Make sure** that the bottom horizontal line is adjusted so that any deviations of the line fall equally above and below a line placed horizontally through the middle (a clear straight edge may be used for this measurement). The deviations above and below this horizontal line cannot exceed 3/16 of an inch on either side of the horizontal line. If the deviation does exceed 3/16 of an inch, a compromise between the top and bottom horizontal lines must be made while trying to keep the top line as as straight as possible.

8. **Adjust** R322 (the Short Axis Geometry control, at the lower center of the Deflection Amplifier board) for the straightest left-hand vertical line.

9. **Pass** a straight edge vertically through the right-hand vertical line of the display pattern to measure the straightness of the right-hand vertical line. (This procedure is similar to the procedure for measuring the straightness of the bottom horizontal line.) Any deviations of the display line should fall equally on both sides of the straight edge and should not exceed 1/8 of an inch on either side of the straight edge. If the display line does fall outside these limits, a compromise must be made between the left-hand and right-hand display lines while keeping the left-hand line as straight as possible.

NOTE

Adjusting the geometry in one axis affects the gains in the other. Readjustments in gain, therefore, are necessary when making geometry adjustments.

10. **Tighten** the yoke adjustment nut and recheck the line straightness.

Orthogonality

Make sure when the center vertical display line has been aligned that the angle between the intersection of the center vertical line and the center horizontal line is not more than 91.2 degrees or less than 88.8 degrees.

NOTE

A compromise between line straightness and orthogonality may be made as long as both are within the tolerances stated previously and are made at the same yoke setting.

Dynamic Focus

1. **Call up** the GAIN pattern using the Self Test procedure.

2. **Attach** the scope probe to the upper end of R126 (the 499K resistor on the center left of the High Voltage and Z-Axis board)..

3. **Adjust** R424 (the DYNAMIC FOCUS control, at the lower center of the Deflection Amplifier board) so that the lowest portion of the waveform changes less than 2 volts as R218 (CORNER FOCUS adjustment -- High Voltage and Z-Axis board) is ranged from one extreme to the other. See Figure 4-13.

4. **Remove** the oscilloscope probe.

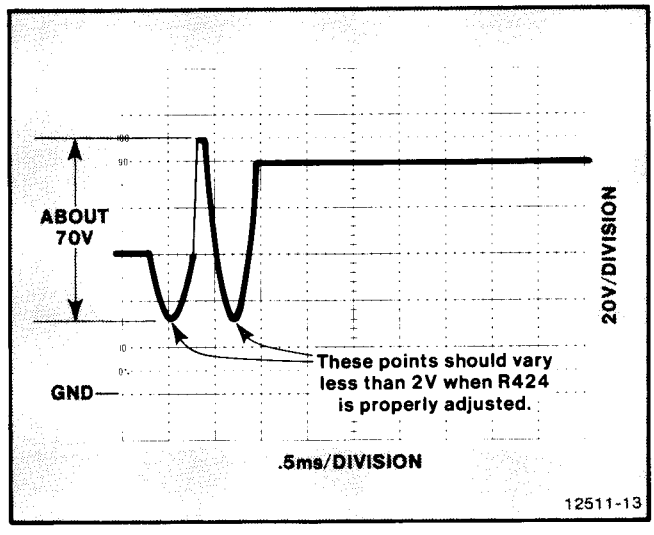


Figure 4-13. Dynamic Focus Waveform.

SLU-0

1. **Display** the X COMP pattern using the Self Test procedure.

2. **Set** the oscilloscope time/div adjustment to 20 us/division and the volts/div adjustment to 2 V/division. Set the slope adjustment to "-".

3. **Connect** the oscilloscope probe to Pin 36 (SLU-0) on the Interconnect board. (Refer to the component location photograph in the 4114 service manual.)

4. **Check** for a TTL pulse (a low of less than 0.8 V and a high of greater than 4 V).

5. **Remove** the oscilloscope probe.

FOCUS

1. **Display** the FOCUS pattern using the Self Test procedure.

2. **Adjust** R471 (the CENTER FOCUS adjustment, at the upper right of the High Voltage and Z-Axis board) while characters are being displayed for the sharpest characters at the center of the crt.

3. **Adjust** R218 (the CORNER FOCUS control, at the lower center of High Voltage and Z-Axis board) while characters are being displayed for a compromise between the sharpest characters at all four corners of the crt.

Dropout

1. **Display** the HARD COPY pattern using the Self Test procedure and wait 2-1/2 minutes. This allows the display to drop into Hold mode.

2. **Bring** the display out of Hold mode by pressing the SHIFT key.

3. **Increase** the OP LEVEL adjustment or the NORMAL INTENSITY adjustment or both in 5 V increments if breaks occur in the Hard Copy pattern. Repeat the Hard Copy pattern for the best picture with a minimum number of breaks. An example of dropout is shown in Figure 4-14.

4. **Check** FOCUS again if NORMAL INTENSITY adjustments are made.

5. **Check** the CE-1, CE-2, display gain, and positioning adjustments if OP Level adjustments are made.

Appendix A

4114 DISPLAY INTERCONNECTING SIGNALS

This appendix is included as a troubleshooting aid in locating defective boards and components. These signals represent signals that are internal to both the standard 4114 and Option 31 Display Modules. These signals can be found on the schematics in this manual and in the 4114 service manual; the "Source; Destination: column specifies the schematics on which each signal appears.

Schematics A8-1, 2, 3, 4 and A9-1, 2, 3, 4, 5 are the Display Controller board and Vector Generator board schematics respectively. They are not found in this manual but can be found in Volume 2 of the 4114 service manual.

Signal Name	Source; Destination	Description
ANODE	A13-1; A14-1	Passes through a current-limiting resistor in the Hard Copy Amplifier board to the anode of the crt.
ANTIBURN	A15-2; A16-1	Made up from LA and SA ANTIBURN signals on schematic.
		If positive, decreases the Z-Axis amplifier drive, reducing the crt writing beam intensity. Goes positive when deflection approaches zero velocity.
BRITE-0	A8-4; A16-1	A TTL low from the Display Controller activates BRITE Intensity, adjustable by R415 in the Intensity Control Logic. In combination with low level on DEFOCUS-0, the BRITE-DEFOCUS mode is useful for displaying wide vectors and merging dots on wide characters. If DEFOCUS-0 is allowed to go high, the writing mode is BRITE-FOCUS, usable for medium-large characters.

Signal Name	Source; Destination	Description
CATHODE	A13-2 A14-1	Ties cathode of crt to ground.
CE1 & CE2	A13-2; A14-1	The collimation electrodes, CE1 and CE2, are electronic lenses that cause a uniform Flood Gun beam pattern over the target.
CENTER-0	----; A15-1	When low, inhibits and resets the operation of the Origin Shift Counter. (Not used in the 4114 pedestal; reserved for future use.)
DBUSY-0	A13-1; A8-3,-4	When low, indicates that the display is busy in Hold mode, erasing the screen, or in Hard Copy operation. This line states that the display is busy and cannot accept further information until brought out of one of these modes.
DEFOCUS-0	A8-4;A16-1	When low, the focus of the crt writing beam is reduced, producing a slightly wider trace (defocused). When high, the writing beam is focused. The use of the DEFOCUS-0 signal line allows a focused or defocused crt writing beam when used in combination with WRITE-THRU, BRITE, and NORMAL (see the 4114 service manual).
DISPLAY SIZE INFO	REAR PANEL CONNECTOR (J5005); HARD COPY UNIT	Tied to ground (logical low). When tied low, it informs the Hard Copy Unit that it is scanning a 19-inch display.
DPC	A9-2; S.S. RELAY	Display Power Control. Causes display ac power to be turned on. 10 mA at +9 to +12 V.

Signal Name	Source; Destination	Description
DYNAMIC FOCUS	A15-1; A16-1	This signal modifies the focus electrode voltage to maintain a consistently focused writing beam over the display screen.
ERASE-0	A8-2; A13-1	Initiates the erase cycle in the storage board circuits. Erases the crt. Must be greater than 2 us. A READ-0 or WAIT-0 signal prevents erasure during hard copy operation.
ERASE TRIGGER	A13-1; A13-2	Internal to Double Erase Storage board schematic. Triggers the crt to erase via ERASE-0 line.
FAST RAMP	HARD COPY UNIT; A15-1	± FAST RAMPs on schematics. Analog deflection voltage from the HCU which controls the vertical deflection during the hard copy scan.
FG FIL	A12-1; A13-2 and A14-1	Flood Gun filaments (± FG FIL on schematic) of crt. Driven by ± 15 volts from low voltage power supply.
GBUSY	----; A13-1	View Reset strap option between GBUSY and Z-AXIS. Optional signal that can be used to reset the View-Erase Counters. A 100 ns or greater pulse is required. (A VIEW-0 signal will also reset the View-Erase Counter.)

Signal Name	Source; Destination	Description
HC INTENSITY	HARD COPY UNIT; A16-1	Hard Copy Intensity. Controls the crt writing beam intensity by adjustment of R415 (Hard Copy Intensity adjustment).
HCS-0	A13-1; A16-1	Hard Copy Scan. Enables operation of Hard Copy circuitry. HCS-0 is asserted by either READ-0 or WAIT-0 (from the Hard Copy Unit) going low. Initiates crt scan by the HCU.
HCS-1	A13-1; A13-2 and A14-1	Inverted HCS-0. Enables operation of Hard Copy circuitry. Refer to the HCS-0 signal.
HCU-0	HARD COPY UNIT; A8-2	Informs the Display Controller that the Hard Copy Unit is capable of accepting a MAKE COPY-0 request.
HOLD-0	A13-1; A15-1	Strap option on Deflection Amplifier board; operational in the IN position. Connects the channel switch to a separate set of inputs that are connected to ground when Hold mode is initiated. The grounded inputs prevent beam deflection and assure minimum deflection amplifier power dissipation during Hold mode.
INTER-0	HARD COPY UNIT; A16-1	This is the hard copy interrogate pulse from the Hard Copy Unit (HCU). As a result the crt writing beam is pulsed (100 ns pulse width) and a target information signal, TARSIG-0, is developed.

Signal Name	Source; Destination	Description
MAKE COPY-0	A8-2; HARD COPY UNIT	Caused by Display Controller or Hard Copy Switch going low. Initiates a hard copy cycle (makes a copy). Requires ground closure of TTL low > 1 ms.
NON-STORE-0	A9-2; A13-2	When low, causes reduced target voltage; permits the crt writing beam to write without storing. (Not used in 4114 Option 31 or 4114. Reserved for later use.)
ORIGIN-1	A13-1; A15-1	During erase cycle from Storage board, triggers the Origin Shift Counter on the Deflection Amplifier board to shift the axes slightly on the next page of screen written data. This feature enhances crt screen life.
READ-0	HARD COPY UNIT; A13-1 and A15-1	Develops HCS-0 and HCS-1 in the Copy Control section. READ-0 causes the Channel Shift and Origin Shift to use the the SLOW and FAST RAMP signals (also from the HCU) to provide LA and SA outputs from the Deflection Amplifier.
REMOTE COPY-0	A8-2; HARD COPY UNIT	Caused by Display Controller switch going low. Initiates a Hard Copy cycle (makes a copy). A direct line from the MAKE COPY-0 signal, which acts as a reference for the Hard Copy Unit (informs the HCU that it is being triggered from a source remote to the HCU).
SLOW RAMP	HARD COPY UNIT; A15-1	± SLOW RAMPs on schematics. Analog deflection voltage from the HCU which controls the horizontal deflection during the hard copy scan.

Signal Name	Source; Destination	Description
SLU-0	A15-2; A8-3,-4	Indicates a temporary wait for the Display Controller while the deflection circuits are lagging the deflection inputs and establishing the new deflection position.
TARGET	A13-2; A14-1	Voltage established at the inside face of the crt.
TARSIG-0	A14-1; HARD COPY UNIT	Target signal. Display information signal from the target sent to the Hard Copy Unit when a hard copy is being made. Goes low when the scan crosses a written area on the crt screen.
TRU Z	A16-1; A13-1 and A15-2	Represents the true Z-Axis (always active high). Turns on crt writing beam depending on the status of the Intensity Control Logic section. Overrides antiburn circuitry in the first few microseconds of operation, due to the time lag of the antiburn circuitry, so as not to blank out any beginning information. (See also Z-AXIS signal definition.)
VIEW-0	A8-1; A13-1	Resets the View-Erase Counters. (GBUSY or Z-AXIS will also do this, depending on the placement of the View-Reset strap.)
WAIT-0	HARD COPY UNIT; A13-1	Remains low until the display screen has been scanned. (Applies only to a Hard Copy Unit with multiplexer option.)

Signal Name	Source; Destination	Description
WRITE-THRU-0	A8-4; A16-1	Selects WRITE-THRU INTENSITY CONTROL (R425-Coarse Write-Thru) and disables NORMAL and BRITE INTENSITY controls.
WT INTENSITY	FRONT BEZEL; A16-1	Controls the WRITE-THRU INTENSITY by R425 adjustment (see WRITE-THRU-0).
X+	A9-5; A15-1	+X,-X on schematic. X-axis input to Display Module.
Y+	A9-5; A15-1	+Y, -Y on schematic. Y-Axis input to the Display Module.
Z-AXIS	A9-5; A13-1 and A16-1	Strap option in Intensity Control Logic for active low or active high. Strap option in View Mode Control for Z-AXIS or TRU Z. Second strap option in View Mode Control (View Reset strap option). This option causes the Z-AXIS to reset the View-Erase Counters (GBUSY or VIEW-0 will also do this). True signal turns on the crt writing beam depending upon the status of the Intensity Control Logic section. Also can be strapped to accept either TTL state (high or low) input signal.

