

# Instruction Manual



## **1730D Digital NTSC Waveform Monitor (S/N B050000 and Up)**

**070-8361-03**

### **Warning**

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.



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# General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

*Only qualified personnel should perform service procedures.*

## To Avoid Fire or Personal Injury

**Use Proper Power Cord.** Use only the power cord specified for this product and certified for the country of use.

**Ground the Product.** This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

**Do Not Operate Without Covers.** Do not operate this product with covers or panels removed.

**Use Proper Fuse.** Use only the fuse type and rating specified for this product.

**Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.

**Wear Eye Protection.** Wear eye protection if exposure to high-intensity rays or laser radiation exists.

**Do Not Operate With Suspected Failures.** If you suspect there is damage to this product, have it inspected by qualified service personnel.

**Do Not Operate in Wet/Damp Conditions.**

**Do Not Operate in an Explosive Atmosphere.**

**Keep Product Surfaces Clean and Dry.**

**Provide Proper Ventilation.** Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

**Symbols and Terms**

**Terms in this Manual.** These terms may appear in this manual:



---

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

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**CAUTION.** Caution statements identify conditions or practices that could result in damage to this product or other property.

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**Terms on the Product.** These terms may appear on the product:

**DANGER** indicates an injury hazard immediately accessible as you read the marking.

**WARNING** indicates an injury hazard not immediately accessible as you read the marking.

**CAUTION** indicates a hazard to property including the product.

**Symbols on the Product.** The following symbols may appear on the product:





# Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

**Do Not Service Alone.** Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

**Disconnect Power.** To avoid electric shock, disconnect the mains power by means of the power cord or, if provided, the power switch.

**Use Caution When Servicing the CRT.** To avoid electric shock or injury, use extreme caution when handling the CRT. Only qualified personnel familiar with CRT servicing procedures and precautions should remove or install the CRT.

CRTs retain hazardous voltages for long periods of time after power is turned off. Before attempting any servicing, discharge the CRT by shorting the anode to chassis ground. When discharging the CRT, connect the discharge path to ground and then the anode. Rough handling may cause the CRT to implode. Do not nick or scratch the glass or subject it to undue pressure when removing or installing it. When handling the CRT, wear safety goggles and heavy gloves for protection.

**Use Care When Servicing With Power On.** Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

**X-Radiation.** To avoid x-radiation exposure, do not modify or otherwise alter the high-voltage circuitry or the CRT enclosure. X-ray emissions generated within this product have been sufficiently shielded.



## Contacting Tektronix

Product Support	<p>For application-oriented questions about a Tektronix measurement product, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time</p> <p>Or contact us by e-mail: tm_app_supp@tek.com</p> <p>For product support outside of North America, contact your local Tektronix distributor or sales office.</p>
Service Support	<p>Contact your local Tektronix distributor or sales office. Or visit our web site for a listing of worldwide service locations.</p> <p><a href="http://www.tektronix.com">http://www.tektronix.com</a></p>
For other information	<p>In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.</p>
To write us	<p>Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000</p>





# Getting Started



## Product Description

The Tektronix 1730D Digital Waveform Monitor is an 8-1/2 inch wide by 5-1/4 inch high waveform monitor. The CRT occupies approximately two-thirds of the front-panel area, with the control panel taking up the remainder of the space. Operation is controlled by a microprocessor that polls the front-panel switches and remote ground closures. Most of the switches are also used to select special functions, which are accessed by holding the switches in until the microprocessor recognizes the request.

The signal is displayed on a bright CRT capable of displaying one line per frame. It is of the mesh type, for better geometry, and uses an internal graticule to reduce parallax. Variable graticule scale illumination provides even lighting over the usable graticule area to improve measurement accuracy and the quality of waveform pictures.

This monitor has two displays which are new to television monitoring and measurement equipment:

- Error Detection and Handling (EDH) is a method of assessing the quality of the incoming serial digital signal. Check words are calculated for each field of video and sent in an ancillary data area. At the receiver, these check words are recovered and compared to check words that are calculated from the received video. If the two check words do not match, a video error has occurred.
- The Eye pattern is an equivalent time sampled display that is primarily used to check serial link quality. It provides the means to check amplitudes, risetimes, aberrations, and time jitter.

To protect the integrity of the signal paths, analog signals for Channels 1, 2, and External Reference, along with the Channels 1 and 2 serial digital inputs, are brought in through high impedance bridging loop-throughs. The parallel digital input is differential ECL with an active loop through. The rear-panel DAC OUT provides a high-quality, 75  $\Omega$  analog signal output from the Digital-to-Analog Converter (DAC). Input switching provides display choices of the Analog Channel 1 or Channel 2 input; the Serial Digital Channel 1 or Channel 2 input; or the Parallel Digital input. Hold for function provides three display choices; both the Channel 1 and Channel 2 Analog inputs, the Analog Channel 1 and Parallel Digital inputs, or the Analog Channel 1 and Serial Digital Channel 1 inputs. Synchronization can be either internal or external, through the rear-panel External Reference Input.

The 1730D offers a choice of three basic sweep rates: 2 Field, 2 Line, and 1 Line, each of which can be magnified to provide three additional sweep rates: 1  $\mu$ s (2 Line), 0.2  $\mu$ s (1 Line), and X25 (2 Field, which provides for viewing the complete vertical interval). In addition, there is full frame line selection that can

be displayed as 1 line, 2 lines, or 15 lines. The Picture Monitor Out signal contains a bright-up pulse that corresponds to the selected line(s).

The vertical signal processing provides a choice of DC restoration, fast or slow, or an unclamped display. The input signal can be unfiltered (Flat), Low Pass filtered, or Chrominance filtered. When Low Pass filtering is selected and either a 2 Line or 2 Field sweep rate is employed, the display consists of one line or field Low Pass filtered and the second line or field unfiltered. Vertical amplitudes can be displayed in a calibrated gain mode (corresponding directly to the graticule vertical scales), magnified 5 times, or set to a specific amplitude with the Variable control.

The 1730D has a Store and Recall function to allow the storage of up to four front-panel setups for later 1-button recall. Selection of the stored front-panel setup can be either by pushing the appropriate front-panel recall button or by grounding the corresponding pin in the rear-panel Remote connector. In addition, four factory-programmed measurement setups that can only be recalled through the Remote connector are also available.

A limited menu system allows user configuration of some instrument and EDH functions.

An auxiliary output, to control a companion 1720-Series Vectorscope, is provided through a rear-panel connector. The auxiliary output contains a bus for two-way communications (RXD-TXD) between the Waveform Monitor and the Vectorscope microprocessors along with a strobe to provide line select unblanking for the Vectorscope.

## Typical Configurations

The 1730D Digital NTSC Waveform Monitor is designed for monitoring and measuring waveform conditions in both the composite analog and composite digital environments.

All of the standard composite analog monitoring and measurement versatility is present in this generation of waveform monitors. This includes the capability to control a 1720-Series Vectorscope. Graticule scales utilized on this monitor are the same as those used by the 1730 Waveform Monitor.

In addition, there are some basic operating parameters, such as input coupling, that can be changed by moving internal plug jumpers. See Section 8 (*Installation*).



## Options

This section describes instrument options and customer–installable Field Upgrade Kits for the 1730D. For a list of standard accessories, see page 1–4.

- CRT Options** The standard instrument is shipped with a P31 (green) phosphor CRT installed. If Option 74 is ordered, the instrument is shipped with a P4 (white) phosphor CRT installed. The Option 74 CRT part number is given at the end of the Replaceable Electrical Parts List.
- Power Cord Options** Any of the power cord options can be ordered for the 1730D. If no power cord option is ordered, instruments are shipped with a North American 125 V power cord and one replacement fuse.
- Options A1, A2, A3** All 1730D Digital NTSC Waveform Monitors are shipped with a 115 VAC power plug and a captive cord. CSA certification applies to the product with CSA-certified power cords. International power cords (Options A1, A2, and A3), which are approved for the country of use, are not CSA certified.
- Unless otherwise specified, power cords for use in North America are UL listed and CSA certified. Cords for use in areas other than North America are approved by at least one test house acceptable in the country to which the product is shipped. Power cord part numbers are shown in the Standard Accessories list at the end of the Replaceable Mechanical Parts List.

## Field Upgrade Kits

Field Upgrade Kits available for the 1730D are described below. (For more information, refer to the cabinet installation drawings in Section 8, or contact a Tektronix field office or distributor.)

- Plain Cabinet (1700F00)** This plain, silver-grey cabinet is designed for permanent mounting. The ventilating holes in the top, bottom, and sides of the cabinet allow heat generated within the instrument to dissipate. When mounting, allow air to circulate freely through these holes.
- Carrying Case (1700F02)** This silver-grey metal cabinet, designed for portable applications, is equipped with feet, flipstand, and carrying handle.
- Side-by-Side Rack Adapter (1700F05)** This 19-inch rack-mounting adapter, which contains two 1700F00 cabinets, accepts two 1700 Series instruments side-by-side.

**Blank Panel (1700F06)** When only one side of a 1700F05 is used, this blank panel can be installed in the other half, to improve appearance and protect air flow.

**Utility Drawer (1700F07)** When only one side of a 1700F05 is used, this utility drawer can be installed in the remaining side of the cabinet to improve appearance, and provide a convenient storage location.

## Ordering

These items can be ordered with the 1730D, or purchased through a Tektronix field office or distributor. When ordering, include both the name and number of the Field Upgrade Kits.

### Included (standard) Accessories

- 1 Manual, Instruction
- 1 Cable Assembly, Power
- 2 Terminators, High Frequency, 75  $\Omega$
- 1 Fuse, Cartridge: 3AG, 2A 250 V, Fast-Blow
- 3 Light Bulbs, replacement for graticule scale
- 1 CRT Filter, smoke gray, installed
- 3 Air Filters, for fan

### Optional Accessories

- Viewing Hood (016-0475-00)
- Front-Panel Cover (200-3897-01)

### Field Installable Upgrades

- 1700F00, Plain Cabinet (painted silver gray)
- 1700F02, Portable Cabinet (painted silver gray)
- 1700F05, Side-by-Side Rack Adapter
- 1700F06, Blank Half-Rack Width Panel
- 1700F07, Rack Drawer (Half-Rack Width)

# Functional Check

The following procedure is provided as an aid in obtaining a display, and as a quick check of basic instrument operation. Only instrument functions, not measurement quantities or specifications, are checked in this procedure. Therefore, a minimum amount of test equipment is required. Make all checks with the cabinet on and all internal jumpers in the factory-set position.