A16R722	321-0272-00			RES.,FXD,FILM:6.65K OHM,1%,0.125W
A16R738	311-1555-00	XB010550		RES.,VAR,NONWIR:100K OHM,20%,0.5W
A16R739	315-0225-00			RES.,FXD,CMPSN:2.2M OHM,5%,0.25W
A16R748	315-0204-00			RES.,FXD,CMPSN:200K OHM,5%,0.25W
A16R749	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W
A16R759	307-0550-01			RES NTWK,FXD FI:HV DIVIDER
A16RV649	307-0638-00	XB010550		RES,V SENSITIVE:18V,20%,0.5W
A16RV657	307-0638-00	B010100	B010549X	RES,V SENSITIVE:18V,20%,0.5W
A16T51	120-1413-00			XFMR,PWR,SDN&SU:HV
A16TP778	214-0579-00			TERM,TEST POINT:BRS CD PL
A16U315	156-0072-02			MICROCIRCUIT,DI:MONOSTABLE MV,BURN-IN
A16U605	156-0058-02	B010100	B010549	MICROCIRCUIT,DI:HEX INVRTR,SCREENED
A16U605	156-0382-02	B010550		MICROCIRCUIT,DI:QUAD 2-INP NAND GATE
A16U615	156-0381-02			MICROCIRCUIT,DI:QUAD 2-INP EXCL OR GATE
A16U616	156-0047-02			MICROCIRCUIT,DI:TP1 3 INP,NAND GATE
A16U645	156-0067-13			MICROCIRCUIT,LI:OPNL AMPL,SELECTED
A16VR235	152-0282-00			SEMICOND DEVICE:ZENER,0.4W,30V,5%
				CHASSIS PARTS
A5001	119-0420-00			FILTER,RFI:6A,250VAC,400HZ
CR1005	152-0518-00			SEMICOND DEVICE:RECT,SI,50V,27A
CR1006	152-0518-00			SEMICOND DEVICE:RECT,SI,50V,27A
F5001	159-0149-00			FUSE,CARTRIDGE:4A,250V,SLOW-BLOW
L1002	119-0971-00			COIL,TUBE DEFL:
Q1001	151-0623-00			TRANSISTOR:SILICON,NPN
Q1002	151-0373-00			TRANSISTOR:SILICON,PNP
Q1003	151-0415-00			TRANSISTOR:SILICON,NPN
R5001	311-2114-00			RES.,VAR,NONWIR:PNL,10K OHM,20%,0.25W
T1001	120-1412-00			XFMR,PWR,SDN&SU:
U1001	148-1005-00			RELAY,SOL STATE:250VAC,10A CONT,12VDC
U1002	156-0277-00			MICROCIRCUIT,LI:VOLTAGE REGULATOR
V5001	154-0845-00	B010100	B011099	ELECTRON TUBE:CRT,T4100-CWT,DVST
V5001	154-0845-01	B011100		E

Tektronix®
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

PRODUCT 4114 OPTION 31 COLOR ENHANCED REFRESH
CHANGE REFERENCE C2/981
MANUAL PART NO. 061-2511-00
DATE 9-4-81

EFFECTIVE ALL SERIAL NUMBERS

TEXT, SCHEMATICS, COMPONENT LOCATION, AND PARTS CHANGES

Pages 4-31, 4-32, and Replaceable Electrical Parts.

REPLACE ABOVE PAGES WITH ATTACHED PAGES

ADD: A11-1 Interconnect Board
A12-1 Low Voltage Power Supply Board
A13-1 Double Erase Storage Board
A13-2 Double Erase Storage Board
A16-1 High Voltage & Z-Axis Board

High Voltage and Z-Axis Component Locations (670-7264-01, 672-1026-01)

THIS IS A PAGE REPLACEMENT PACKAGE.

The area of change is marked
by a change bar in the margin.

1. Remove the appropriate pages from your manual and insert the attached pages.

2. Update Manual Revision Status page i in the front of your manual to indicate the new revision letter, date revised, and which pages were revised. You will find this information, centered, at the bottom of each replacement page. (This update is for your information only.)

3. Keep this cover sheet in the Change Information section at the very back of your manual for a permanent record.

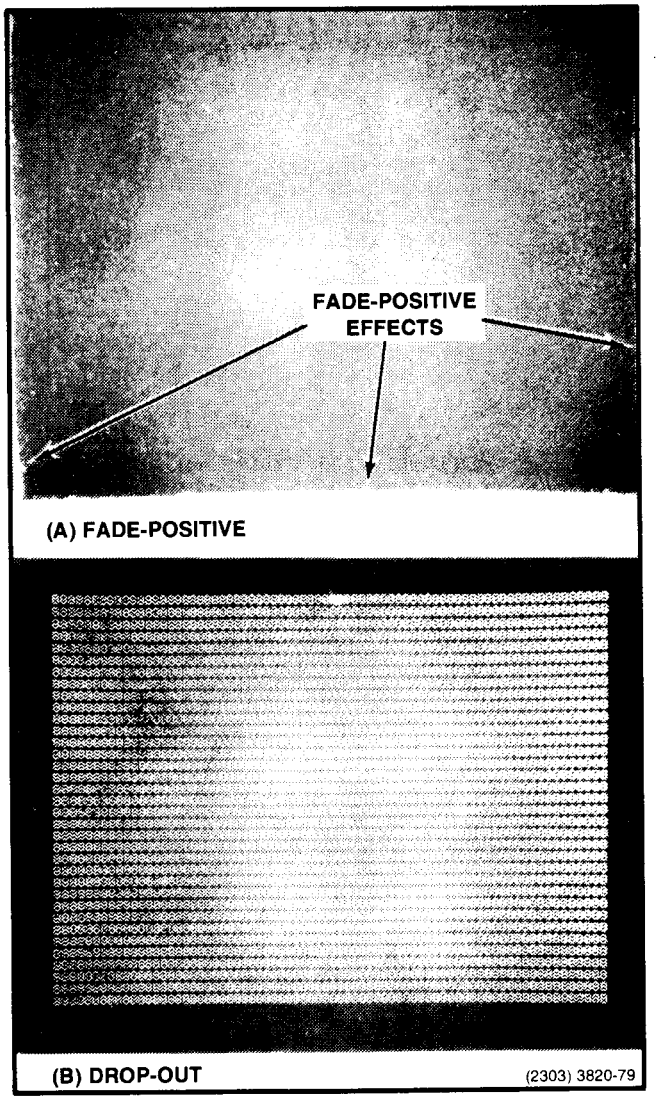


Figure 4-14. Display Conditions.

6. Noticeable differences in luminescence may exist between different displays because of variations in CRT performance.

Brite Intensity and Defocus

1. **Display** the DEFOCUS pattern using the Self Test procedure.

2. **Attach** the oscilloscope probe to R637 (the 20K resistor where the Normal Intensity measurement is made).

3. **Adjust** R715 (the Brite Intensity control, at the lower corner of the High Voltage and Z-Axis board) to 10 V higher than the NORMAL INTENSITY adjustment. See Figure 4-15.

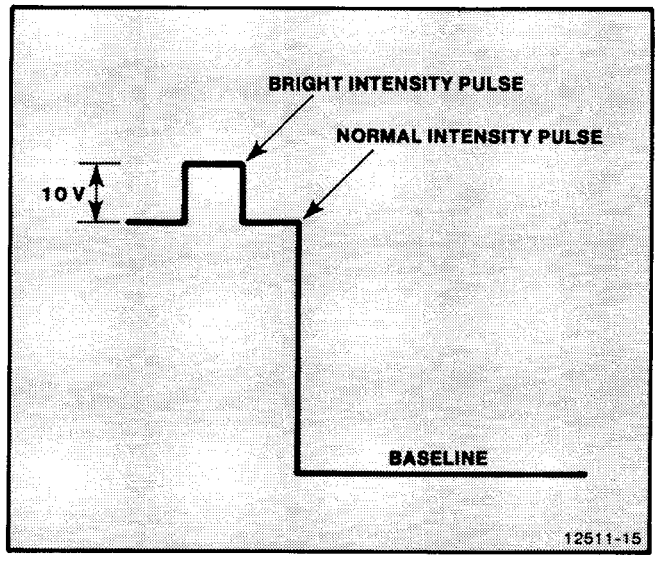


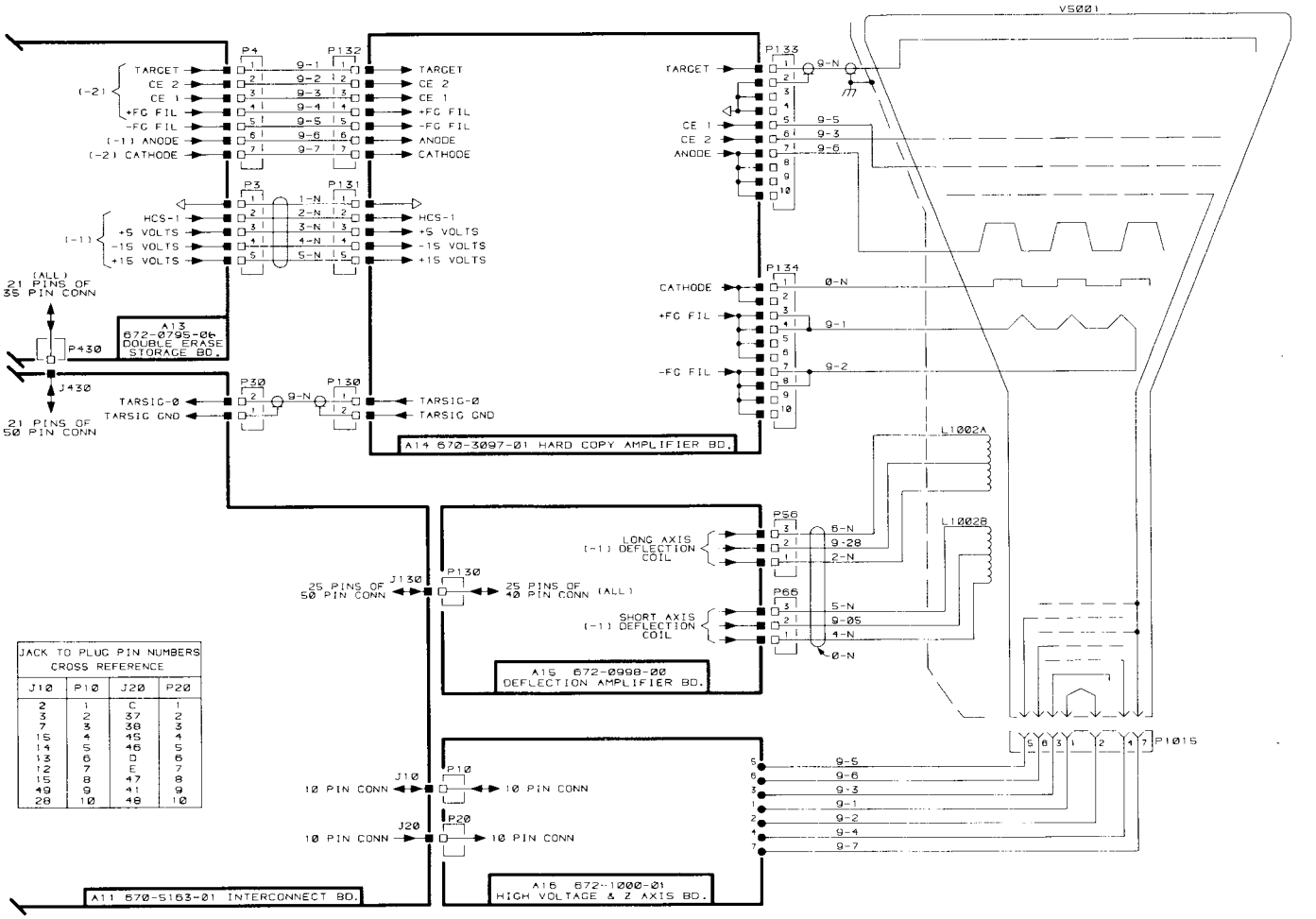
Figure 4-15. Brite Intensity Pulse.

4. **Remove** the oscilloscope probe.

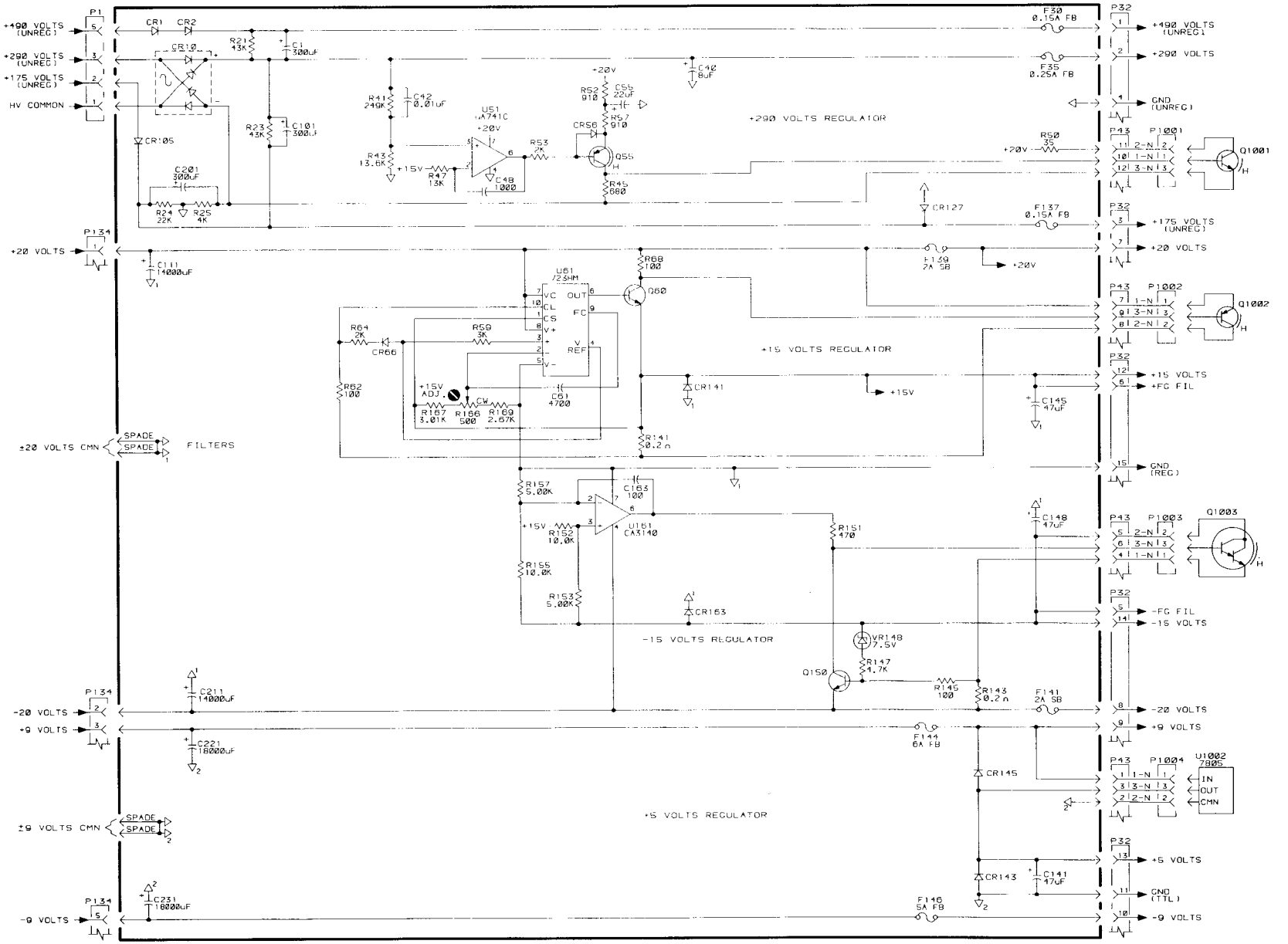
5. **Adjust** the refresh lines to be the same width as the stored vectors.

   a. Display the GAIN pattern using the Self Test procedure.

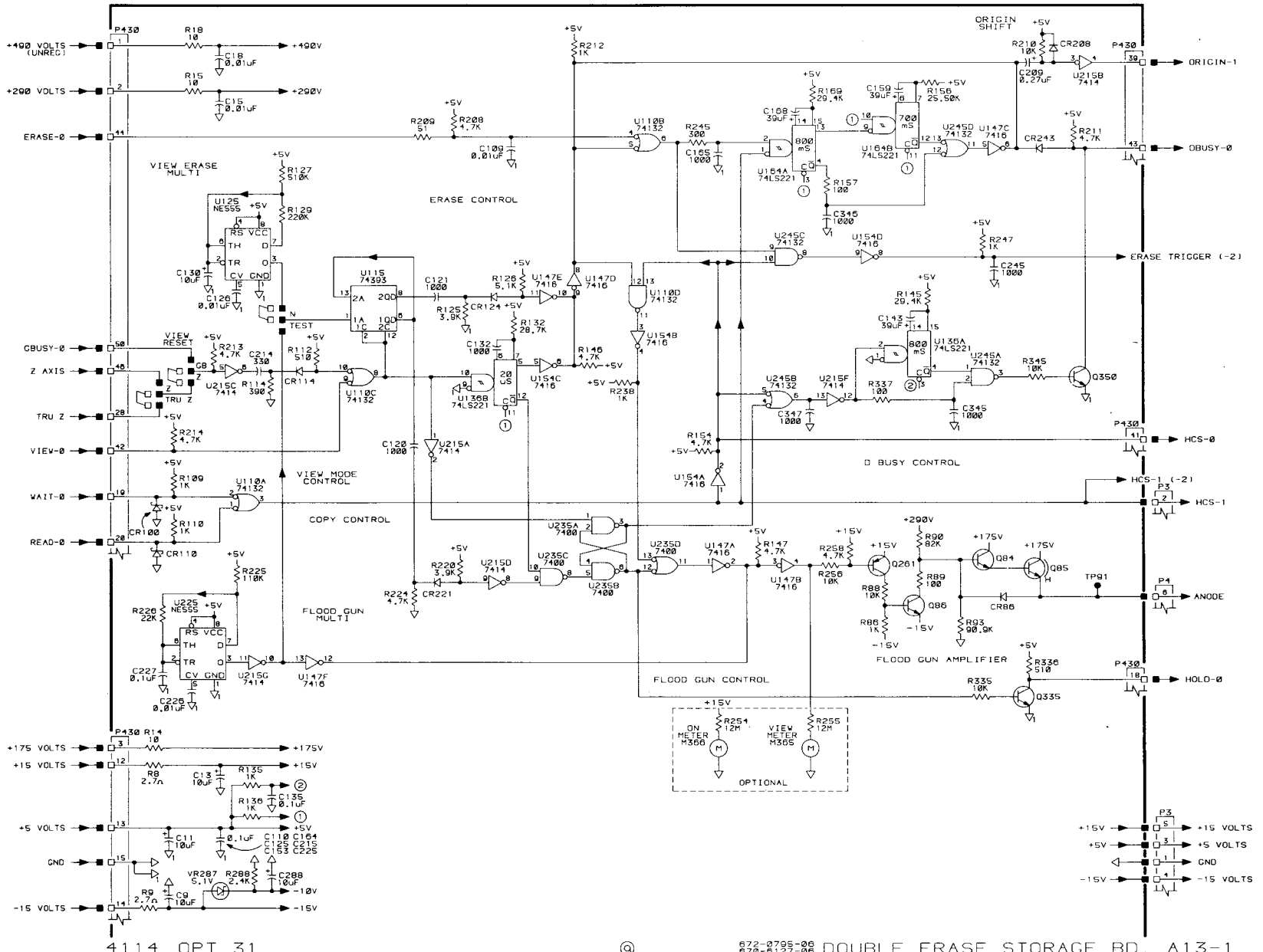
   b. Alternate the pattern between Stored and Refresh modes by pressing the SPACE bar while adjusting R215 for the same vector width in both modes.



JACK TO PLUG PIN NUMBERS CROSS REFERENCE			
J10	P10	J20	P20
2	1	C	1
3	2	37	2
7	3	38	3
15	4	45	4
14	5	46	5
13	6	D	6
12	7	E	7
15	8	47	8
49	9	41	9
28	10	48	10



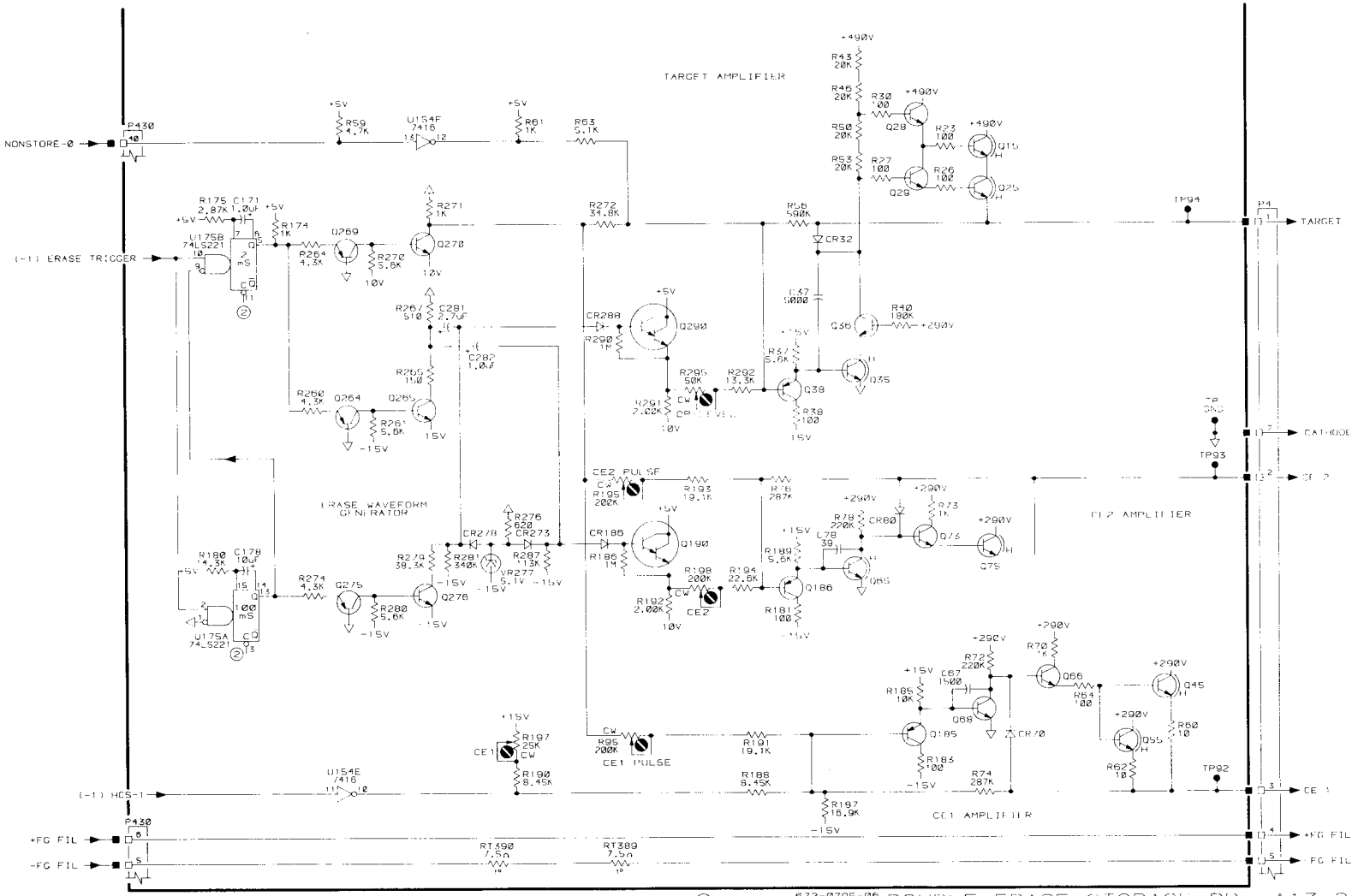
4114 OPT.31 @ 3818-45 670-4798-04 LOW VOLTAGE POWER SUPPLY BD. A12-1 (1 OF 1)