If performing the Operator's Checkout Procedure reveals improper operation or instrument malfunction, first check the operation of associated equipment. If associated equipment is performing normally, refer the 1730D Waveform Monitor to qualified service personnel for repair or adjustment.

For a complete check of the instrument performance specifications, refer to the *Performance Check* (which should only be performed by qualified service personnel) in Section 6 of this manual.

This procedure requires a source of composite, serial digital, and parallel digital video. It can be the TEKTRONIX TSG170D (Option 1S for serial output) and the TEKTRONIX 1410 Television Test Signal Generator with Sync, Color Bar, and Linearity modules.

When used with the serial output of the TSG170D, almost any 75  $\Omega$  terminating resistor will work; however, if the expected waveform is not displayed, it may be because of the high frequency characteristics of the terminating resistor.

## Procedure

This procedure requires only one hook-up to perform. Figure 1-1 shows the required connections. Once the signals are connected go to step 1 of the procedure.

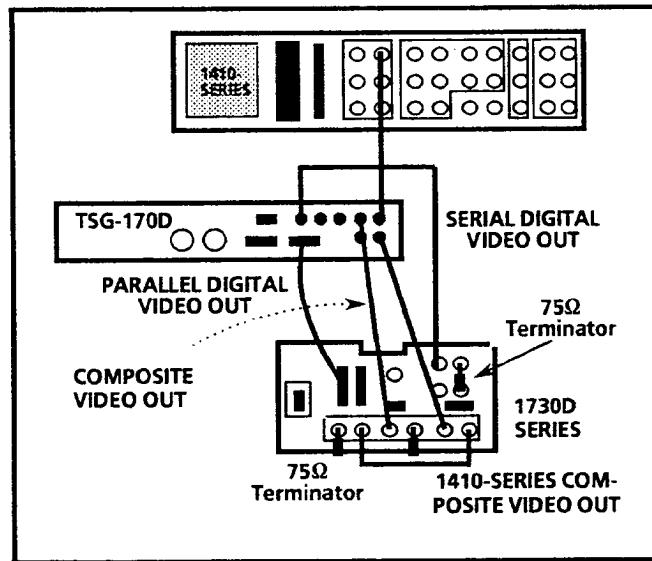


Figure 1-1: Equipment connections for the Operator's Checkout Procedure

### 1. Initial Generator Setup

TSG170D

Staircase Signal

1410-Series Video Signal Generator

Test Signals

Full Field Color Bars

75% Ampl. 7.5% Setup NTSC

## 2. Apply Power

Connect the instrument to a suitable AC power source and push the POWER button. A center dot should appear in the eye of the POWER switch to indicate that it is on.

---

**NOTE.** Do not set any of the front-panel screwdriver controls until after the instrument warms up (20 minutes minimum).

---

## 3. Initial Front-Panel Setup

### 1730D Monitor

FILTER	FLAT
INPUT	CH 1 – ANLG
DC REST	OFF
GAIN	Off (no indicators on)
VERTICAL POSITION	as is
REF	INT
SWEEP	2LINE
MAG	Off (no indicators on)
HORIZONTAL POSITION	as is
DOWN	as is
UP	as is
FIELD	as is
LINE SELECT	off (no line number readout on CRT)
FOCUS	as is
SCALE	as is
INTENS	as is
RECALL SETUP	as is
ROTATE	as is
V CAL	as is
H CAL	as is
READOUT	as is
POWER	ON

## 4. Obtain Display

- a. Adjust the INTENS and FOCUS controls for the desired brightness and a well-defined display.
- b. Adjust the multi-turn VERTICAL Position control to place the display blanking level on the graticule 0 IRE line.
- c. Center the display with the HORIZONTAL Position. See Figure 1–2.
- d. Adjust the SCALE illumination control for the desired graticule scale brightness.

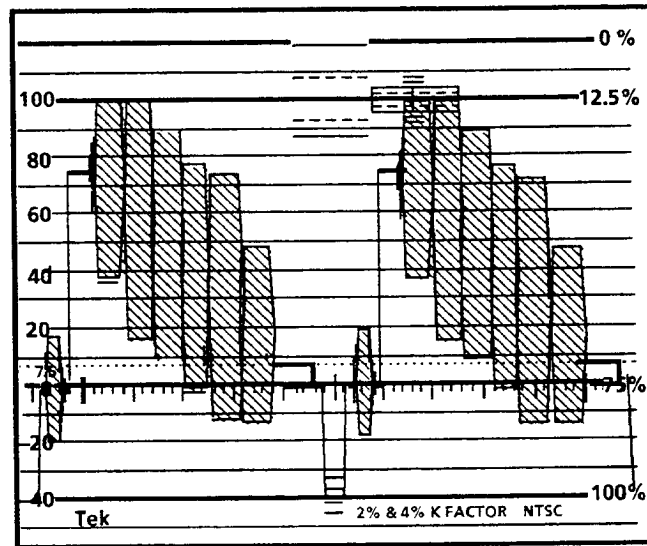


Figure 1-2: 2 Line color bar display in FLAT filter mode. (shown here is a full field color bar)

5. Check the Rotation of the Display

Variations in the earth's magnetic field may make adjustment of the ROTATE control necessary at installation time or whenever the instrument is moved.

Check that the display blanking level is parallel to the horizontal axis. If not, adjust the ROTATE screwdriver adjustment until the sweep is parallel to the horizontal axis.

6. Calibrate Display

- a. The CAL mode on the REF switch enables the waveform monitor calibrator signal. Press and hold the REF button until the CAL indicator LED is lit. Adjust the VERTICAL and HORIZONTAL Position controls to obtain a display similar to that shown in Figure 1-3.
- b. If necessary, adjust the V CAL screwdriver control for 1 V amplitude (140 IRE). Switch REF to INT mode.

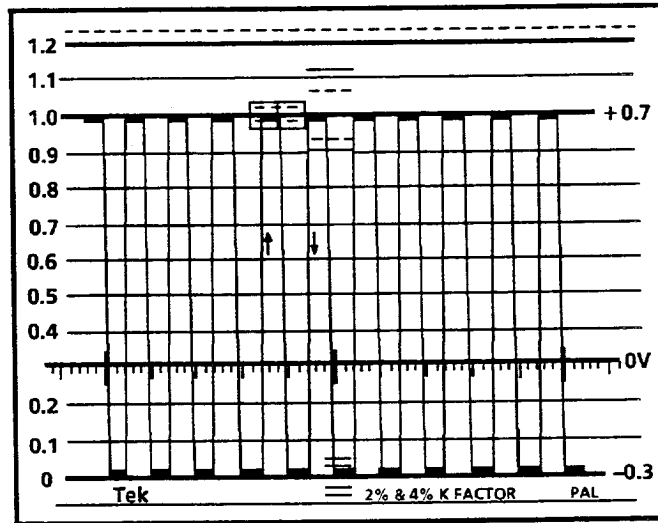


Figure 1-3: Checking Vertical Gain Calibration with the 1730D internal CAL Reference

7. Select Input

- a. Position the color bar waveform so that the blanking level is at the 0 IRE (0.3 V) graticule line and the sync pulses are at each end of the graticule.

See Figure 1–2.

- b. Push the 1730D CH 2 switch. Note that the linearity waveform is displayed.
- c. Push and hold the channel (CH1/CH2, etc) button until both the ANLG, CH-1, and CH-2 front-panel indicators are on. Check that both the color bar and linearity waveforms are displayed. See Figure 1–4.
- d. Push the INPUT Channel switch to return to ANLG, CH1 (color bar) display.
- e. Push the INPUT mode switch (ANLG/PRL/ SER) to display the PRL input (PRL and CH 1 indicators lit). Check the CRT display for the linearity signal.
- f. Push the INPUT mode switch (ANLG/PRL/ SER) to display the SER input (SER and CH 1 indicators lit). Check the CRT display for the linearity signal.

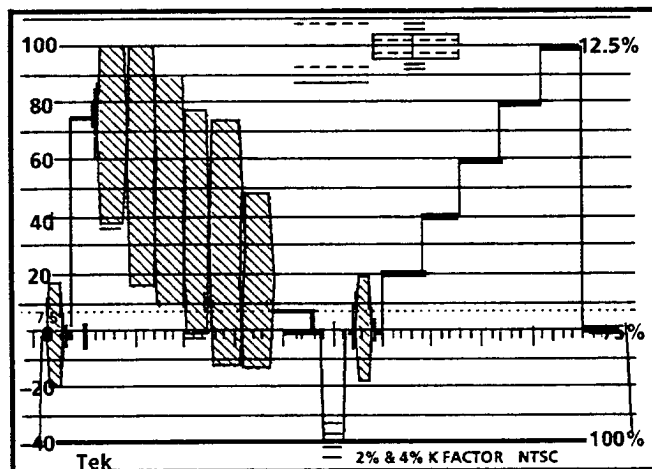


Figure 1–4: Dual channel, 2 line display of a color bar signal (CH 1) and a linearity signal (CH 2)



## 8. EDH Readout

- a. Push the EDH READOUT switch and the display should change to the EDH readout. See Figure 1-5.
- b. Push the FLD [MENU] switch, in the LINE SEL block, and check that the CRT readout changes from FF (Full Field) to AP (Active Picture).
- c. Push the Channel switch (CH1/CH2) and check that the ERROR counter and TIME SINCE ERROR counts go to zero.
- d. Push the EDH READOUT switch and check that the linearity signal is again displayed.