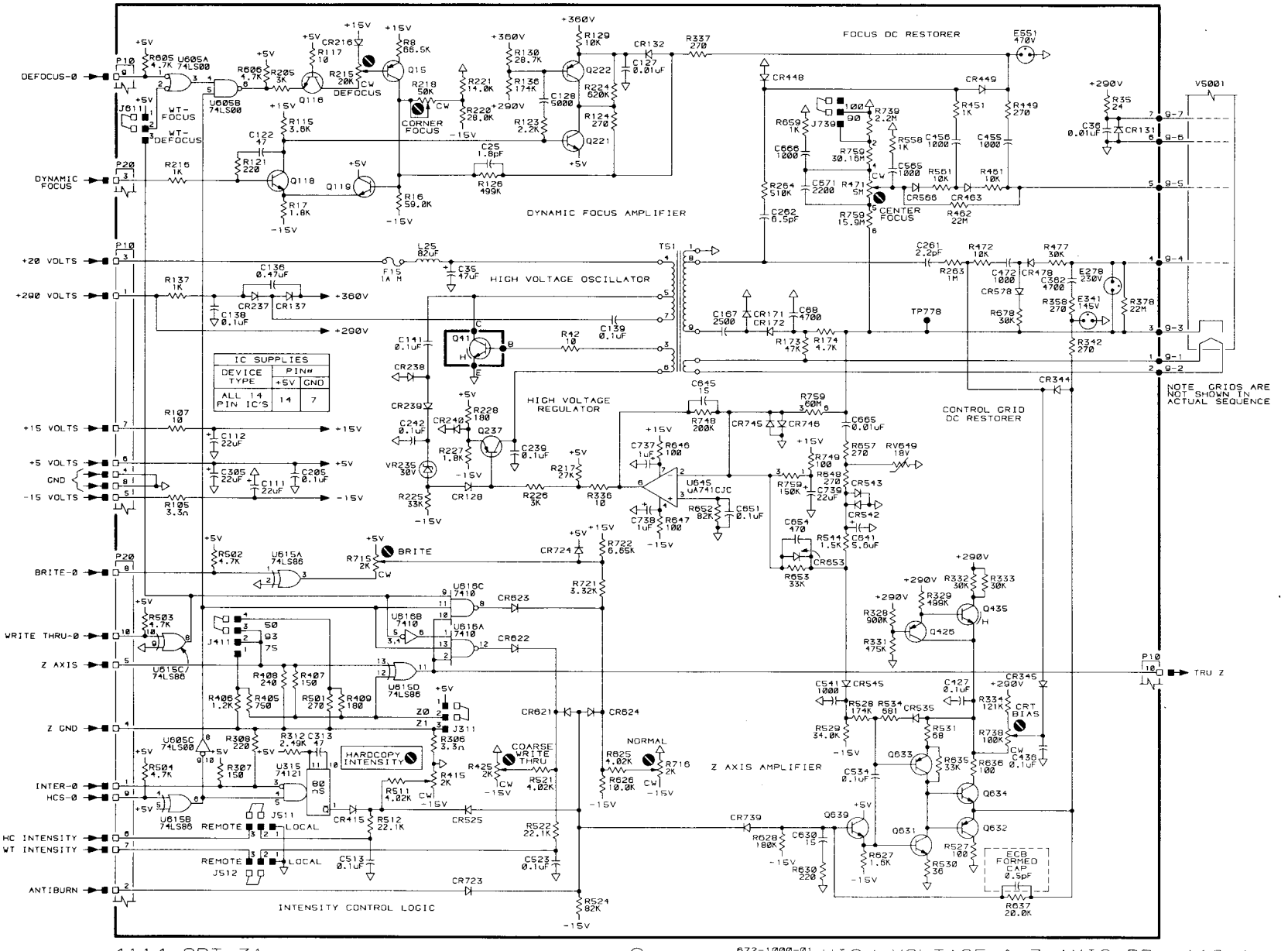


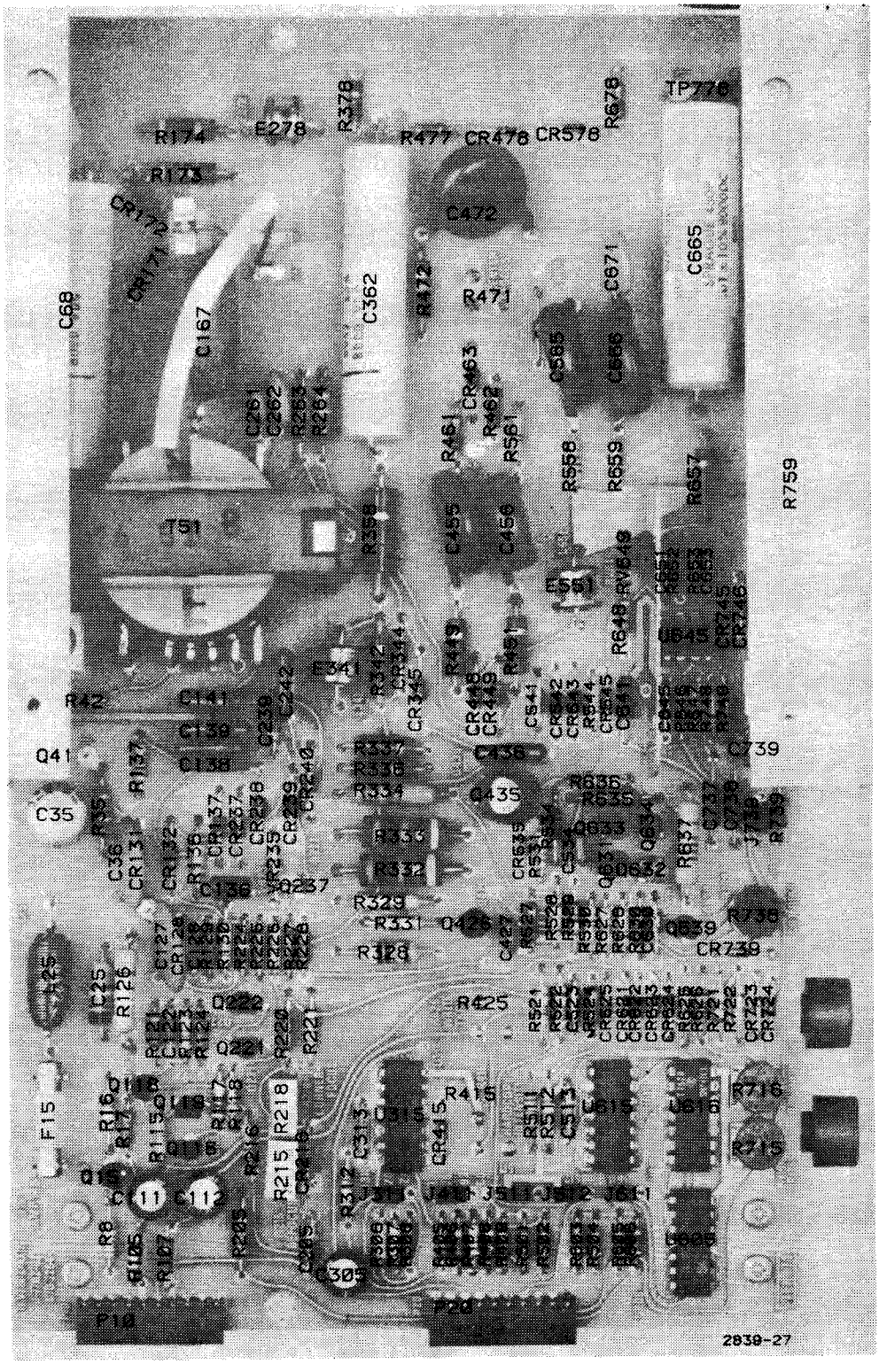
4114 OPT.31

3818-47

672-0795-00
670-8127-00 DOUBLE ERASE STORAGE BD. A13-1
(1 OF 2)


TARGET AMPLIFIER
ERASE WAVEFORM GENERATOR
CE2 AMPLIFIER
CE1 AMPLIFIER
NONSTORE-0
(-1) ERASE TRIGGER
(-1) HDS-1
+FG FIL
-FG FIL
TARGET
CATHODE
CE 2
CE 1
+490V
+290V
+15V
-15V
+5V
CE2 PULSE
CE1 PULSE
4114 OPT. 51
@ 3818 48
672-0795-06
670-8127-06 DOUBLE ERASE STORAGE BD. A13-2
(2 OF 2)


DEFOCUS-0
DYNAMIC FOCUS
+20 VOLTS
+290 VOLTS
+15 VOLTS
+5 VOLTS
GND
-15 VOLTS
BRITE-0
WRITE THRU-0
Z AXIS
Z GND
INTER-0
HCS-0
HC INTENSITY
WT INTENSITY
ANTIBURN
TRU Z
DYNAMIC FOCUS AMPLIFIER
HIGH VOLTAGE OSCILLATOR
HIGH VOLTAGE REGULATOR
FOCUS DC RESTORER
CONTROL GRID DC RESTORER
Z AXIS AMPLIFIER
INTENSITY CONTROL LOGIC
IC SUPPLIES
DEVICE TYPE
PIN#
+5V
GND
ALL 14 PIN IC'S
14
7
NOTE GRIDS ARE NOT SHOWN IN ACTUAL SEQUENCE
4114 OPT.31
3818-51
672-1000-01
670-7264-01
HIGH VOLTAGE & Z AXIS BD. A16-1
(1 OF 1)



High Voltage and Z-Axis Component Locations (670-7264-01, 672-1026-01).

REPLACEABLE ELECTRICAL PARTS

A11	670-5163-01		CKT BOARD ASSY:INTERCONNECT
A12	670-4798-04		CKT BOARD ASSY:LV POWER SUPPLY
A13	672-0795-03		CKT BOARD ASSY:STORAGE
A13A1	670-6127-XX		(NOT REPLACEABLE SEE A13)
A14	670-3097-01		CKT BOARD ASSY:HARD COPY AMPL
A15	672-0998-00		CKT BOARD ASSY:DEFL AMPL
A15A1	670-7553-XX		(NOT REPLACEABLE SEE A15)
A16	672-1000-00	B010100 B010549	CKT BOARD ASSY:HV & Z AXIS
A16	----- -----		(OPTION 31 ONLY)
A16	672-1000-01	B010550	CKT BOARD ASSY:HV & Z AXIS
A16	----- -----		(OPTION 31 ONLY)
A16A1	670-7264-XX		(NOT REPLACEABLE SEE A16)

A11 INTERCONNECT

A11	670-5163-01		CKT BOARD ASSY:INTERCONNECT
A11J10	131-0589-00		TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A11J10	----- -----		(QUANTITY OF 10)
A11J20	131-0589-00		TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A11J20	----- -----		(QUANTITY OF 10)
A11J80	131-1976-00		TERM. SET,PIN:15 MALE CONT
A11J130	131-0589-00		TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A11J130	----- -----		(QUANTITY OF 29)
A11J230	131-0589-00		TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A11J230	----- -----		(QUANTITY OF 25)
A11J330	131-0589-00		TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A11J330	----- -----		(QUANTITY OF 27)
A11J430	131-0589-00		TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A11J430	----- -----		(QUANTITY OF 20)
A11J530	131-0589-00		TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A11J530	----- -----		(QUANTITY OF 27)

A12 LV POWER SUPPLY

A12	670-4798-04		CKT BOARD ASSY:LV POWER SUPPLY
A12C1	290-0799-00		CAP.,FXD,ELCTLT:300UF,+100-75%,300V
A12C40	290-0002-00		CAP.,FXD,ELCTLT:8UF,+50-10%,450V
A12C42	283-0002-00		CAP.,FXD,CER DI:0.01UF,+80-20%,500V
A12C48	281-0770-00		CAP.,FXD,CER DI:0.001UF,20%,100V
A12C55	290-0718-00		CAP.,FXD,ELCTLT:22UF,20%,35V
A12C61	281-0772-00		CAP.,FXD,CER DI:0.0047UF,10%,100V
A12C101	290-0799-00		CAP.,FXD,ELCTLT:300UF,+100-75%,300V
A12C111	290-0581-00	B010100 B010549	CAP.,FXD,ELCTLT:14,000UF,+75-10%,25V
A12C111	290-0968-00	B010550	CAP.,FXD,ELCTLT:14000UF,+100-10%,30V
A12C141	290-0746-00		CAP.,FXD,ELCTLT:47UF,+50-10%,16V
A12C145	290-0746-00		CAP.,FXD,ELCTLT:47UF,+50-10%,16V
A12C148	290-0746-00		CAP.,FXD,ELCTLT:47UF,+50-10%,16V
A12C163	281-0523-00		CAP.,FXD,CER DI:100PF,+/-20PF,500V
A12C168	283-0002-00		CAP.,FXD,CER DI:0.01UF,+80-20%,500V
A12C201	290-0799-00		CAP.,FXD,ELCTLT:300UF,+100-75%,300V
A12C211	290-0581-00	B010100 B010549	CAP.,FXD,ELCTLT:14,000UF,+75-10%,25V
A12C211	290-0968-00	B010550	CAP.,FXD,ELCTLT:14000UF,+100-10%,30V
A12C221	290-0961-00		CAP.,FXD,ELCTLT:18000UF,+100-10%,15V
A12C231	290-0961-00		CAP.,FXD,ELCTLT:18000UF,+100-10%,15V
A12CR1	152-0066-00		SEMICOND DEVICE:SILICON,400V,750MA
A12CR2	152-0066-00		SEMICOND DEVICE:SILICON,400V,750MA
A12CR10	152-0666-00		SEMICOND DEVICE:RECT,SI,800V,1.5A
A12CR56	152-0066-00		SEMICOND DEVICE:SILICON,400V,750MA
A12CR66	152-0066-00		SEMICOND DEVICE:SILICON,400V,750MA

A12CR105	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A12CR127	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A12CR141	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A12CR143	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A12CR145	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A12CR163	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A12F30	159-0083-00	FUSE,CARTRIDGE:0.15A,250V,FAST-BLOW
A12F35	159-0028-00	FUSE,CARTRIDGE:3AG,0.25A,250V,FAST-BLOW
A12F137	159-0083-00	FUSE,CARTRIDGE:0.15A,250V,FAST-BLOW
A12F139	159-0023-00	FUSE,CARTRIDGE:3AG,2A,250V,5SEC
A12F141	159-0023-00	FUSE,CARTRIDGE:3AG,2A,250V,5SEC
A12F144	159-0013-00	FUSE,CARTRIDGE:3AG,6A,125V,7SEC
A12F146	159-0014-00	FUSE,CARTRIDGE:3AG,5A,250V,FAST-BLOW
A12J32	131-1976-00	TERM. SET,PIN:15 MALE CONT
A12J43	131-1975-00	TERM. SET,PIN:12 MALE CONTACTS
A12J134	131-1974-00	TERM. SET,PIN:5 MALE CONTACTS
A12J134	----- -----	(QUANTITY OF 2)
A12Q55	151-0280-00	TRANSISTOR:SILICON,PNP
A12Q60	151-0136-00	TRANSISTOR:SILICON,NPN
A12Q150	151-0190-00	TRANSISTOR:SILICON,NPN
A12R21	305-0433-00	RES.,FXD,CMPSN:43K OHM,5%,2W
A12R23	315-0433-00	RES.,FXD,CMPSN:43K OHM,5%,2W
A12R24	305-0223-00	RES.,FXD,CMPSN:22K OHM,5%,2W
A12R25	308-0228-00	RES.,FXD,CMPSN:4K OHM,5%,7W
A12R41	323-0423-00	RES.,FXD,FILM:249K OHM,1%,0.50W
A12R43	321-0724-03	RES.,FXD,FILM:13.6K OHM,0.25W,0.125W
A12R45	315-0681-03	RES.,FXD,CMPSN:680 OHM,5%,0.25W
A12R47	315-0133-00	RES.,FXD,CMPSN:13K OHM,5%,0.25W
A12R50	308-0223-00	RES.,FXD,WW:35 OHM,5%,3W
A12R52	315-0911-00	RES.,FXD,CMPSN:910 OHM,5%,0.25W
A12R53	315-0202-00	RES.,FXD,CMPSN:2K OHM,5%,0.25W
A12R57	315-0911-00	RES.,FXD,CMPSN:910 OHM,5%,0.25W
A12R59	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
A12R60	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A12R62	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A12R64	315-0202-00	RES.,FXD,CMPSN:2K OHM,5%,0.25W
A12R68	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A12R141	308-0795-00	RES.,FXD,WW:0.2 OHM,5%,3W
A12R143	308-0795-00	RES.,FXD,WW:0.2 OHM,5%,3W
A12R145	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A12R147	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A12R151	315-0471-00	RES.,FXD,CMPSN:470 OHM,5%,0.25W
A12R152	321-0289-03	RES.,FXD,FILM:10K OHM,0.25%,0.125W
A12R153	321-0816-07	RES.,FXD,FILM:5K OHM,0.1%,0.125W
A12R155	321-0289-03	RES.,FXD,FILM:10K OHM,0.25%,0.125W
A12R157	321-0816-07	RES.,FXD,FILM:5K OHM,0.1%,0.125W
A12R166	311-1920-00	RES.,VAR,NONWIR:500 OHM,10%,0.50W
A12R167	321-0239-00	RES.,FXD,FILM:3.01K OHM,1%,0.125W
A12R169	321-0234-00	RES.,FXD,FILM:2.67K OHM,1%,0.125W
A12U51	156-0049-02	MICROCIRCUIT,LI:OPNL AMPL,SCREENED
A12U61	156-0699-01	MICROCIRCUIT,LI:VOLTAGE REGULATOR
A12U161	156-0921-01	MICROCIRCUIT,LI:OPERATIONAL,AMPLIFIER,SEL
A12VR148	152-0127-00	SEMICOND DEVICE:ZENER,0.4W,7.5V,5%
		A13 STORAGE
A13	672-0795-04	CKT BOARD ASSY:STORAGE
A13A1	670-6127-XX	(NOT REPLACEABLE SEE A13)
A13C09	290-0301-00	CAP.,FXD,ELCTLT:10UF,10%,20V
A13C11	290-0301-00	CAP.,FXD,ELCTLT:10UF,10%,20V

A13C13	290-0301-00	CAP.,FXD,ELCTLT:10UF,10%,20V
A13C15	283-0002-00	CAP.,FXD,CER DI:0.01UF,+80-20%,500V
A13C18	283-0013-00	CAP.,FXD,CER DI:0.01UF,+100-0%,1000V
A13C37	283-0029-00	CAP.,FXD,CER DI:0.005UF,5%,500V
A13C67	283-0035-00	CAP.,FXD,CER DI:0.0015UF,20%,400V
A13C78	281-0603-00	CAP.,FXD,CER DI:39PF,5%,500V
A13C109	281-0773-00	CAP.,FXD,CER DI:0.01UF,10%,100V
A13C110	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C120	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13C121	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13C125	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C126	281-0773-00	CAP.,FXD,CER DI:0.01UF,10%,100V
A13C130	290-0301-00	CAP.,FXD,ELCTLT:10UF,10%,20V
A13C132	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13C135	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C143	290-0297-00	CAP.,FXD,ELCTLT:39UF,10%,10V
A13C153	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C159	290-0297-00	CAP.,FXD,ELCTLT:39UF,10%,10V
A13C164	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C165	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13C168	290-0297-00	CAP.,FXD,ELCTLT:39UF,10%,10V
A13C171	290-0183-00	CAP.,FXD,ELCTLT:1UF,10%,35V
A13C178	290-0301-00	CAP.,FXD,ELCTLT:10UF,10%,20V
A13C209	290-0288-00	CAP.,FXD,ELCTLT:0.27UF,10%,35V
A13C214	281-0767-00	CAP.,FXD,CER DI:330PF,20%,100V
A13C215	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C225	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C226	281-0773-00	CAP.,FXD,CER DI:0.01UF,10%,100V
A13C227	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A13C245	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13C281	290-0263-00	CAP.,FXD,ELCTLT:2.7UF,15V
A13C282	290-0183-00	CAP.,FXD,ELCTLT:1UF,10%,35V
A13C288	290-0301-00	CAP.,FXD,ELCTLT:10UF,10%,20V
A13C345	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13C346	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13C347	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A13CR32	152-0107-00	SEMICOND DEVICE:SILICON,400V,400MA
A13CR70	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR80	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR86	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR100	152-0322-00	SEMICOND DEVICE:SILICON,15V,HOT CARRIER
A13CR100	----- -----	(OPTION 31 ONLY)
A13CR110	152-0322-00	SEMICOND DEVICE:SILICON,15V,HOT CARRIER
A13CR110	----- -----	(OPTION 31 ONLY)
A13CR114	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR124	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR186	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR208	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR221	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR243	152-0075-00	SEMICOND DEVICE:GE,25V,40MA
A13CR273	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR278	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13CR288	152-0333-00	SEMICOND DEVICE:SILICON,55V,200MA
A13J3	131-0787-00	CONTACT,ELEC:0.64 INCH LONG
A13J3	----- -----	(QUANTITY OF 5)
A13J4	131-0787-00	CONTACT,ELEC:0.64 INCH LONG
A13J4	----- -----	(QUANTITY OF 7)
A13Q15	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q25	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q28	151-0169-00	TRANSISTOR:SILICON,NPN

A13Q29	151-0169-00	TRANSISTOR:SILICON,NPN
A13Q35	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q36	151-0169-00	TRANSISTOR:SILICON,NPN
A13Q38	151-0188-00	TRANSISTOR:SILICON,PNP
A13Q45	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q55	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q65	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q66	151-0169-00	TRANSISTOR:SILICON,NPN
A13Q68	151-0169-00	TRANSISTOR:SILICON,NPN
A13Q73	151-0169-00	TRANSISTOR:SILICON,NPN
A13Q75	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q84	151-0169-00	TRANSISTOR:SILICON,NPN
A13Q85	151-0423-00	TRANSISTOR:SILICON,NPN
A13Q86	151-0169-00	TRANSISTOR:SILICON,NPN
A13Q185	151-0188-00	TRANSISTOR:SILICON,PNP
A13Q186	151-0188-00	TRANSISTOR:SILICON,PNP
A13Q190	151-0254-00	TRANSISTOR:SILICON,NPN
A13Q261	151-0188-00	TRANSISTOR:SILICON,PNP
A13Q264	151-0188-00	TRANSISTOR:SILICON,PNP
A13Q265	151-0190-00	TRANSISTOR:SILICON,NPN
A13Q269	151-0188-00	TRANSISTOR:SILICON,PNP
A13Q270	151-0190-00	TRANSISTOR:SILICON,NPN
A13Q275	151-0188-00	TRANSISTOR:SILICON,PNP
A13Q290	151-0254-00	TRANSISTOR:SILICON,NPN
A13Q335	151-0190-00	TRANSISTOR:SILICON,NPN
A13Q350	151-0190-00	TRANSISTOR:SILICON,NPN
A13R8	307-0103-00	RES.,FXD,CMPSN:2.7 OHM,5%,0.25W
A13R9	307-0103-00	RES.,FXD,CMPSN:2.7 OHM,5%,0.25W
A13R14	315-0100-02	RES.,FXD,CMPSN:10 OHM,5%,0.25W
A13R15	315-0100-02	RES.,FXD,CMPSN:10 OHM,5%,0.25W
A13R18	315-0100-02	RES.,FXD,CMPSN:10 OHM,5%,0.25W
A13R23	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R26	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R27	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R30	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R38	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R40	304-0184-00	RES.,FXD,CMPSN:180K OHM,10%,1W
A13R43	305-0203-00	RES.,FXD,CMPSN:20K OHM,5%,2W
A13R46	305-0203-00	RES.,FXD,CMPSN:20K OHM,5%,2W
A13R50	305-0203-00	RES.,FXD,CMPSN:20K OHM,5%,2W
A13R53	305-0203-00	RES.,FXD,CMPSN:20K OHM,5%,2W
A13R56	323-0459-00	RES.,FXD,FILM:590K OHM,1%,0.50W
A13R60	315-0100-02	RES.,FXD,CMPSN:10 OHM,5%,0.25W
A13R61	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R62	315-0100-02	RES.,FXD,CMPSN:10 OHM,5%,0.25W
A13R63	315-0512-00	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W
A13R64	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R70	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R72	301-0224-00	RES.,FXD,CMPSN:220K OHM,5%,0.50W
A13R72	315-0102-00	RES.,FXD,CMPSN,1K OHM,5%,0.25W
A13R74	323-0429-00	RES.,FXD,FILM:287K OHM,1%,0.5W
A13R76	323-0429-00	RES.,FXD,FILM:287K OHM,1%,0.5W
A13R78	301-0224-00	RES.,FXD,CMPSN:220K OHM,5%,0.50W
A13R86	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R88	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A13R89	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R90	305-0823-00	RES.,FXD,CMPSN:82K OHM,5%,2W
A13R93	323-0381-00	RES.,FXD,FILM:90.9K OHM,1%,0.50W
A13R95	311-1940-00	RES.,VAR,NONWIR:TRMR,200K OHM,10%
A13R109	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R110	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W

A13R112	315-0511-00	RES.,FXD,CMPSN:510 OHM,5%,0.25W
A13R114	315-0391-00	RES.,FXD,CMPSN:390 OHM,5%,0.25W
A13R125	315-0392-00	RES.,FXD,CMPSN:3.9K OHM,5%,0.25W
A13R126	315-0512-00	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W
A13R127	315-0514-00	RES.,FXD,CMPSN:510K OHM,5%,0.25W
A13R129	321-0222-00	RES.,FXD,FILM:2K OHM,1%,0.125W
A13R132	321-0333-00	RES.,FXD,FILM:28.7K OHM,1%,0.125W
A13R135	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R136	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R145	321-0334-00	RES.,FXD,FILM:29.4K OHM,1%,0.125W
A13R147	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A13R154	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A13R156	321-0328-00	RES.,FXD,FILM:25.5K OHM,1%,0.125W
A13R157	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R169	321-0334-00	RES.,FXD,FILM:29.4K OHM,1%,0.125W
A13R174	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R175	321-0237-00	RES.,FXD,FILM:2.87K OHM,1%,0.125W
A13R180	321-0304-00	RES.,FXD,FILM:14.3K OHM,1%,0.125W
A13R181	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R183	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R185	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A13R186	315-0105-00	RES.,FXD,CMPSN:1M OHM,5%,0.25W
A13R187	321-0311-00	RES.,FXD,FILM:16.9K OHM,1%,0.125W
A13R188	321-0282-00	RES.,FXD,FILM:8.45K OHM,1%,0.125W
A13R189	315-0562-00	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W
A13R190	321-0282-00	RES.,FXD,FILM:8.45K OHM,1%,0.125W
A13R191	321-0316-00	RES.,FXD,FILM:19.1K OHM,1%,0.125W
A13R192	321-0222-00	RES.,FXD,FILM:2K OHM,1%,0.125W
A13R193	321-0316-00	RES.,FXD,FILM:19.1K OHM,1%,0.125W
A13R194	321-0323-00	RES.,FXD,FILM:22.6K OHM,1%,0.125W
A13R195	311-1940-00	RES.,VAR,NONWIR:TRMR,200K OHM,10%
A13R197	311-1240-00	RES.,VAR,NONWIR:25K OHM,10%,0.50W
A13R198	311-1940-00	RES.,VAR,NONWIR:TRMR,200K OHM,10%
A13R208	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A13R209	315-0510-00	RES.,FXD,CMPSN:51 OHM,5%,0.25W
A13R210	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A13R211	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A13R212	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R220	315-0392-00	RES.,FXD,CMPSN:3.9K OHM,5%,0.25W
A13R225	315-0114-00	RES.,FXD,CMPSN:110K OHM,5%,0.25W
A13R226	315-0223-00	RES.,FXD,CMPSN:22K OHM,5%,0.25W
A13R238	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R245	315-0301-00	RES.,FXD,CMPSN:300 OHM,5%,0.25W
A13R247	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R254	316-0126-00	RES.,FXD,CMPSN:12M OHM,10%,0.25W
A13R255	316-0126-00	RES.,FXD,CMPSN:12M OHM,10%,0.25W
A13R256	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A13R260	315-0432-00	RES.,FXD,CMPSN:4.3K OHM,5%,0.25W
A13R261	315-0562-00	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W
A13R264	315-0432-00	RES.,FXD,CMPSN:4.3K OHM,5%,0.25W
A13R265	315-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.25W
A13R267	315-0511-00	RES.,FXD,CMPSN:510 OHM,5%,0.25W
A13R270	315-0562-00	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W
A13R271	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A13R272	321-0341-00	RES.,FXD,FILM:34.8K OHM,1%,0.125W
A13R274	315-0432-00	RES.,FXD,CMPSN:4.3K OHM,5%,0.25W
A13R276	315-0621-00	RES.,FXD,CMPSN:620 OHM,5%,0.25W
A13R279	321-0345-00	RES.,FXD,FILM:38.3K OHM,1%,0.125W
A13R280	315-0562-00	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W
A13R281	321-0436-00	RES.,FXD,FILM:340K OHM,1%,0.125W

A13R287	321-0390-00	RES.,FXD,FILM:113K OHM,1%,0.125W
A13R288	315-0242-00	RES.,FXD,CMPSN:2.4K OHM,5%,0.25W
A13R290	315-0105-00	RES.,FXD,CMPSN:1M OHM,5%,0.25W
A13R291	321-0222-00	RES.,FXD,FILM:2K OHM,1%,0.125W
A13R292	321-0301-00	RES.,FXD,FILM:13.3K OHM,1%,0.125W
A13R295	311-1935-00	RES.,VAR,NONWIR:TRMR,50K OHM,10%,0.50W
A13R315	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A13R335	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A13R336	315-0511-00	RES.,FXD,CMPSN:510 OHM,5%,0.25W
A13R337	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A13R390	307-0350-00	RES.,FXD,WW:7.5 OHM,10%,5W
A13RT389	307-0350-00	RES.,FXD,WW:7.5 OHM,10%,5%
A13TP91	214-0579-00	TERM,TEST POINT:BRS CD PL
A13TP92	214-0579-00	TERM,TEST POINT:BRS CD PL
A13TP93	214-0579-00	TERM,TEST POINT:BRS CD PL
A13TP94	214-0579-00	TERM,TEST POINT:BRS CD PL
A13U110	156-0371-02	MICROCIRCUIT,DI:QUAD 2 INP STNAND GATE
A13U115	156-0617-02	MICROCIRCUIT,DI:DUAL 4 BIT CNTR,SCRN
A13U125	156-0402-02	MICROCIRCUIT,LI:TIMER,CHK
A13U136	156-0733-02	MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN
A13U147	156-0093-02	MICROCIRCUIT,DI:HEX INV BUFFER,BURN-IN
A13U154	156-0093-02	MICROCIRCUIT,DI:HEX INV BUFFER,BURN-IN
A13U164	156-0733-02	MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN
A13U175	156-0733-02	MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN
A13U215	156-0462-02	MICROCIRCUIT,DI:HEX INVERTER,SCREENED
A13U225	156-0402-02	MICROCIRCUIT,LI:TIMER,CHK
A13U235	156-0030-03	MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE
A13U245	156-0371-02	MICROCIRCUIT,DI:QUAD 2 INP STNAND GATE
A13VR277	152-0279-00	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%
A13VR287	152-0279-00	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%