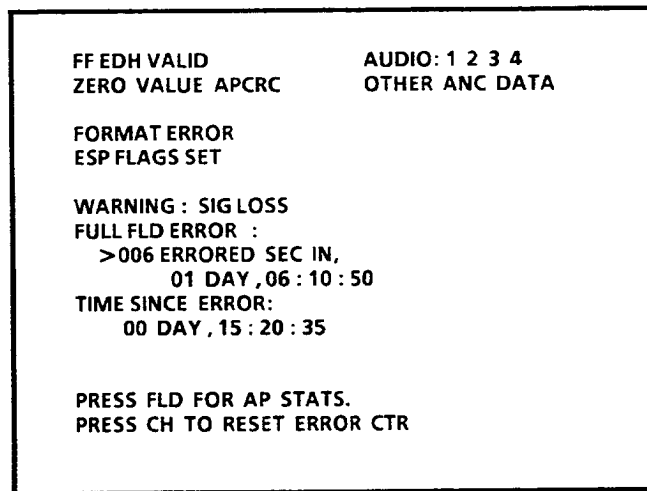


Figure 1-5: Full Field EDH readout screen

## 9. Select Time Base

- a. Be sure that SWEEP is still 2LINE. Hold the REF button until the CAL signal appears. Position it so the top of the display is on the 70 IRE. Horizontally position the display so the first transition is on the left side timing mark (the mark that goes completely through the blanking line. There are three on the graticule.) See Figure 1-6a. Check that the falling transition of the 10th square wave passes directly through the right side timing mark. The H CAL can be adjusted if timing is off. Push the MAG button and check for one cycle of square wave over the 10 divisions of timing area. See Figure 1-6b.
- b. Hold the SWEEP button until the 1LINE front-panel indicator lights. Check for five full cycles over the 10-division timing area. See Figure 1-6c.

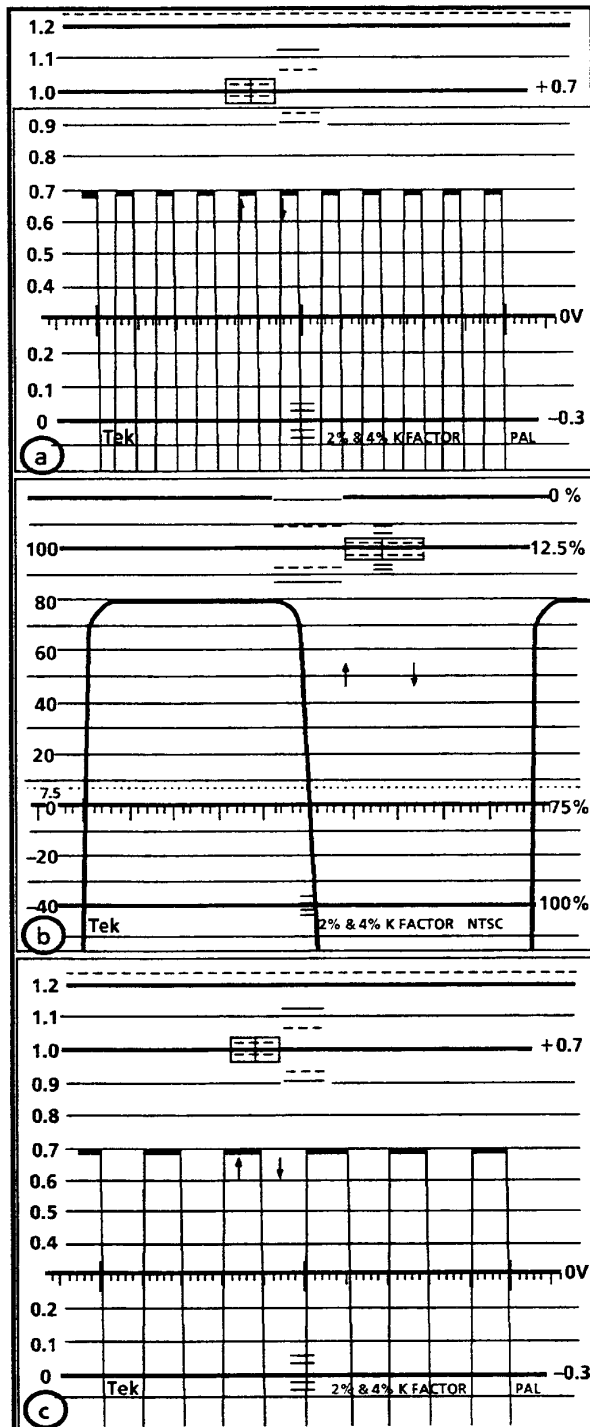


Figure 1-6: Checking timing with the internal calibrator signal (a) 2 Line display, (b) 2 Line display magnified, (c) 1 Line display

- c. Push the waveform monitor REF switch and return to INT. Check that the composite color bar signal is again displayed.

#### 10. Eye Display

- a. Push the INPUT mode switch until the Eye pattern appears and the front-panel EYE indicator lights. See Figure 1-7.
- b. Push and hold the MODE button until the EQ indicator lights. The eye display should now show more noise, as indicated by the sample (or dot) pattern.

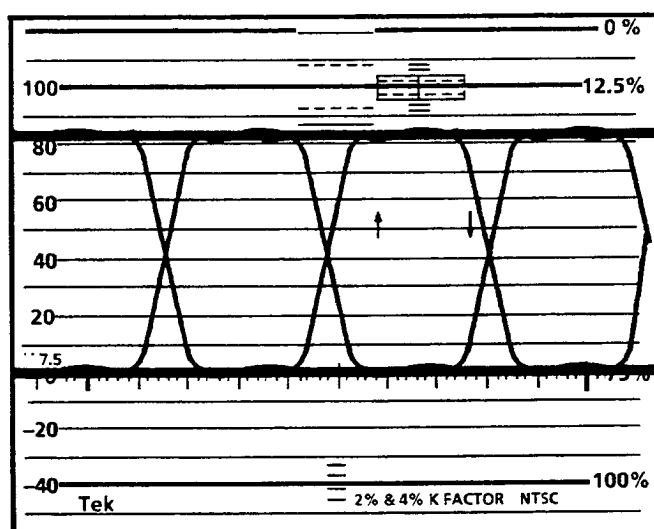


Figure 1-7: Eye pattern display

#### 11. Gain Control

- a. Push the INPUT mode switch until the ANLG indicator lights. The normal GAIN setting (with the GAIN switch off) is 1 V full scale with neither the X5 nor the VAR indicator lit. The GAIN (VAR) control changes the amplifier gain so that signals greater or lesser in amplitude to the calibrated 1 volt full scale can be displayed as full scale.
- b. Push the GAIN switch and note that the VAR indicator is lit. Also note the range of amplitude (signal amplitude greater than the scale at one extreme and considerably smaller at the other) that is obtained with the control.
- c. Push the GAIN button and check that the X5 indicator lights. Check for a large increase in gain. (It can be determined that this is a X5 gain increase by setting the signal base line on the graticule 0 IRE and

checking that the maximum excursion of color burst is at approximately the 100 IRE or 1 V graticule line.)

- d. Push the button in and hold it until both the VAR and X5 indicators are lit. Rotate the GAIN control and look for a greater than 5X amplitude display at one extreme and a nearly normal amplitude display at the other extreme.
- e. Push the GAIN button once and notice that the display amplitude returns to 1 V Full Scale.

## 12. Filter Selection

The FILTER button selects the frequency response characteristic for the displayed signal. The FLAT response is used for normal applications. Figure 1-2 shows the color bar signal with the FLAT response.

- a. Press and hold the FILTER button to get the front-panel LPASS indicator to light. This provides the low-pass frequency response; the chrominance component of the signal has been removed. See Figure 1-8.

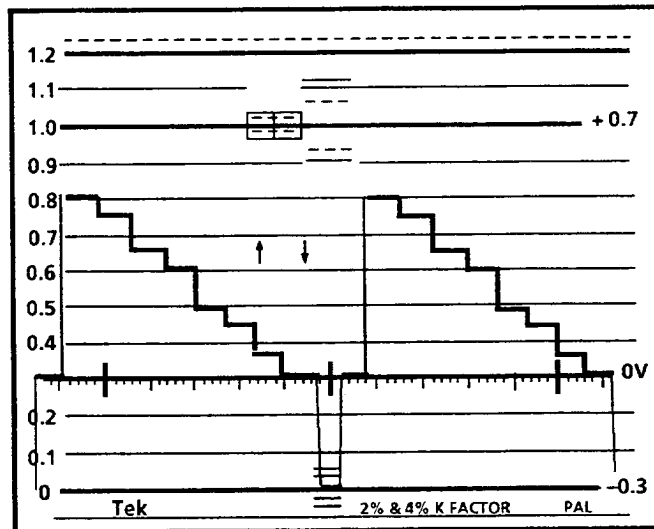


Figure 1-8: 2 Line display of color bar signal with Low Pass filter on

- b. Press the FILTER button once more and look to see that the CHROMA indicator is lit. The signal is now displayed as chrominance only; the luminance component is removed. See Figure 1-9.

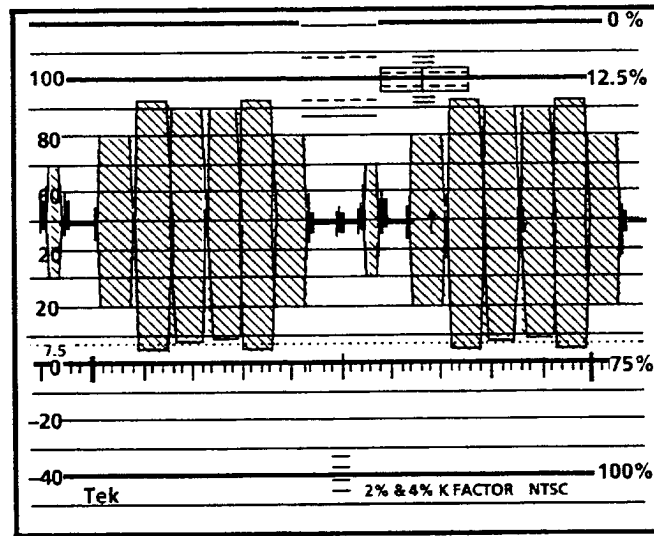


Figure 1-9: 2 Line display of color bar signal with Chroma filter on

- c. Hold the FILTER button in until both the FLAT and LPASS front-panel indicators are lit. The display now consists of two lines, the first of which has the chrominance removed and the second is unfiltered. See Figure 1-10.