A14 HARD COPY AMPLIFIER

A14	670-3097-01	CKT BOARD ASSY:HARD COPY AMPL
A14C1	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A14C6	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A14C12	281-0623-00	CAP.,FXD,CER DI:650PF,5%,500V
A14C13	281-0623-00	CAP.,FXD,CER DI:650PF,5%,500V
A14C17	283-0000-00	CAP.,FXD,CER DI:0.001UF,+100-0%,500V
A14C31	281-0623-00	CAP.,FXD,CER DI:650PF,5%,500V
A14C34	281-0512-00	CAP.,FXD,CER DI:27PF,+/-2.7PF,500V
A14C35	281-0623-00	CAP.,FXD,CER DI:650PF,5%,500V
A14C105	281-0523-00	CAP.,FXD,CER DI:100PF,+/-20PF,500V
A14C122	290-0536-00	CAP.,FXD,ELCTLT:10UF,20%,25V
A14C123	290-0536-00	CAP.,FXD,ELCTLT:10UF,20%,25V
A14C131	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A14C141	283-0008-00	CAP.,FXD,CER DI:0.1UF,20%,500V
A14C142	283-0008-00	CAP.,FXD,CER DI:0.1UF,20%,500V
A14C145	283-0008-00	CAP.,FXD,CER DI:0.1UF,20%,500V
A14C157	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A14C158	283-0111-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A14L44	108-0146-00	COIL,RF:5UH
A14L140	108-0214-00	COIL,RF:400UH
A14L144	108-0214-00	COIL,RF:400UH
A14Q115	151-0223-00	TRANSISTOR:SILICON,NPN
A14Q134	151-0134-00	TRANSISTOR:SILICON,PNP
A14R2	315-0100-00	RES.,FXD,CMPSN:10 OHM,5%,0.25W
A14R5	315-0100-00	RES.,FXD,CMPSN:10 OHM,5%,0.25W
A14R7	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A14R11	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W

A14R14	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A14R15	315-0153-00	RES.,FXD,CMPSN:15K OHM,5%,0.25W
A14R16	315-0432-00	RES.,FXD,CMPSN:4.3K OHM,5%,0.25W
A14R26	311-1228-00	RES.,VAR,NONWIR:10K OHM,20%,0.50W
A14R32	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A14R33	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A14R36	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A14R37	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A14R45	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
A14R54	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A14R106	315-0562-00	RES.,FXD,CMPSN:5.6K OHM,5%,0.25W
A14R112	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A14R113	315-0471-00	RES.,FXD,CMPSN:470 OHM,5%,0.25W
A14R114	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A14R121	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A14R125	307-0103-00	RES.,FXD,CMPSN:2.7 OHM,5%,0.25W
A14R126	307-0103-00	RES.,FXD,CMPSN:2.7 OHM,5%,0.25W
A14R132	321-0214-00	RES.,FXD,FILM:1.65K OHM,1%,0.125W
A14R135	301-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.50W
A14R136	321-0231-00	RES.,FXD,FILM:2.49K OHM,1%,0.125W
A14R145	301-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.50W
A14R146	301-0100-00	RES.,FXD,CMPSN:10 OHM,5%,0.50W
A14T53	120-0827-00	XFMR,TOROID:THREE 12 TURN WINDINGS
A14TP1	214-0579-00	TERM,TEST POINT:BRS CD PL
A14TP12	214-0579-00	TERM,TEST POINT:BRS CD PL
A14TP13	214-0579-00	TERM,TEST POINT:BRS CD PL
A14TP116	214-0579-00	TERM,TEST POINT:BRS CD PL
A14U3	156-0096-02	MICROCIRCUIT,LI:VOLTAGE COMPARATOR,SCRN
A14U21	156-0162-00	MICROCIRCUIT,LI:DIFFERENTIAL VIDEO AMPL
A14U43	156-0162-00	MICROCIRCUIT,LI:DIFFERENTIAL VIDEO AMPL
A14U101	156-0072-00	MICROCIRCUIT,DI:MONOSTABLE MV,TTL,14 DIP

A15 DEFLECTION AMPLIFIER

A15	672-0998-00	CKT BOARD ASSY:DEFL AMPL
A15A1	670-7553-XX	(NOT REPLACEABLE, SEE A15)
A15C15	290-0779-00	CAP.,FXD,ELCTLT:10UF,+50-10%,50VDC
A15C16	290-0779-00	CAP.,FXD,ELCTLT:10UF,+50-10%,50VDC
A15C115	290-0745-00	CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A15C116	290-0745-00	CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A15C117	290-0745-00	CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A15C118	290-0745-00	CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A15C146	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A15C149	281-0592-00	CAP.,FXD,CER DI:4.7PF,+/-0.5PF,500V
A15C151	283-0730-00	CAP.,FXD,MICA D:274PF,1%,500V
A15C154	283-0594-00	CAP.,FXD,MICA D:0.001UF,1%,100V
A15C161	283-0730-00	CAP.,FXD,MICA D:274PF,1%,500V
A15C164	283-0594-00	CAP.,FXD,MICA D:0.001UF,1%,100V
A15C176	281-0812-00	CAP.,FXD,CER DI:1000PF,10%,100V
A15C179	281-0592-00	CAP.,FXD,CER DI:4.7PF,+/-0.5PF,500V
A15C196	283-0060-00	CAP.,FXD,CER DI:100PF,5%,200V
A15C197	283-0060-00	CAP.,FXD,CER DI:100PF,5%,200V
A15C254	290-0745-00	CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A15C255	290-0745-00	CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A15C282	281-0826-00	CAP.,FXD,CER DI:2200PF,5%,100V
A15C290	281-0809-00	CAP.,FXD,CER DI:200PF,5%,100V
A15C292	281-0826-00	CAP.,FXD,CER DI:2200PF,5%,100V
A15C334	281-0788-00	CAP.,FXD,CER DI:470PF,10%,100V
A15C338	281-0788-00	CAP.,FXD,CER DI:470PF,10%,100V
A15C352	285-1069-00	CAP.,FXD,PLSTC:0.047UF,200V

A15C353	281-0604-00	CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V
A15C362	285-1069-00	CAP.,FXD,PLSTC:0.047UF,200V
A15C363	281-0604-00	CAP.,FXD,CER DI:2.2PF,+/-0.25PF,500V
A15C381	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A15C393	281-0773-00	CAP.,FXD,CER DI:0.01UF,10%,100V
A15C1001	283-0065-00	CAP.,FXD,CER DI:0.001UF,5%,100V
A15C1101	283-0065-00	CAP.,FXD,CER DI:0.001UF,5%,100V
A15C1102	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A15C1106	281-0767-00	CAP.,FXD,CER DI:330PF,20%,100V
A15C1202	281-0811-00	CAP.,FXD,CER DI:10PF,10%,100V
A15C1212	281-0775-00	CAP.,FXD,CER DI:0.1UF,20%,50V
A15C1213	281-0772-00	CAP.,FXD,CER DI:0.0047UF,10%,100V
A15CR21	152-0676-00	SEMICOND DEVICE:RECT,SI,400V,3A
A15CR22	152-0676-00	SEMICOND DEVICE:RECT,SI,400V,3A
A15CR23	152-0676-00	SEMICOND DEVICE:RECT,SI,400V,3A
A15CR24	152-0676-00	SEMICOND DEVICE:RECT,SI,400V,3A
A15CR36	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR42	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A15CR43	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A15CR45	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR46	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR75	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR76	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR82	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A15CR83	152-0066-00	SEMICOND DEVICE:SILICON,400V,750MA
A15CR86	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR119	152-0322-00	SEMICOND DEVICE:SILICON,15V,HOT CARRIER
A15CR132	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR137	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR139	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR142	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR172	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR182	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR187	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR189	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR283	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR284	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR285	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR286	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR372	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR373	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR382	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR383	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR423	152-0322-00	SEMICOND DEVICE:SILICON,15V,HOT CARRIER
A15CR454	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR455	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR464	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR465	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR474	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR484	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR1104	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR1313	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR1411	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15CR1414	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
A15J56	131-0589-00	TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A15J56	----- -----	(QUANTITY OF 3)
A15J66	131-0589-00	TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A15J66	----- -----	(QUANTITY OF 3)
A15J199	131-0589-00	TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A15J199	----- -----	(QUANTITY OF 8)

A15J311	131-0589-00	TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A15J311	----- -----	(QUANTITY OF 2)
A15J314	131-0589-00	TERM,PIN:0.46 L X 0.025 SQ.PH BRZ GL
A15J314	----- -----	(QUANTITY OF 2)
A15Q20	151-0607-00	TRANSISTOR:SILICON,PNP
A15Q26	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q27	151-0188-00	TRANSISTOR:SILICON,PNP
A15Q30	151-0606-00	TRANSISTOR:SILICON,NPN
A15Q36	151-0188-00	TRANSISTOR:SILICON,PNP
A15Q38	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q40	151-0606-00	TRANSISTOR:SILICON,NPN
A15Q46	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q48	151-0188-00	TRANSISTOR:SILICON,PNP
A15Q50	151-0607-00	TRANSISTOR:SILICON,PNP
A15Q60	151-0606-00	TRANSISTOR:SILICON,NPN
A15Q70	151-0607-00	TRANSISTOR:SILICON,PNP
A15Q75	151-0188-00	TRANSISTOR:SILICON,PNP
A15Q76	151-0188-00	TRANSISTOR:SILICON,PNP
A15Q78	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q80	151-0607-00	TRANSISTOR:SILICON,PNP
A15Q84	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q86	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q88	151-0188-00	TRANSISTOR:SILICON,PNP
A15Q90	151-0606-00	TRANSISTOR:SILICON,NPN
A15Q96	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q97	151-0188-00	TRANSISTOR:SILICON,PNP
A15Q239	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q249	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q296	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q411	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q496	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q1200	151-0190-00	TRANSISTOR:SILICON,NPN
A15Q1201	151-0190-00	TRANSISTOR:SILICON,NPN
A15R17	308-0242-00	RES.,FXD,WW:0.25 OHM,5%,5W
A15R25	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R26	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R28	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R34	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R35	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R42	307-0593-00	RES.,FXD,FOIL:0.25 OHM,5%
A15R43	308-0590-00	RES.,FXD,WW:0.25 OHM,5%,3W
A15R44	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R45	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R50	311-1244-00	RES.,VAR,NONWIR:100 OHM,10%,0.50W
A15R51	311-1245-00	RES.,VAR,NONWIR:10K OHM,10%,0.50W
A15R52	308-0590-00	RES.,FXD,WW:0.25 OHM,5%,3W
A15R54	315-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.25W
A15R55	315-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.25W
A15R57	315-0274-00	RES.,FXD,CMPSN:270K OHM,5%,0.25W
A15R58	315-0274-00	RES.,FXD,CMPSN:270K OHM,5%,0.25W
A15R60	308-0590-00	RES.,FXD,WW:0.25 OHM,5%,3W
A15R64	315-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.25W
A15R65	315-0151-00	RES.,FXD,CMPSN:150 OHM,5%,0.25W
A15R66	315-0274-00	RES.,FXD,CMPSN:270K OHM,5%,0.25W
A15R67	311-1244-00	RES.,VAR,NONWIR:100 OHM,10%,0.50W
A15R68	315-0274-00	RES.,FXD,CMPSN:270K OHM,5%,0.25W
A15R69	311-1245-00	RES.,VAR,NONWIR:10K OHM,10%,0.50W
A15R71	308-0590-00	RES.,FXD,WW:0.25 OHM,5%,3W
A15R72	307-0593-00	RES.,FXD,FOIL:0.25 OHM,5%
A15R74	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W

A15R75	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R84	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R95	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R96	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R98	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R99	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R119	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R121	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R122	321-0244-00	RES.,FXD,FILM:3.4K OHM,1%,0.125W
A15R123	321-0104-00	RES.,FXD,FILM:118 OHM,1%,0.125W
A15R124	321-0244-00	RES.,FXD,FILM:3.4K OHM,1%,0.125W
A15R125	321-0104-00	RES.,FXD,FILM:118 OHM,1%,0.125W
A15R131	315-0220-00	RES.,FXD,CMPSN:22 OHM,5%,0.25W
A15R133	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R134	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R135	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R139	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R141	315-0220-00	RES.,FXD,CMPSN:22 OHM,5%,0.25W
A15R143	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R144	315-0221-00	RES.,FXD,CMPSN:220 OHM,5%,0.25W
A15R145	315-0221-00	RES.,FXD,CMPSN:220 OHM,5%,0.25W
A15R147	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R148	315-0153-00	RES.,FXD,CMPSN:15K OHM,5%,0.25W
A15R149	315-0134-00	RES.,FXD,CMPSN:130K OHM,5%,0.25W
A15R150	311-1245-00	RES.,VAR,NONWIR:10K OHM,10%,0.50W
A15R152	321-0127-00	RES.,FXD,FILM:205 OHM,1%,0.125W
A15R153	321-0206-00	RES.,FXD,FILM:1.37K OHM,1%,0.125W
A15R162	321-0127-00	RES.,FXD,FILM:205 OHM,1%,0.125W
A15R163	321-0206-00	RES.,FXD,FILM:1.37K OHM,1%,0.125W
A15R167	311-1245-00	RES.,VAR,NONWIR:10K OHM,10%,0.50W
A15R171	315-0220-00	RES.,FXD,CMPSN:22 OHM,5%,0.25W
A15R173	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R174	315-0221-00	RES.,FXD,CMPSN:220 OHM,5%,0.25W
A15R175	315-0221-00	RES.,FXD,CMPSN:220 OHM,5%,0.25W
A15R177	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R178	315-0153-00	RES.,FXD,CMPSN:15K OHM,5%,0.25W
A15R179	315-0134-00	RES.,FXD,CMPSN:130K OHM,5%,0.25W
A15R181	315-0220-00	RES.,FXD,CMPSN:22 OHM,5%,0.25W
A15R183	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R184	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R185	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R192	321-0244-00	RES.,FXD,FILM:3.4K OHM,1%,0.125W
A15R193	321-0104-00	RES.,FXD,FILM:118 OHM,1%,0.125W
A15R194	321-0244-00	RES.,FXD,FILM:3.4K OHM,1%,0.125W
A15R195	321-0104-00	RES.,FXD,FILM:118 OHM,1%,0.125W
A15R211	321-0289-00	RES.,FXD,FILM:10K OHM,1%,0.125W
A15R212	321-0193-00	RES.,FXD,FILM:1K OHM,1%,0.125W
A15R213	321-0236-00	RES.,FXD,FILM:2.8K OHM,1%,0.125W
A15R214	321-0277-00	RES.,FXD,FILM:7.5K OHM,1%,0.125W
A15R215	321-0193-00	RES.,FXD,FILM:1K OHM,1%,0.125W
A15R216	321-0289-00	RES.,FXD,FILM:10K OHM,1%,0.125W
A15R217	321-0193-00	RES.,FXD,FILM:1K OHM,1%,0.125W
A15R218	321-0208-00	RES.,FXD,FILM:1.43K OHM,1%,0.125W
A15R227	311-1239-00	RES.,VAR,NONWIR:2.5K OHM,10%,0.50W
A15R228	311-1237-00	RES.,VAR,NONWIR:1K OHM,10%,0.50W
A15R229	311-1245-00	RES.,VAR,NONWIR:10K OHM,10%,0.50W
A15R233	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R235	321-0330-00	RES.,FXD,FILM:26.7K OHM,1%,0.125W
A15R237	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R238	315-0182-00	RES.,FXD,CMPSN:1.8K OHM,5%,0.25W

A15R245	321-0289-00	RES.,FXD,FILM:10K OHM,1%,0.125W
A15R247	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R248	315-0182-00	RES.,FXD,CMPSN:1.8K OHM,5%,0.25W
A15R250	311-1241-00	RES.,VAR,NONWIR:100K OHM,10%,0.5W
A15R251	321-0285-00	RES.,FXD,FILM:9.09K OHM,1%,0.125W
A15R252	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R253	321-0206-00	RES.,FXD,FILM:1.37K OHM,1%,0.125W
A15R261	321-0286-00	RES.,FXD,FILM:9.31K OHM,1%,0.125W
A15R262	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R263	321-0206-00	RES.,FXD,FILM:1.37K OHM,1%,0.125W
A15R266	321-0289-00	RES.,FXD,FILM:10K OHM,1%,0.125W
A15R267	311-1241-00	RES.,VAR,NONWIR:100K OHM,10%,0.5W
A15R271	315-0134-00	RES.,FXD,CMPSN:130K OHM,5%,0.25W
A15R274	315-0471-00	RES.,FXD,CMPSN:470 OHM,5%,0.25W
A15R275	315-0471-00	RES.,FXD,CMPSN:470 OHM,5%,0.25W
A15R282	315-0754-00	RES.,FXD,CMPSN:750K OHM,5%,0.25W
A15R283	315-0113-00	RES.,FXD,CMPSN:11K OHM,5%,0.25W
A15R287	315-0113-00	RES.,FXD,CMPSN:11K OHM,5%,0.25W
A15R291	315-0202-00	RES.,FXD,CMPSN:2K OHM,5%,0.25W
A15R296	315-0203-00	RES.,FXD,CMPSN:20K OHM,5%,0.25W
A15R311	321-0193-00	RES.,FXD,FILM:1K OHM,1%,0.125W
A15R312	321-0277-00	RES.,FXD,FILM:7.5K OHM,1%,0.125W
A15R313	315-0752-00	RES.,FXD,CMPSN:7.5K OHM,5%,0.25W
A15R314	315-0242-00	RES.,FXD,CMPSN:2.4K OHM,5%,0.25W
A15R315	315-0752-00	RES.,FXD,CMPSN:7.5K OHM,5%,0.25W
A15R316	315-0242-00	RES.,FXD,CMPSN:2.4K OHM,5%,0.25W
A15R317	315-0752-00	RES.,FXD,CMPSN:7.5K OHM,5%,0.25W
A15R318	315-0242-00	RES.,FXD,CMPSN:2.4K OHM,5%,0.25W
A15R322	311-1238-00	RES.,VAR,NONWIR:5K OHM,10%,0.50W
A15R326	311-1238-00	RES.,VAR,NONWIR:5K OHM,10%,0.50W
A15R333	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R335	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R337	315-0101-00	RES.,FXD,CMPSN:100 OHM,5%,0.25W
A15R351	315-0561-00	RES.,FXD,CMPSN:560 OHM,5%,0.25W
A15R361	315-0561-00	RES.,FXD,CMPSN:560 OHM,5%,0.25W
A15R381	315-0754-00	RES.,FXD,CMPSN:750K OHM,5%,0.25W
A15R391	315-0302-00	RES.,FXD,CMPSN:3K OHM,5%,0.25W
A15R392	315-0432-00	RES.,FXD,CMPSN:4.3K OHM,5%,0.25W
A15R393	315-0272-00	RES.,FXD,CMPSN:2.7K OHM,5%,0.25W
A15R411	315-0752-00	RES.,FXD,CMPSN:7.5K OHM,5%,0.25W
A15R412	315-0242-00	RES.,FXD,CMPSN:2.4K OHM,5%,0.25W
A15R413	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R414	315-0682-00	RES.,FXD,CMPSN:6.8K OHM,5%,0.25W
A15R415	315-0362-00	RES.,FXD,CMPSN:3.6K OHM,5%,0.25W
A15R423	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R424	311-1238-00	RES.,VAR,NONWIR:5K OHM,10%,0.50W
A15R425	321-0330-00	RES.,FXD,FILM:26.7K OHM,1%,0.125W
A15R426	311-1245-00	RES.,VAR,NONWIR:10K OHM,10%,0.50W
A15R431	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R442	321-0252-00	RES.,FXD,FILM:4.12K OHM,1%,0.125W
A15R443	321-0312-00	RES.,FXD,FILM:17.4K OHM,1%,0.125W
A15R444	321-0397-00	RES.,FXD,FILM:133K OHM,1%,0.125W
A15R445	321-0334-00	RES.,FXD,FILM:29.4K OHM,1%,0.125W
A15R446	321-0386-00	RES.,FXD,FILM:102K OHM,1%,0.125W
A15R446	321-0373-00	RES.,FXD,FILM:75K OHM, 1%,0.125W
A15R446	----- -----	(OPTION 31 ONLY)
A15R447	321-0252-00	RES.,FXD,FILM:4.12K OHM,1%,0.125W
A15R451	315-0114-00	RES.,FXD,CMPSN:110K OHM,5%,0.25W
A15R452	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R453	315-0304-00	RES.,FXD,CMPSN:300K OHM,5%,0.25W

A15R454	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A15R457	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R459	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R461	315-0114-00	RES.,FXD,CMPSN:110K OHM,5%,0.25W
A15R462	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R463	315-0304-00	RES.,FXD,CMPSN:300K OHM,5%,0.25W
A15R464	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A15R467	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R469	315-0104-00	RES.,FXD,CMPSN:100K OHM,5%,0.25W
A15R471	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A15R472	315-0154-00	RES.,FXD,CMPSN:150K OHM,5%,0.25W
A15R473	315-0203-00	RES.,FXD,CMPSN:20K OHM,5%,0.25W
A15R475	315-0154-00	RES.,FXD,CMPSN:150K OHM,5%,0.25W
A15R476	315-0203-00	RES.,FXD,CMPSN:20K OHM,5%,0.25W
A15R477	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A15R481	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A15R482	315-0154-00	RES.,FXD,CMPSN:150K OHM,5%,0.25W
A15R483	315-0203-00	RES.,FXD,CMPSN:20K OHM,5%,0.25W
A15R485	315-0154-00	RES.,FXD,CMPSN:150K OHM,5%,0.25W
A15R486	315-0203-00	RES.,FXD,CMPSN:20K OHM,5%,0.25W
A15R487	315-0472-00	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A15R491	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A15R492	315-0153-00	RES.,FXD,CMPSN:15K OHM,5%,0.25W
A15R493	315-0222-00	RES.,FXD,CMPSN:2.2K OHM,5%,0.25W
A15R495	315-0511-00	RES.,FXD,CMPSN:510 OHM,5%,0.25W
A15R497	315-0203-00	RES.,FXD,CMPSN:20K OHM,5%,0.25W
A15R1000	321-0304-00	RES.,FXD,FILM:14.3K OHM,1%,0.125W
A15R1100	321-0371-00	RES.,FXD,FILM:71.5K OHM,1%,0.125W
A15R1103	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R1105	315-0183-00	RES.,FXD,CMPSN:18K OHM,5%,0.25W
A15R1107	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R1108	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A15R1203	315-0303-00	RES.,FXD,CMPSN:30K OHM,5%,0.25W
A15R1213	321-0335-00	RES.,FXD,FILM:30.1K OHM,1%,0.125W
A15R1314	315-0102-00	RES.,FXD,CMPSN:1K OHM,5%,0.25W
A15R1315	315-0103-00	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A15R1415	321-0193-00	RES.,FXD,FILM:1K OHM,1%,0.125W
A15U228	155-0154-00	MICROCIRCUIT,LI:CHANNEL SWITCH
A15U256	156-0317-02	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER
A15U266	156-0317-02	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER
A15U293	156-0096-02	MICROCIRCUIT,LI:VOLTAGE COMPARATOR,SCRN
A15U342	155-0152-01	MICROCIRCUIT,LI:GEOMETRY & FOCUS CORR
A15U353	156-0742-02	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL
A15U363	156-0742-02	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL
A15U373	156-0742-02	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL
A15U383	156-0742-02	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL
A15U393	156-0742-02	MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,SEL
A15U1002	156-0733-02	MICROCIRCUIT,DI:DUAL MONOSTABLE MV,BURN-IN
A15U1311	156-0072-02	MICROCIRCUIT,DI:MONOSTABLE MV,BURN-IN
A15VR136	152-0166-00	SEMICOND DEVICE:ZENER,0.4W,6.2V,5%
A15VR138	152-0166-00	SEMICOND DEVICE:ZENER,0.4W,6.2V,5%
A15VR186	152-0166-00	SEMICOND DEVICE:ZENER,0.4W,6.2V,5%
A15VR188	152-0166-00	SEMICOND DEVICE:ZENER,0.4W,6.2V,5%
A15VR210	152-0166-00	SEMICOND DEVICE:ZENER,0.4W,6.2V,5%
A15VR211	152-0166-00	SEMICOND DEVICE:ZENER,0.4W,6.2V,5%
A15VR456	152-0195-00	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%
A15VR458	152-0195-00	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%
A15VR466	152-0195-00	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%
A15VR468	152-0195-00	SEMICOND DEVICE:ZENER,0.4W,5.1V,5%

A16 HIGH VOLTAGE & Z AXIS
(OPTION 31 ONLY)