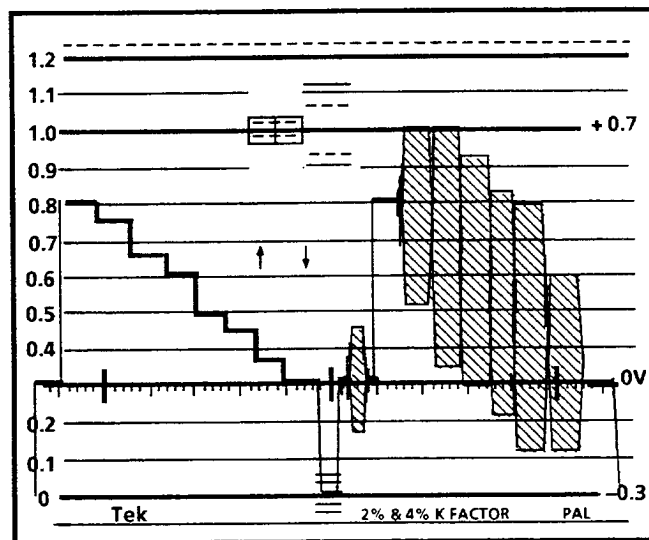


Figure 1-10: 2 Line display with dual filter selected (Low Pass and Flat)

- d. Push the FILTER switch and return to FLAT.

13. Sweep Speeds and Line Select

- a. Turn on LINE SELECT and push and hold both the UP and DOWN buttons until the readout indicates that line 19 of field 1 is being displayed. Use the LINE SELECT UP or DOWN button to display line 131. See Figure 1-11. Holding in the UP or DOWN button causes the counter to move faster.

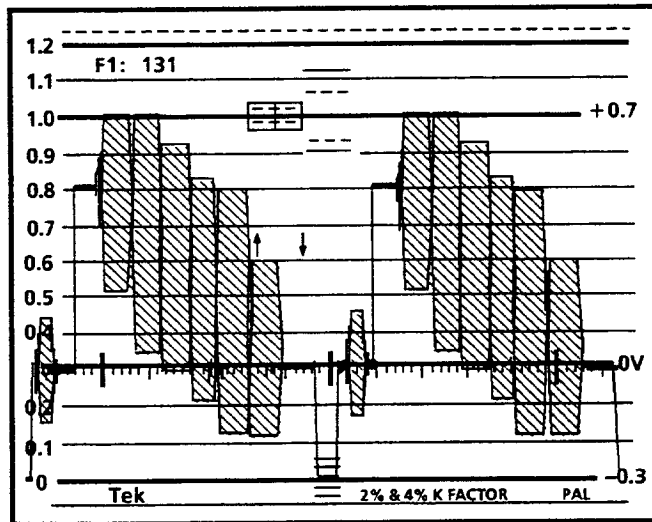


Figure 1-11: 2 Line display with LINE SELECT on (Note readout in upper left corner of graticule.)

- b. Push the sweep button and observe the 2FLD Sweep with an intensified line at the mid point of one of the fields. See Figure 1-12.

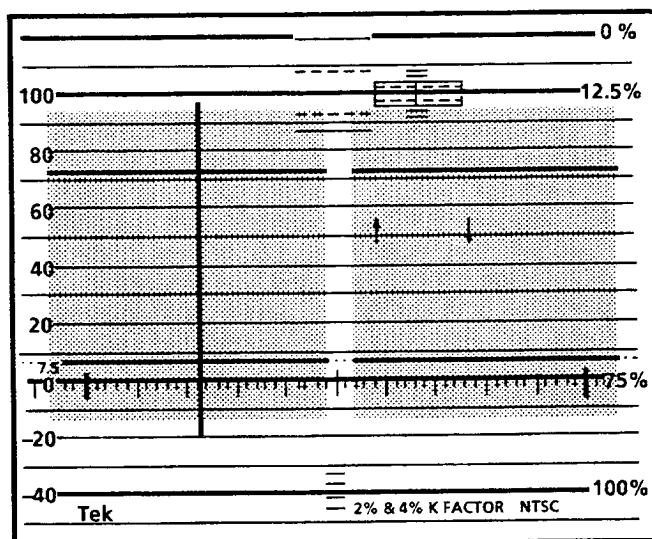


Figure 1-12: 2 Field display with intensified line in the first displayed field

- c. Push and hold the LINE SELECT button until the intensified portion of the display increases in width; this is the 15 Line mode of LINE SELECT. See Figure 1-13.

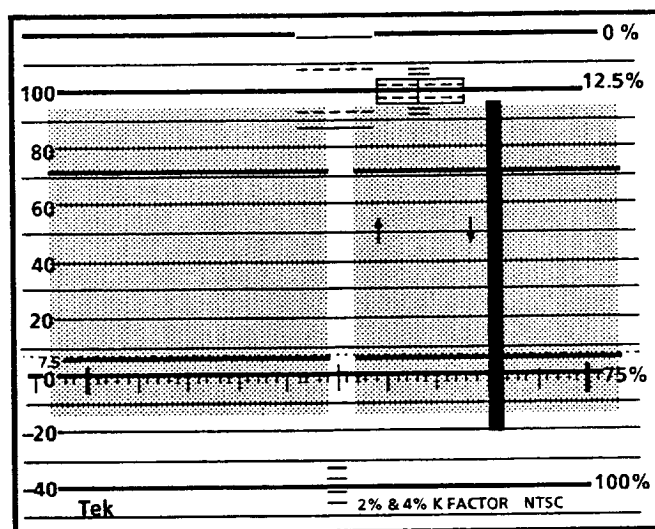


Figure 1-13: 2 Field display with 15 Line mode of LINE SELECT on

- d. Push and hold the SWEEP button until the front-panel 1LINE indicator lights. Look for a display of one line, with a line F1 or F2:131 over 15 readout. This is 15 continuous lines in field 1 or field 2 (as indicated by the readout). See Figure 1-14.

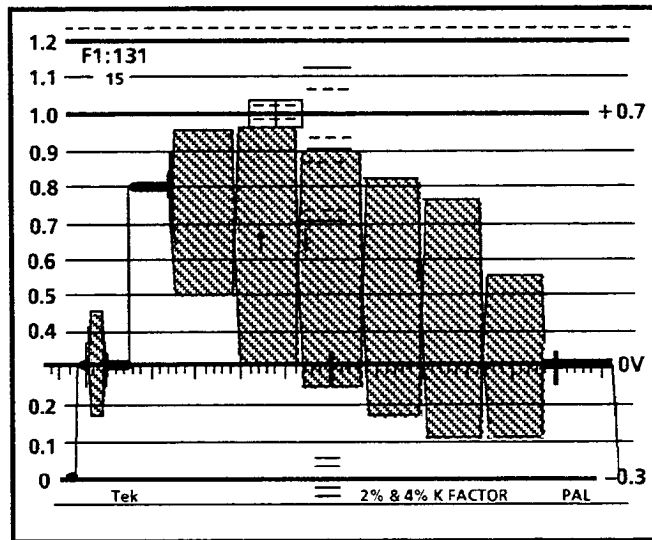


Figure 1-14: A 1 Line Sweep rate with 15 continuous lines (from mid field) displayed using LINE SELECT

- e. Change the field by pushing the FIELD button. Turn off the LINE SELECT.



#### 14. Horizontal Magnifier

Select the 2LINE Sweep and center the horizontal sync on the screen. Press the MAG button and note the magnification of the horizontal sync details. Push SWEEP for 2FLD and MAG for X25 and note that the vertical interval is displayed. See Figure 1-15. Note that the MAG button works with any sweep selection. Push the MAG button to turn off the MAG.

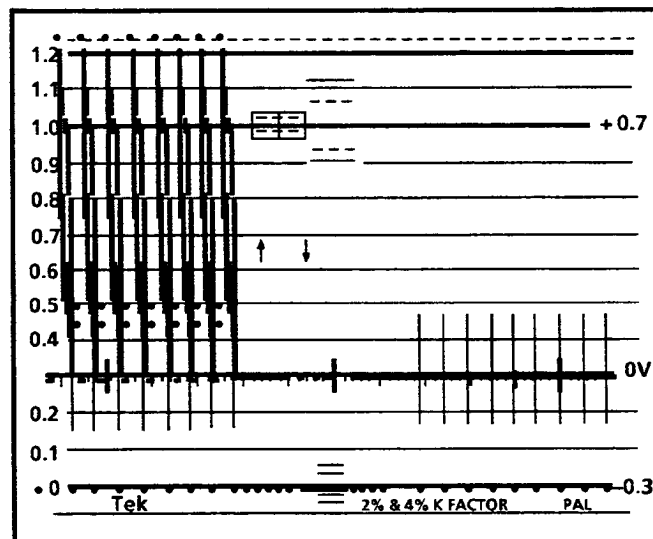
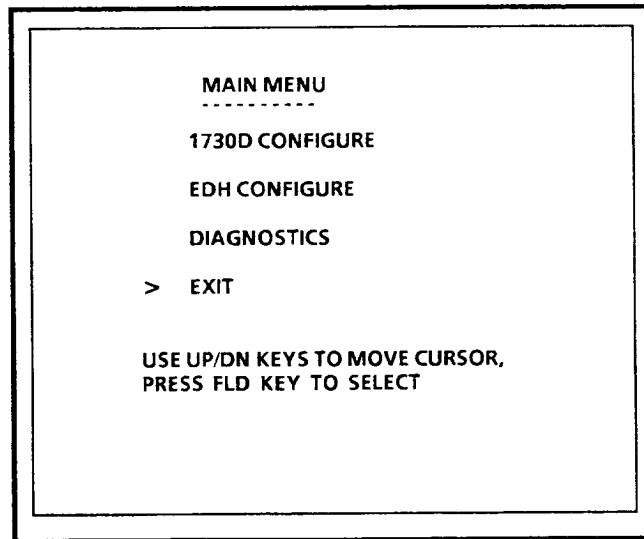


Figure 1-15: Display of vertical interval with magnified 2FLD Sweep

**15. Menu**

- a.** Push and hold the FLD [MENU] switch. The 1730D Main menu will appear. See Figure 1-16.



**Figure 1-16: Main menu display**

- b.** Push the DN switch until the > aligns with the 1730D CONFIGURE. Note that the cursor will wrap around. Press the FLD [MENU] switch to select the 1730D CONFIGURE menu. The menu will appear on the CRT. See Figure 1-17.

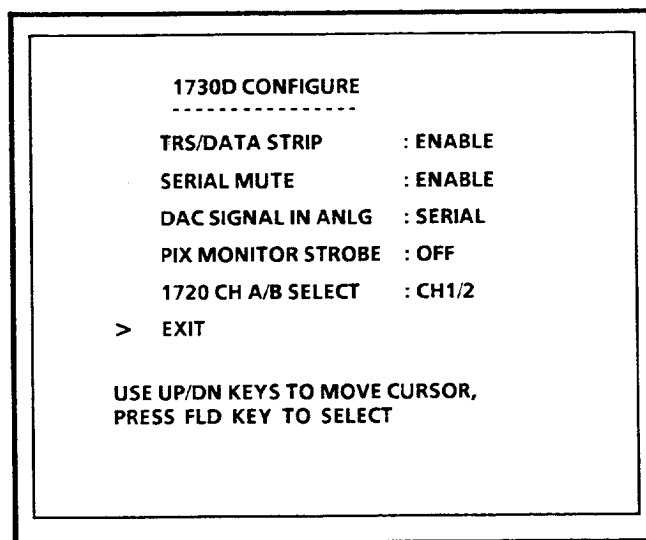


Figure 1-17: The 1730D Configure menu

- c. Use the DN (or UP, which also moves the cursor) to select TRS / DATA STRIP and press the FLD [MENU] switch.
- d. Push the FLD [MENU] switch and check the TRS DATA STRIP entry. It should cycle through ENABLE, LEGAL ONLY, and OFF. Leave in ENABLE.
- e. Push the DN switch until the cursor is at EXIT. See Figure 1-17. Push the FLD [MENU] switch and return to the Main menu and push the FLD [MENU] switch again to restore the waveform display.

#### 16. Recall Setup

Set the 1730D for both CH-1 and CH-2 input, SWEEP to 1LINE, MAG on, and VERTICAL GAIN to X5. Note front-panel indicators. Push the RECALL SETUP 1 button and note that the front-panel setup changes.

---

**NOTE.** The Store function could also be checked; however, operating settings may be stored in the memory location, and they would be overwritten with the new front-panel information. For more information on how to use the Store function, see *CONTROLS* and *CONNECTORS* in this section of the manual.

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# Operating Basics



# Functional Overview

These instructions describe the front-panel controls and their operation. They also discuss the rear-panel connectors and graticules.

## Front-Panel Controls and Indicators

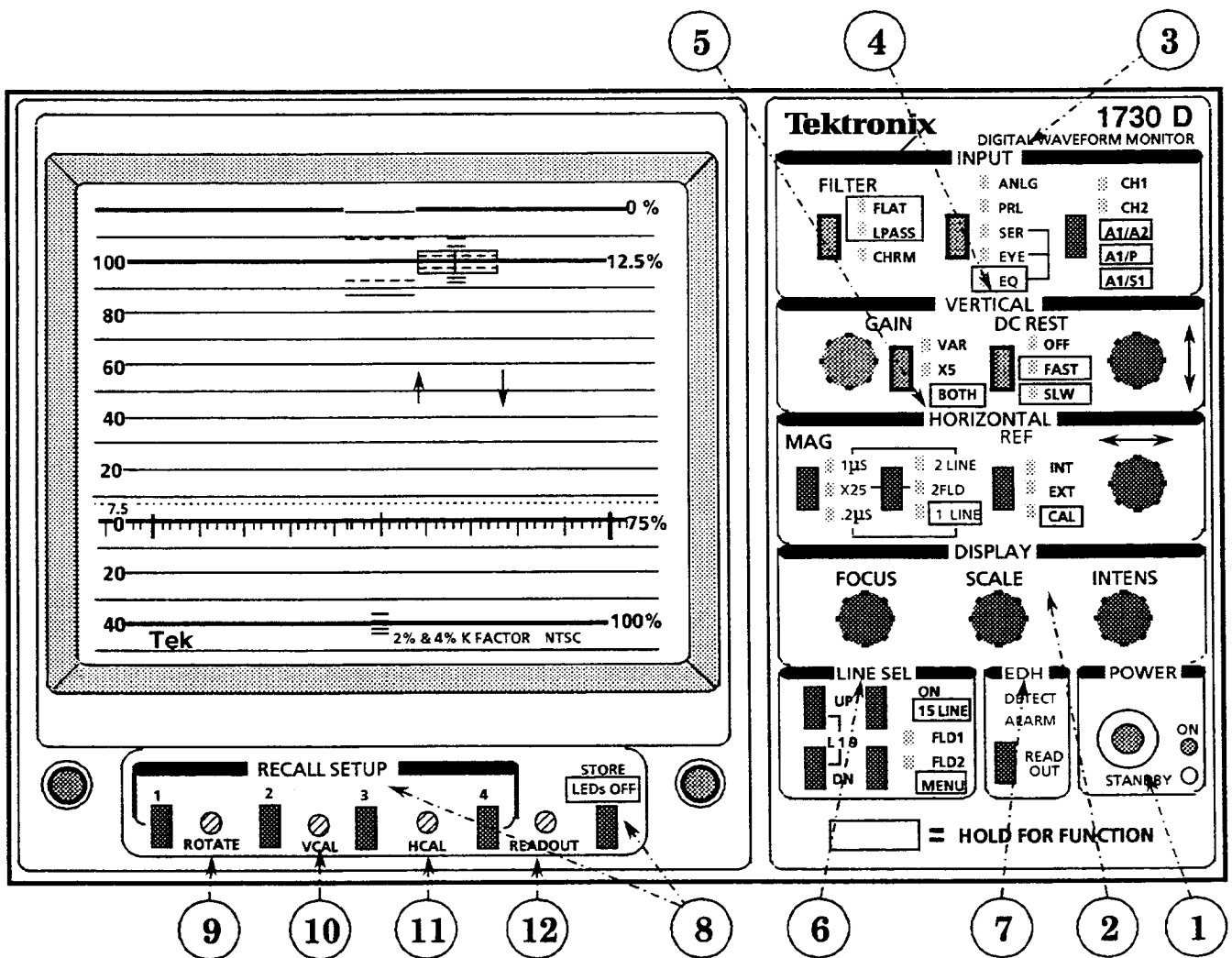


Figure 2-1: 1730D front panel

The front-panel controls and indicators consist of momentary contact push-button switches, variable controls, and backlit switch selections. See Figure 2–1 for control and indicator locations.

Some push-button switches have functions that are accessed by holding the switch down for approximately one second. These functions are identified by a blue box surrounding the front-panel label.

### 1. POWER

Switches between full power and standby. The mechanical indicator in the center of the switch is green when the switch is in the ON position.

### 2. DISPLAY

- SCALE. A variable control that sets the level of graticule illumination.
- INTENSITY. A variable control that sets the level of display brightness.
- FOCUS. A variable control that adjusts the CRT beam for optimum definition.

### 3. INPUT

- FILTER. Toggles through three positions: FLAT, LPASS, and CHROMA. In 2 LINE or 2FLD sweep, a combination filtering routine, consisting of Low Pass and Flat for alternate lines or fields, can be accessed by holding the FILTER push button until the two front-panel indicators light. In the dual filter mode, the low pass filtered line or field will always be on the left. The dual filter cannot be accessed when the 1730D is in the BOTH mode (A1/A2, A1/P or A1/S1), or in LINE SELECT. Filtering always returns to FLAT when exiting the BOTH mode.
- Display Format. There is a choice of 5 display formats. ANLG selects the CH 1 or CH 2 Analog input for display. PRL selects the Parallel Digital Input for display. SER selects the CH 1 or CH 2 Serial input for display. EYE selects an eye pattern display of the selected Serial Input for troubleshooting the serial digital signal. EQ is an equalized eye display of the serial receiver output.
- Display Selection. This push-button switch toggles through the Channel1, and Channel2 input selections of either Analog, Serial, or EYE modes depending on the display format switch. Three Both (alternate) displays are available: A1/A2 (Both Analog), A1/P (Analog 1 and Parallel Digital), and A1/S1 (Analog Channel 1 and Serial Digital Channel 1). In the hold for function selections, when 2 LINE or 2FLD sweep is selected, Channel 1 is displayed on the left, with Channel 2, Parallel, or Serial Digital Channel 1 on the right. In 1 LINE mode, the displays are overlaid.



Holding the input switch selects the display containing the current mode; that is, from SER it will be A1/S1. Continuing to hold the switch selects the next item in the series; choice reverts to the top of the list when the end of the list is reached. In the BOTH mode, the REF is forced to EXT and the DC REST to SLOW. If the FILTER was in the LPASS-FLAT switching mode, it is forced to LPASS; otherwise, it remains in the previous position. When exiting a BOTH mode, these functions return to their previous settings.

#### 4. VERTICAL

- POSITION. Variable control that positions the waveform display vertically.
- DC REST. Toggles the DC Restorer on and off. Pushing and holding the switch toggles the restorer speed to the opposite rate. Once the restorer time constant has been selected, pushing the DC Restorer button turns the DC RESTORER on (at the previously selected fast or slow time constant) or off.
- GAIN (Switch). Toggles between VAR, X5, and off. The BOTH mode, consisting of VAR and X5, is accessed by holding the button until both indicators light.
- GAIN (Control). Enabled when the GAIN switch is in VAR. Adjusts amplifier input gain to a convenient value. Control has no detent.

#### 5. HORIZONTAL

- POSITION. Positions the waveform display horizontally.
- SWEEP. Toggles between 2 LINE (10  $\mu$ s/division) and 2FLD sweep. 1 LINE (5  $\mu$ s/division) sweep is accessed by holding the SWEEP push button in until recognition occurs.
- MAG. Toggles between on and off. Operates in conjunction with the SWEEP mode to provide usable sweep rates as shown below. Changing the SWEEP rate with the MAG on disables the MAG.

$$2 \text{ LINE} + \text{MAG} = 1 \mu\text{s/div.}$$

$$1 \text{ LINE} + \text{MAG} = 0.2 \mu\text{s/div.}$$

$$2\text{FLD} + \text{MAG} = 1 \text{ full vertical interval, minimum}$$

The vertical interval displayed in 2FLD MAG is the one following the selected field; for example, if FLD1 is selected, the vertical interval displayed is the one between field 1 and field 2 (field 2 interval).

- REF. Toggles between internal and external reference. Calibrator is accessed by holding the REF switch. Instrument status is held in memory when CAL is selected and restored when the push button is again pushed. All front-panel lights, except SWEEP and MAG, go out

and GAIN goes to X1, but X5 and VAR are still usable in the CAL mode. CAL cannot be STOREd or RECALLED. (Note that MAG and SWEEP are switchable but revert to their previous setting when the CAL mode is exited.)