A16	672-1000-00	B010100	B010549	CKT BOARD ASSY:HV & Z AXIS
A16	672-1000-01	B010550		CKT BOARD ASSY:HV & Z AXIS
A16A1	670-7264-XX			(NOT REPLACEABLE SEE A16)
A16C25	281-0755-00			CAP.,FXD,CER DI:1.8PF,0.1%,500V
A16C35	290-0312-00	B010100	B010549	CAP.,FXD,ELCTLT:47UF,10%,35V
A16C35	290-0846-00	B010550		CAP.,FXD,ELCTLT:47UF,-10+75%,35 WVDC
A16C36	283-0013-00			CAP.,FXD,CER DI:0.01UF,+100-0%,1000V
A16C68	285-1137-00			CAP.,FXD,PLSTC:0.0047UF,10%,8000V
A16C111	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A16C112	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A16C122	281-0763-00	XB010550		CAP.,FXD,CER DI:47PF,10%,100V
A16C127	283-0013-00	XB010550		CAP.,FXD,CER DI:0.01UF,+100-0%,1000V
A16C128	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V
A16C135	283-0013-00	B010100	B010549X	CAP.,FXD,CER DI:0.01UF,+100-0%,1000V
A16C136	283-0346-00			CAP.,FXD,CER DI:0.47UF,+80-20%,100V
A16C138	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V
A16C139	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V
A16C141	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V
A16C167	283-0036-00			CAP.,FXD,CER DI:2500PF,+100-0%,6000V
A16C205	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V
A16C218	281-0763-00	B010100	B010549X	CAP.,FXD,CER DI:47PF,10%,100V
A16C239	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V
A16C242	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V
A16C261	283-0363-00			CAP.,FXD,CER DI:2.2PF,0.25%,2KV
A16C262	283-0342-00			CAP.,FXD,CER DI:6.5PF,0.5%,2000V
A16C305	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A16C313	281-0763-00			CAP.,FXD,CER DI:47PF,10%,100V
A16C362	285-1137-00			CAP.,FXD,PLSTC:0.0047UF,10%,8000V
A16C427	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V
A16C436	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V
A16C455	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V
A16C456	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V
A16C472	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V
A16C513	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V
A16C523	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V
A16C534	283-0211-00			CAP.,FXD,CER DI:0.1UF,10%,200V
A16C541	281-0812-00			CAP.,FXD,CER DI:1000PF,10%,100V
A16C565	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V
A16C630	281-0797-00			CAP.,FXD,CER DI:15PF,10%,100V
A16C637	290-0267-00			CAP.,FXD,ELCTLT:1UF,20%,35V
A16C641	290-0247-00			CAP.,FXD,ELCTLT:5.6UF,10%,6V
A16C645	281-0797-00			CAP.,FXD,CER DI:15PF,10%,100V
A16C651	281-0775-00			CAP.,FXD,CER DI:0.1UF,20%,50V
A16C654	281-0788-00			CAP.,FXD,CER DI:470PF,10%,100V
A16C665	285-1138-00			CAP.,FXD,PLSTC:0.01UF,10%,8000V
A16C666	283-0300-00			CAP.,FXD,CER DI:0.001UF,+80-20%,10,000V
A16C671	283-0280-00			CAP.,FXD,CER DI:2200PF,10%,2000V
A16C738	290-0267-00			CAP.,FXD,ELCTLT:1UF,20%,35V
A16C739	290-0745-00			CAP.,FXD,ELCTLT:22UF,+50-10%,25V
A16CR18	152-0141-02	B010100	B010549X	SEMICOND DEVICE:SILICON,30V,150MA
A16CR128	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA
A16CR131	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR132	152-0107-03	XB010550		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR135	152-0107-03	B010100	B010549X	SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR137	152-0107-03			SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR171	152-0639-00			SEMICOND DEVICE:RECT,SI,10KV,10MA
A16CR172	152-0639-00			SEMICOND DEVICE:RECT,SI,10KV,10MA

A16CR216	152-0141-02	XB010550	SEMICOND DEVICE:SILICON,30V,150MA
A16CR237	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR238	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR239	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR240	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR344	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR345	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR415	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR448	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR449	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR463	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR478	152-0242-00		SEMICOND DEVICE:SILICON,225V,200MA
A16CR525	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR535	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR542	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR543	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR545	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR566	152-0107-03		SEMICOND DEVICE:SILICON,375V,400MA,SEL
A16CR578	152-0242-00		SEMICOND DEVICE:SILICON,225V,200MA
A16CR621	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR622	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR623	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR624	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR653	152-0322-00		SEMICOND DEVICE:SILICON
A16CR723	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR724	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR739	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR745	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16CR746	152-0141-02		SEMICOND DEVICE:SILICON,30V,150MA
A16E278	119-0181-00		ARSR,ELEC SURGE:230V,GAS FILLED
A16E341	119-0759-00		ARSR,ELEC SURGE:145V,GAS FILLED
A16E551	119-0285-00		ARSR,ELEC SURGE:470VDC,+/-15%
A16F15	159-0064-00		FUSE,CARTRIDGE:1A,250V,10 SEC
A16J311	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD
A16J311	----- -----		(QUANTITY OF 3)
A16J411	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD
A16J411	----- -----		(QUANTITY OF 4)
A16J511	131-0608-00	XB010550	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD
A16J511	----- -----		(QUANTITY OF 3)
A16J512	131-0608-00	XB010550	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD
A16J512	----- -----		(QUANTITY OF 3)
A16J611	131-0608-00	XB010550	TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD
A16J611	----- -----		(QUANTITY OF 3)
A16J739	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD
A16J739	----- -----		(QUANTITY OF 3)
A16L25	108-0422-00		COIL,RF:FIXED,82UH
A16Q15	151-0188-00		TRANSISTOR:SILICON,PNP
A16Q41	151-0469-00		TRANSISTOR:SILICON,NPN
A16Q116	151-0192-00		TRANSISTOR:SILICON,NPN,SEL FROM MPS6521
A16Q118	151-0192-00		TRANSISTOR:SILICON,NPN,SEL FROM MPS6521
A16Q119	151-0192-00		TRANSISTOR:SILICON,NPN,SEL FROM MPS6521
A16Q221	151-0750-00		TRANSISTOR:NPN,SI,MPS-A44
A16Q222	151-0749-00		TRANSISTOR:PNP,SI,MPS-A92
A16Q237	151-0216-00		TRANSISTOR:SILICON,PNP
A16Q426	151-0219-00		TRANSISTOR:SILICON,PNP
A16Q435	151-0169-00		TRANSISTOR:SILICON,NPN
A16Q631	151-0347-00		TRANSISTOR:SILICON,NPN
A16Q632	151-0350-00		TRANSISTOR:SILICON,PNP
A16Q633	151-0350-00		TRANSISTOR:SILICON,PNP
A16Q634	151-0347-00		TRANSISTOR:SILICON,NPN
A16Q639	151-0223-00		TRANSISTOR:SILICON,NPN

A16R8	321-0368-00			RES.,FXD,FILM:66.5K OHM,1%,0.125W
A16R16	321-0363-00	XB010550		RES.,FXD,FILM:59K OHM,1%,0.125W
A16R17	315-0182-00	XB010550		RES.,FXD,CMPSN:1.8K OHM,5%,0.25W
A16R21	311-1914-00	B010100	B010549X	RES.,VAR,NONWIR:TRMR,50K OHM,10%,0.50W
A16R26	323-0452-00	B010100	B010549X	RES.,FXD,FILM:499K OHM,1%,0.50W
A16R35	301-0240-00			RES.,FXD,CMPSN:24 OHM,5%,0.50W
A16R42	315-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.25W
A16R105	307-0104-00			RES.,FXD,CMPSN:3.3 OHM,5%,0.25W
A16R107	315-0100-02			RES.,FXD,CMPSN:10 OHM,5%,0.25W
A16R115	311-1915-00	B010100	B010549	RES.,VAR,NONWIR:20K OHM,10%,0.50W
A16R115	315-0362-00	B010550		RES.,FXD,CMPSN:3.6K OHM,5%,0.25W
A16R121	315-0182-00	B010100	B010549	RES.,FXD,CMPSN:1.8K OHM,5%,0.25W
A16R121	315-0221-00	B010550		RES.,FXD,CMPSN:220 OHM,5%,0.25W
A16R122	315-0362-00	B010100	B010549X	RES.,FXD,CMPSN:3.6K OHM,5%,0.25W
A16R123	315-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.25W
A16R124	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W
A16R126	321-0332-00	B010100	B010549X	RES.,FXD,FILM:28K OHM,1%,0.125W
A16R126	323-0452-00	XB010550		RES.,FXD,FILM:499K OHM,1%,0.50W
A16R127	321-0303-00	B010100	B010549X	RES.,FXD,FILM:14K OHM,1%,0.125W
A16R128	321-0363-00	B010100	B010549X	RES.,FXD,FILM:59K OHM,1%,0.125W
A16R129	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W
A16R130	321-0333-00			RES.,FXD,FILM:28.7K OHM,1%,0.125W
A16R136	321-0408-00			RES.,FXD,FILM:174K OHM,1%,0.125W
A16R137	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W
A16R173	302-0473-00	B010100	B010549	RES.,FXD,CMPSN:47K OHM,10%,0.50W
A16R173	302-0473-01	B010550		E
A16R174	302-0472-00	B010100	B010549	RES.,FXD,CMPSN:4.7K OHM,10%,050W
A16R174	302-0472-02	B010550		E
A16R205	301-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.50W
A16R215	311-1198-00	XB010550		RES.,VAR,NONWIR:20K OHM,20%,0.5W
A16R216	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W
A16R217	315-0273-00			RES.,FXD,CMPSN:27K OHM,5%,0.25W
A16R218	315-0221-00	B010100	B010549	RES.,FXD,CMPSN:220 OHM,5%,0.25W
A16R218	311-1246-00	B010550		RES.,VAR,NONWIR:50K OHM,10%,0.50W
A16R220	321-0332-00	XB010550		RES.,FXD,FILM:28K OHM,1%,0.125W
A16R221	321-0303-00	XB010550		RES.,FXD,FILM:14K OHM,1%,0.125W
A16R224	315-0624-00			RES.,FXD,CMPSN:620K OHM,5%,0.25W
A16R225	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W
A16R226	315-0302-00			RES.,FXD,CMPSN:3K OHM,5%,0.25W
A16R227	315-0182-00			RES.,FXD,CMPSN:1.8K OHM,5%,0.25W
A16R228	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W
A16R263	301-0105-00			RES.,FXD,CMPSN:1M OHM,5%,0.50W
A16R264	301-0514-00			RES.,FXD,CMPSN:510K OHM,5%,0.50W
A16R306	307-0104-00			RES.,FXD,CMPSN:3.3 OHM,5%,0.25W
A16R307	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W
A16R308	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W
A16R312	321-0231-00			RES.,FXD,FILM:2.49K OHM,1%,0.125W
A16R328	322-0621-00			RES.,FXD,FILM:900K OHM,1%,0.25W
A16R329	322-0452-00			RES.,FXD,FILM:499K OHM,1%,0.25W
A16R331	323-0450-00			RES.,FXD,FILM:475K OHM,1%,0.50W
A16R332	303-0303-00			RES.,FXD,CMPSN:30K OHM,5%,1W
A16R333	303-0303-00			RES.,FXD,CMPSN:30K OHM,5%,1W
A16R334	323-0393-00			RES.,FXD,FILM:121K OHM,1%,0.50W
A16R336	301-0100-00			RES.,FXD,CMPSN:10 OHM,5%,0.50W
A16R337	302-0271-00	B010100	B010549	RES.,FXD,CMPSN:270 OHM,10%,0.50W
A16R337	301-0271-01	B010550		E
A16R342	302-0271-00	B010100	B010549	RES.,FXD,CMPSN:270 OHM,10%,0.50W
A16R342	301-0271-01	B010550		E
A16R358	304-0271-00	B010100	B010549	RES.,FXD,CMPSN:270 OHM,10%,1W
A16R358	304-0271-01	B010550		E

A16R378	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W
A16R405	315-0751-00			RES.,FXD,CMPSN:750 OHM,5%,0.25W
A16R406	315-0122-00			RES.,FXD,CMPSN:1.2K OHM,5%,0.25W
A16R407	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W
A16R408	315-0241-00			RES.,FXD,CMPSN:240 OHM,5%,0.25W
A16R409	315-0181-00			RES.,FXD,CMPSN:180 OHM,5%,0.25W
A16R415	311-1934-00			RES.,VAR,NONWIR:PNL,2K OHM,20%,0.50W
A16R425	311-1934-00			RES.,VAR,NONWIR:PNL,2K OHM,20%,0.50W
A16R431	311-1555-00	B010100	B010549X	RES.,VAR,NONWIR:100K OHM,20%,0.5W
A16R449	304-0271-00	B010100	B010549	RES.,FXD,CMPSN:270 OHM,10%,1W
A16R449	301-0271-01	B010550		E
A16R451	301-0102-00	B010100	B010549	RES.,FXD,CMPSN:1K OHM,5%,0.50W
A16R451	302-0102-03	B010550		E
A16R461	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W
A16R462	315-0226-00			RES.,FXD,CMPSN:22M OHM,5%,0.25W
A16R471	311-1933-00			RES.,VAR,NONWIR:PNL,5M OHM,10%,0.50W
A16R472	315-0103-00	B010100	B010549	RES.,FXD,CMPSN:10K OHM,5%,0.25W
A16R472	301-0103-02	B010550		E
A16R477	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W
A16R501	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W
A16R502	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A16R503	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A16R504	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A16R511	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W
A16R512	321-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.125W
A16R521	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W
A16R522	321-0322-00			RES.,FXD,FILM:22.1K OHM,1%,0.125W
A16R524	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W
A16R527	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W
A16R528	321-0408-00			RES.,FXD,FILM:174K OHM,1%,0.125W
A16R529	321-0340-00			RES.,FXD,FILM:34K OHM,1%,0.125W
A16R530	315-0360-00			RES.,FXD,CMPSN:36 OHM,5%,0.25W
A16R531	315-0680-00			RES.,FXD,CMPSN:68 OHM,5%,0.25W
A16R534	321-0177-00			RES.,FXD,FILM:681 OHM,1%,0.125W
A16R544	315-0152-00			RES.,FXD,CMPSN:1.5K OHM,5%,0.25W
A16R558	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W
A16R561	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W
A16R605	315-0472-00			RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A16R606	315-0472-00	XB010550		RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A16R625	321-0251-00			RES.,FXD,FILM:4.02K OHM,1%,0.125W
A16R626	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W
A16R627	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W
A16R628	315-0184-00			RES.,FXD,CMPSN:180K OHM,5%,0.25W
A16R630	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W
A16R635	301-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.50W
A16R636	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W
A16R637	323-0318-00			RES.,FXD,FILM:20K OHM,1%,0.50W
A16R646	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W
A16R647	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W
A16R648	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W
A16R652	315-0823-00			RES.,FXD,CMPSN:82K OHM,5%,0.25W
A16R653	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W
A16R657	302-0271-00	B010100	B010549	RES.,FXD,CMPSN:270 OHM,10%,0.50W
A16R657	301-0271-01	B010550		E
A16R659	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W
A16R678	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W
A16R705	315-0472-00	B010100	B010549X	RES.,FXD,CMPSN:4.7K OHM,5%,0.25W
A16R715	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W
A16R716	311-1562-00			RES.,VAR,NONWIR:2K OHM,20%,0.50W
A16R721	321-0243-00			RES.,FXD,FILM:3.32K OHM,1%,0.125W