## 6. LINE SELECT

- ON. Toggles between on and off. Line and field number are displayed on the CRT in 1 LINE or 2 LINE sweep rates. Readout of both field and line are displayed with a colon as a delimiter, for example: F1:19 (field 1, line 19). In LINE SELECT mode, the selected line is displayed in 1 LINE sweep rate, the selected line is displayed first in the 2 LINE sweep rate, and a bright-up is provided to mark the selected line in 2FLD sweep rate. The field from which the line will be displayed is dependent on the selected field.

15LINE display is accessed by holding the LINE SELECT ON button until there is recognition. In 2FLD, the 15 lines are intensified in the display. In 1 LINE or 2 LINE, the CRT readout is active, giving the field and line of the first displayed line plus a small 15 immediately below the colon in the readout.

Lines displayed in the LINE SELECT mode have their active video intensified on the PIX MON OUT signal.

- FIELD. Toggles between FLD1, FLD2, and ALL Fields. This button also determines which field triggers the 2 field sweep. The selected field is the first (left) field displayed. In LINE SELECT, the indicator lights go off, but triggering continues on the selected field. In 2 FLD, a line strobe identifies the selected line. In 1 LINE or 2 LINE, the FIELD button determines the field from which the selected line is displayed.
- MENU. Pushing and holding the FLD [MENU] switch brings up the main configure and diagnostic menu. Figure 2–2 shows the menus and how to access them. Use the UP/DN buttons to move the cursor to the selection and then push the FLD switch to activate. Menus are self explanatory; however, more information on the configure menus is contained in *1730D Configure Menus* on page 2–10.
- UP. Increments the line count (when enabled). Holding the UP push button increments faster.
- DN. (Down) Decrements the line count (when enabled). Holding the DN button decrements faster.

(Holding in both the UP and DN push buttons returns the line count to Field 1, Line 19.)

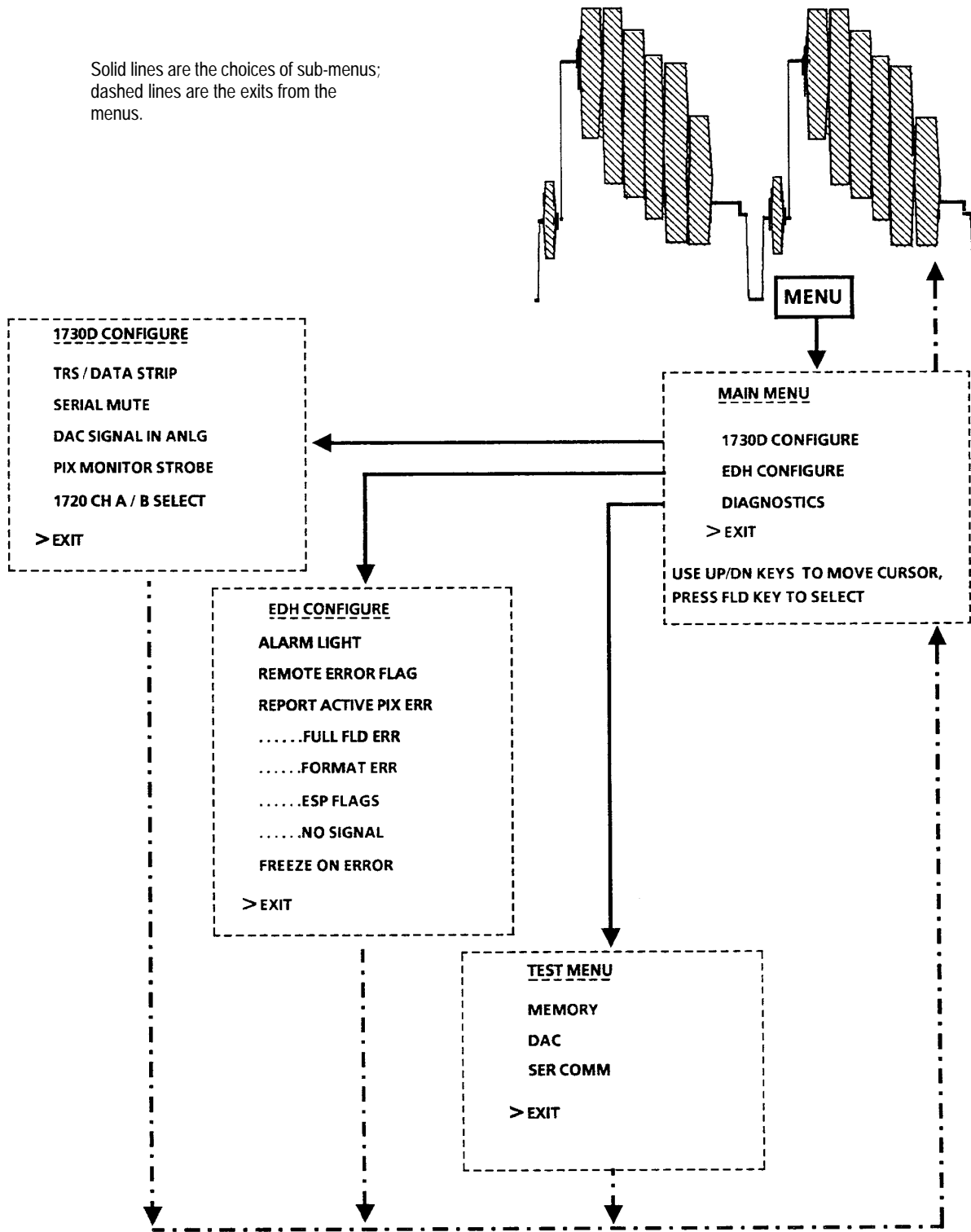


Figure 2-2: The 1730D menus for configuration and diagnostics

**7. EDH (Error Detection and Handling)**

Provides a method of evaluating the integrity of the serial digital data, based upon a Cyclic Redundancy Code (CRC) checkword system. A check word is calculated for each field of the transmitted video and is sent as ancillary data. At the receiver the check word is recovered and compared to a check word calculated from the received video. If they do not agree, an error message is generated, and the front-panel ALARM indicator is turned on.

- **DETECT.** Lights when the error detection signal is present in the serial digital signal ancillary data.
- **ALARM.** Lights briefly when a serial digital error occurs. The EDH Configure menu selects the types of errors that trigger the ALARM.
- **READ OUT.** Turns on and off the CRT readout that gives serial error information and indicates the presence of ancillary data, such as audio. See Figure 2–3.

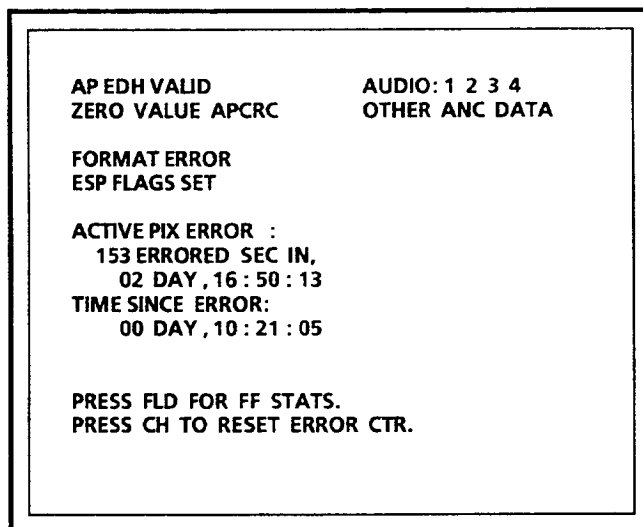


Figure 2–3: EDH message display

## 8. RECALL SETUP

- **RECALL.** Recalls often repeated or critical measurement settings with a single push button. Front-panel setups are stored in four memory locations as dictated by the four RECALL SETUP push buttons.
- **STORE.** Enables the store function. When STORE is pushed, all front-panel lights cycle off and on approximately 15 times to indicate that the front panel, as it is currently set up, can be stored. When one of the RECALL SETUP switches is pushed, the current front-panel setup is stored in the selected RECALL position. Calibrator cannot be stored.

Push any front-panel button, except RECALL SETUP, to cancel the STORE mode.

- **LEDS OFF.** Turns off the front-panel indicators when you push and hold the STORE button. Touching any front-panel switch turns them back on.
- **RECALL SETUP (1–2–3–4).** Recalls a front-panel setup from memory or selects the storage location for a front-panel setup. Each of the four switches operates with a memory location and the STORE button.

## 9. ROTATION (Trace)

The ROTATION control is a screwdriver adjustment that aligns the display with the graticule.

## 10. V CAL

V CAL is a screwdriver adjustment that sets the vertical amplifier gain. It is normally used with the CAL position of the REF switch.

## 11. H CAL

H CAL is a screwdriver adjustment that sets the time base. Can be used accurately with the CAL position of the REF switch in the 2H sweeps.

## 12. READOUT (Intensity)

The READOUT control adjusts the brightness of the readout portion of the CRT display, relative to the waveform intensity.

## Rear-Panel Connectors

Figure 2-4 is an illustration of the rear-panel. Refer to the following descriptions for functional information.

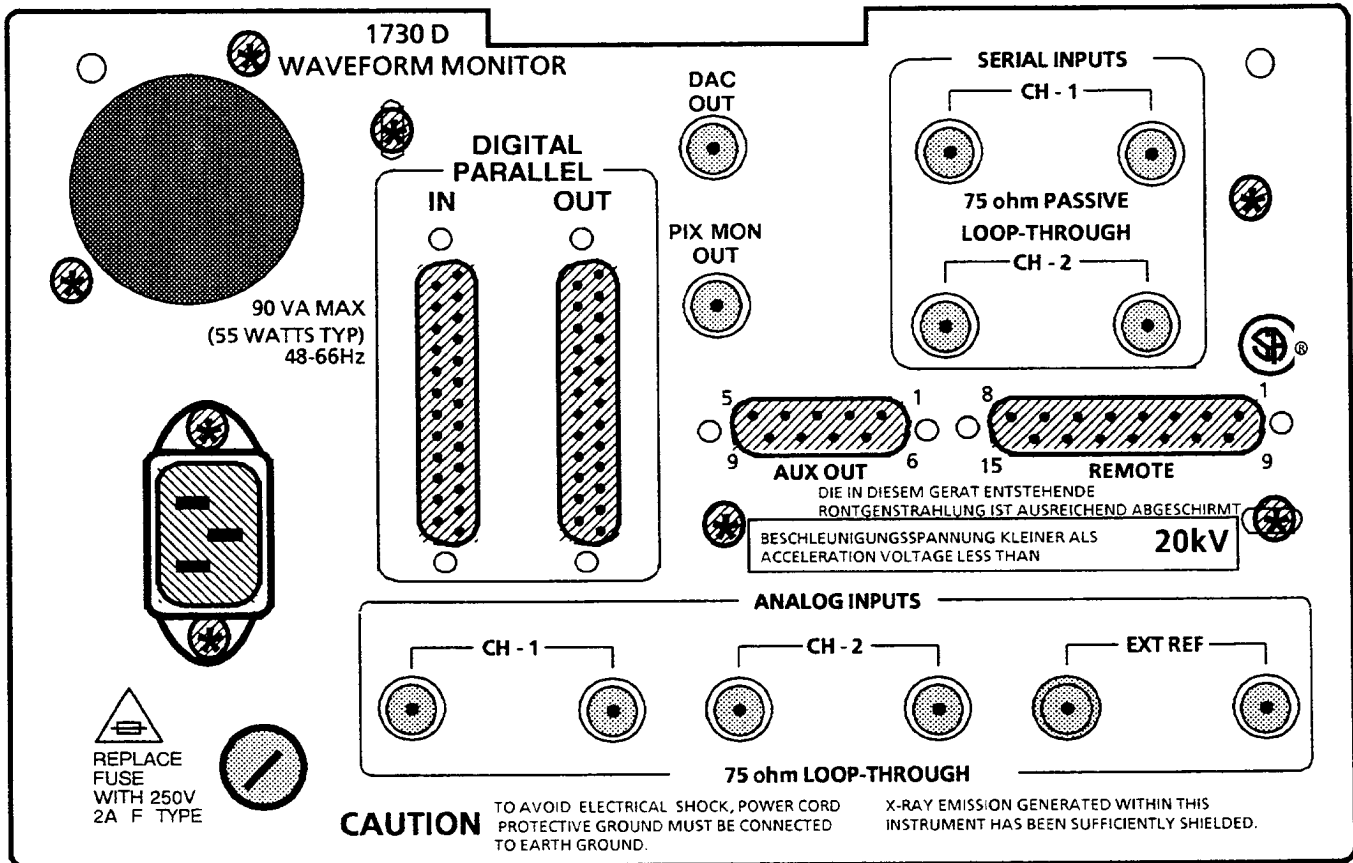


Figure 2-4: 1730D rear panel

### Loop-Through Inputs

### Serial Inputs.

CH-1. Passive loop-through video input (compensated for 75  $\Omega$ ), selected by the front-panel INPUT switches.

CH-2. Passive loop-through video input (compensated for 75  $\Omega$ ), selected by the front-panel INPUT switches.

**Analog Inputs.**

CH-1. Bridging loop-through video input (compensated for 75  $\Omega$ ), selected by the front-panel INPUT switches.

CH-2. Bridging loop-through video input (compensated for 75  $\Omega$ ), identical to CH-1, selected by the front-panel INPUT switches.

EXT REF. Loop-through synchronization input (compensated for 75  $\Omega$ ), selected by the front-panel REF switch. The input signal may be composite sync, black burst, or composite video.

**BNC Output Connectors**

**PIX MON.** A 75  $\Omega$  output signal that corresponds to the front-panel selected display. This signal has a bright-up in the LINE SELECT mode, and is used to drive a picture monitor.

**DAC OUT.** A 75  $\Omega$  filtered output of the Digital-to-Analog (DAC) conversion of the serial or parallel digital input.

**Multi-Pin Connectors**

**DIGITAL PARALLEL IN.** A 25-pin input connector for differential ECL input signals, requiring a minimum of 185 mV differential input.

**DIGITAL PARALLEL OUT.** This 25-pin connector provides active loop-through output of the parallel digital input.

**REMOTE.** A 15-pin D-type connector that provides limited remote control functions, such as four factory-preset front-panel setups.

Remote functions are activated by polled ground closure; only changes in remote input are responded to, allowing the front panel to be fully operational.

**AUXILIARY.** A 9-pin D-type connector to interface with the 1720-Series. Auxiliary control consists of a signal line and an interface bus. The bus provides the 1730D with control of the status of the 1720-Series.

**AC FUSE.** Holder for the instrument's mains fuse.

## 1730D Configure Menus

The front-panel MENU button accesses additional functions through the two Configure menus and a diagnostic menu. See Figure 2–5. Conditions set by menu selections are retained when the menu is exited. When exiting one of the configure or diagnostic menus, it takes two pushes of the MENU button to return to a signal display. Additional information about the Diagnostic menu can be found in the *Maintenance* section of this manual.

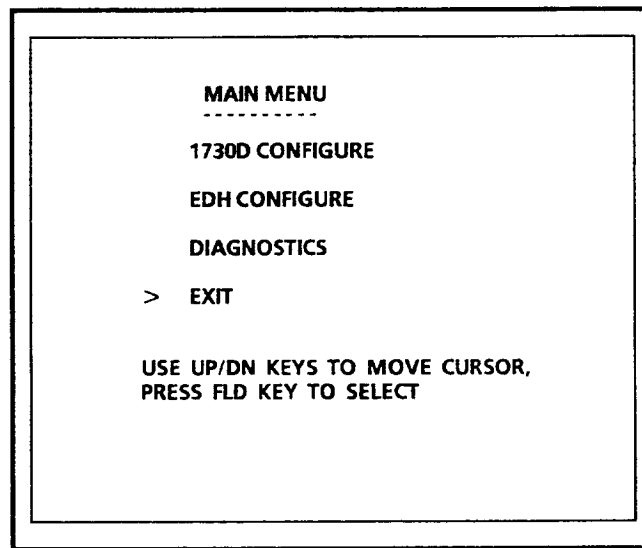


Figure 2–5: Main menu display

Once the main menu is displayed, it is possible to branch out into one of the other sub-menus, including the Configure menu shown in Figure 2–6 and the EDH Configure menu.



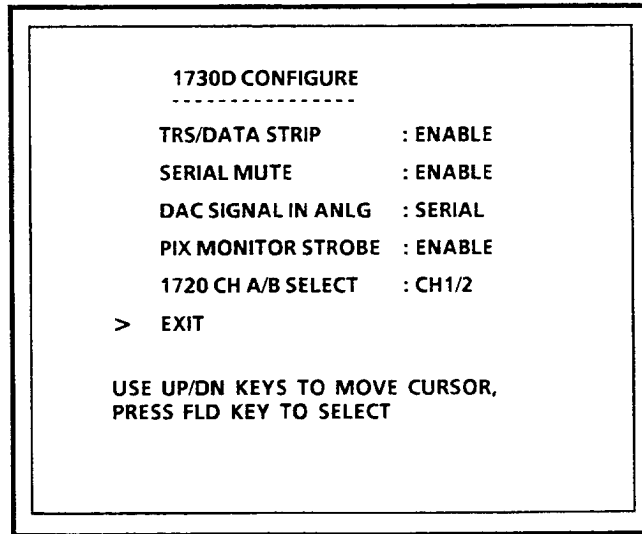


Figure 2–6: 1730D Configure menu (Factory shipped configuration)

## Instrument Configuration

Five selections are available through the 1730D Configure menu. The Line Select Up/Down buttons are used to move the cursor (>) up or down the list. When the cursor is at the choice, touching the FLD/MENU switch will toggle through the available options. The condition that is displayed will remain when the menu is exited.

### 1730D Configure Selections.

- TRS / DATA STRIP:

ENABLE: Strips off all recognizable Timing Reference Signals (TRS), line identification, and ancillary data.

LEGAL ONLY: Strips off only those TRS, line ID, and ancillary data signals that comply with the serial standard.

OFF: All data from the de-serializer is input to the Digital-to-Analog Converter (DAC).

- SERIAL MUTE:

ENABLE: Sets the de-serialized video data to 000 when the serial receiver detects no signal.

OFF: All data from the de-serializer is input to the DAC.

- DAC SIGNAL IN ANLG:

SERIAL: When analog input is selected, the input to the DAC is from the de-serializer. The rear-panel DAC out signal is from the SERIAL INPUT.

PARALLEL: The DAC input is from the PARALLEL INPUT when the analog input is selected. The rear-panel DAC out signal is from the PARALLEL INPUT.

- PIX MONITOR STROBE:

ENABLE: In the line select modes, the rear-panel PIX MON OUT signal has a bright-up pulse added to it.

OFF: No bright-up pulse is added to the PIX MON OUT signal in the line select modes.

- 1720 CH A / B SELECT:

When the 1720-Series is running in AUXILIARY mode, the front-panel switching for the 1730D also controls vectorscope operation. Inputs are controlled as follows:

CH1 / 2: When the 1730D is in CH 1, the 1720-Series is set to the CH A Input. When the 1730D is in CH 2, the 1720-Series is set to the CH B Input.

ANLG / DGTL: When the 1730D is in Analog mode, the 1720-Series is in CH A INPUT. When the 1730D is in Digital mode (PRL, SER, EYE), the 1720-Series is in CH B INPUT.

OFF: The 1720-Series INPUT switching is not affected by the 1730D INPUT selections.

**EDH Configure Selections.** It is necessary to change some of the EDH measurement criteria in order to get meaningful information for a specific EDH measurement application. Figure 2–7 shows the EDH Configure menu as shipped from the factory.

<b>EDH CONFIGURE</b>	
<b>ALARM LIGHT</b>	<b>:ENABLE</b>
<b>REMOTE ERROR FLAG</b>	<b>:ENABLE</b>
<b>REPORT ACTIVE PIX ERR</b>	<b>:YES</b>
..... <b>FULL FLD ERR</b>	<b>:YES</b>
..... <b>FORMAT ERR</b>	<b>:NO</b>
..... <b>ESP FLAGS</b>	<b>:NO</b>
..... <b>NO SIGNAL</b>	<b>:NO</b>
<b>FREEZE ON ERROR</b>	<b>:NO</b>
<b>&gt; EXIT</b>	
<b>USE UP / DN KEYS TO MOVE CURSOR, PRESS FLD KEY TO SELECT</b>	

**Figure 2–7: EDH Configure menu (factory shipped configuration)**

To change the EDH Configuration, move the cursor to select a function and then touch the Line Select FLD/MENU to toggle the selections. When all selections have been made, they are locked in by exiting the EDH Configure menu.

- **ALARM LIGHT:**
  - ENABLE: Alarm indicator turns on when a defined error condition occurs.
  - OFF: Alarm light does not come on.
- **REMOTE ERROR FLAG:**
  - ENABLE: Pin 8 of the rear-panel REMOTE connector goes low when a defined error condition occurs.
  - OFF: Pin 8 (Remote Error Flag) is always high.
- **REPORT ACTIVE PIX ERR:**
  - YES: Activates enabled alarms when an EDH active picture error occurs.
  - NO: No alarm activation is generated when an active picture error occurs.

■ . . . . . FULL FIELD ERR:

YES: Activates enabled alarms when an EDH detected full field error occurs.

NO: No alarm generated for an EDH detected full field error.

■ . . . . . FORMAT ERR:

YES: Activates enabled alarms when the co-processor detects a serial video format error. Detected errors include:

- Timing Reference Signal (TRS) missing.
- TRS placed incorrectly.
- Line or Field Identification incorrect.
- Line too long (>910 words).
- Field too long (>262 or 263 lines, depending on odd or even field).
- Reserved values used improperly.
- Data parity error.
- Ancillary data overrun.

NO: No alarm generated for format error.

■ . . . . . ESP FLAGS:

YES: Activates enabled alarms when an incoming Error Status Packet (ESP) flag is set. These flags generally indicate an error detected in the equipment sourcing the signal. ESP flags are a part of the EDH system.

NO: No alarm generated for ESP flags.

■ . . . . . NO SIGNAL:

YES: Activates enabled alarms when a no signal condition is detected by the serial receiver. The condition must last for at least 1 field.

NO: No alarm generated for a no signal condition.

■ . . . . . FREEZE ON ERROR:

YES: Continuously activates enabled alarms when a selected error condition occurs. EDH readout freezes the current status, including the real time clock. "Time Since Error" starts counting up from 00:00:00 when the freeze occurs, to determine when the error occurred. (The Freeze is cleared and rearmed by pushing the front-panel INPUT CH selection switch.)

NO: Selected error conditions are reported through enabled alarms only for the duration of the error.

## Diagnostic Tests

The 1730D incorporates a set of diagnostic routines that are accessed through the menu display. Push the MENU button and move the cursor with the UP/DN buttons until the cursor is on DIAGNOSTICS. Push the FLD [MENU] button to bring up the TEST MENU. Figure 2–8 is the Diagnostic menu.

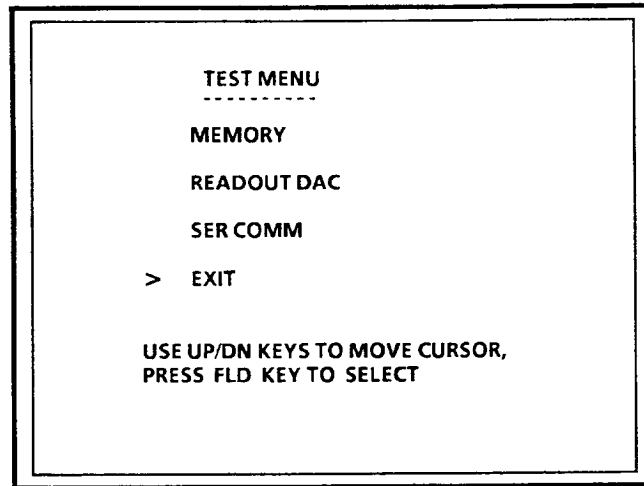
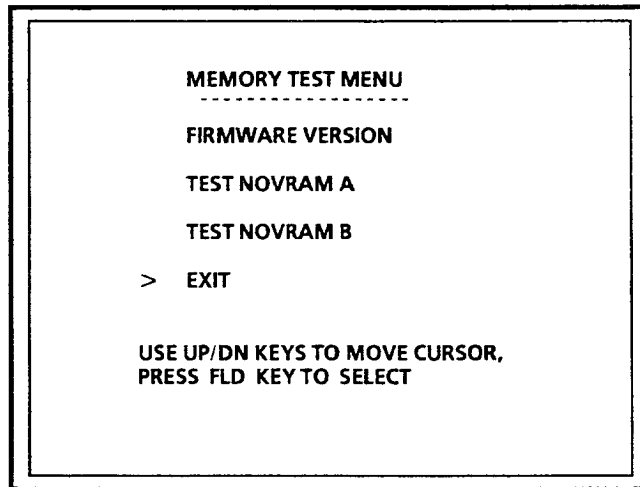


Figure 2–8: Diagnostic test menu display

### Test Menu Selections

Once the Test menu is displayed, there is a choice of Memory Tests, Serial Communication Tests, and graphic Digital-to-Analog Converter (DAC) Test. To select one of the tests, move the cursor (using the UP/DN keys) to the selection of choice and then push the FLD button.

**Memory Tests**     Selecting the Memory Tests provides a choice of the Firmware Version readout and Non-Volatile Random Access Memory (NOVRAM) Tests for both the A and B NOVRAMs. See Figure 2–9.



**Figure 2–9: Diagnostic memory test menu display**

**FIRMWARE VERSION:** Prints a message indicating the firmware version level and date. Other instrument-specific information may also appear. Included are the part number for the Read-Only-Memory (ROM), version number, code date, and copyright.

**TEST NOVRAM A or B:** Performs a read / write test on the selected NOVRAM A or B bank and prints out the status.

**SERIAL COMM.** Selecting the SER COMM Tests provides a choice of the 1720-Serial Communications or Serial Board Communications. See Figure 2–10.

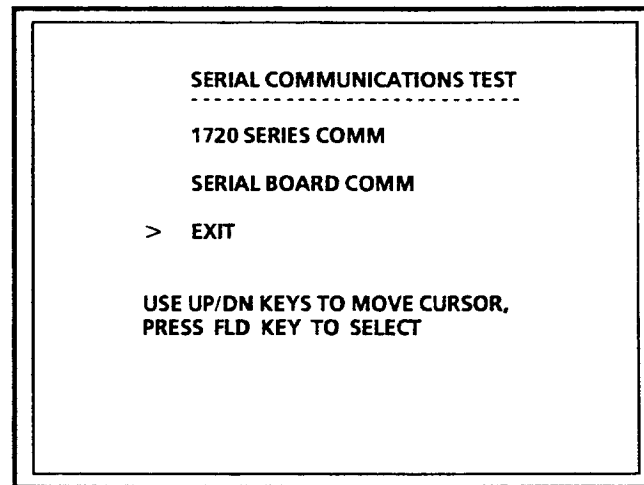


Figure 2–10: Serial communications test menu display

**1720 SERIES COMM:** Tests the serial communications path for a companion Tektronix 1720-Series vectorscope (pins 8 and 9 of the AUX connector).

**SERIAL BOARD COMM:** Tests the serial communications path between the main microprocessor and the serial board coprocessor.

**READOUT DAC.** Selecting the READOUT DAC brings up a test pattern showing that the Readout DAC is operational. See Figure 2-11. The test pattern is used to adjust the readout size and position.

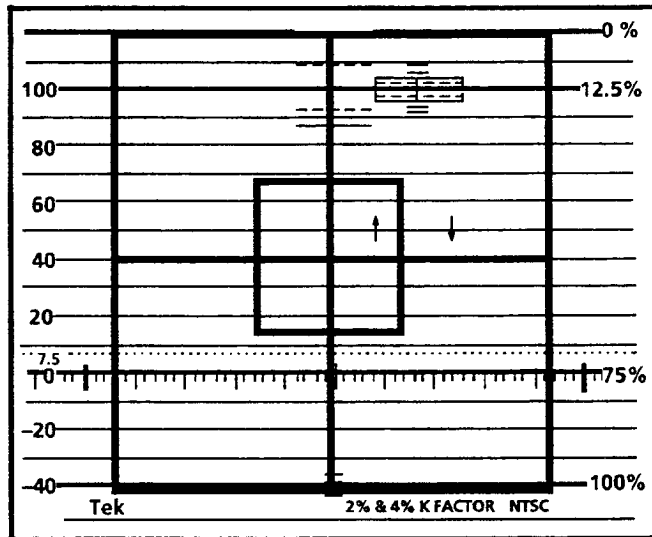


Figure 2-11: DAC test pattern superimposed on the 1730D graticule

Pushing any front-panel switch exits the DAC test pattern.



## EDH Readout

The front-panel READOUT button activates a CRT readout which gives information about the selected serial channel, such as error rate. Pressing READOUT toggles between the selected waveform display and the CRT readout. The readout can be entered from any mode except MENU.

There are two separate readout screens, one for Full Field (FF) error information, and the second for Active Picture (AP) error information. The upper half of each screen gives general information about the serial signal, such as the presence of embedded audio or the occurrence of serial format errors. The lower half of each screen gives error rate information, based on the Error Detection and Handling (EDH) system. EDH calculates a unique check word for each field of video at the signal source. These check words are sent with the serial video as ancillary data. At the receiver these check words are compared with those calculated for the received video. If they do not match, one or more data errors has occurred during the particular field. Specific information on the EDH system can be found in the February 1991 SMPTE Conference paper, "A Proposal for Error Detection and Handling in Studio Equipment," by Bob Elkind and Dave Fibush.

Figure 2–12 shows a typical Full Field screen, and will be used to explain the various screen messages. The Active Picture screen is very similar. The differences between the two screens are denoted in the following discussion.

### 1. AUDIO 1 2 3 4

Indicates the presence of up to 4 channels of AES/EBU embedded audio. A channel number is indicated if the proper data ID word is detected and the data valid bit is set. If no audio is present, this field is cleared.

### 2. OTHER ANC DATA

Indicates the presence of ancillary data other than AES/EBU audio and EDH. The field is cleared if ancillary data is absent.

### 3. FORMAT ERROR

This message appears if a serial format error occurs. Detected errors are:

- TRS missing or incorrectly positioned.
- Line or field ID incorrect.
- Line too long (>910 words).
- Field too long.
- Reserved data values used improperly.  
(*Video amplitudes outside of allowed ranges.*)
- Line/field ID or ancillary data parity error.
- Ancillary data overrun.

The message field is cleared if no format errors are detected.

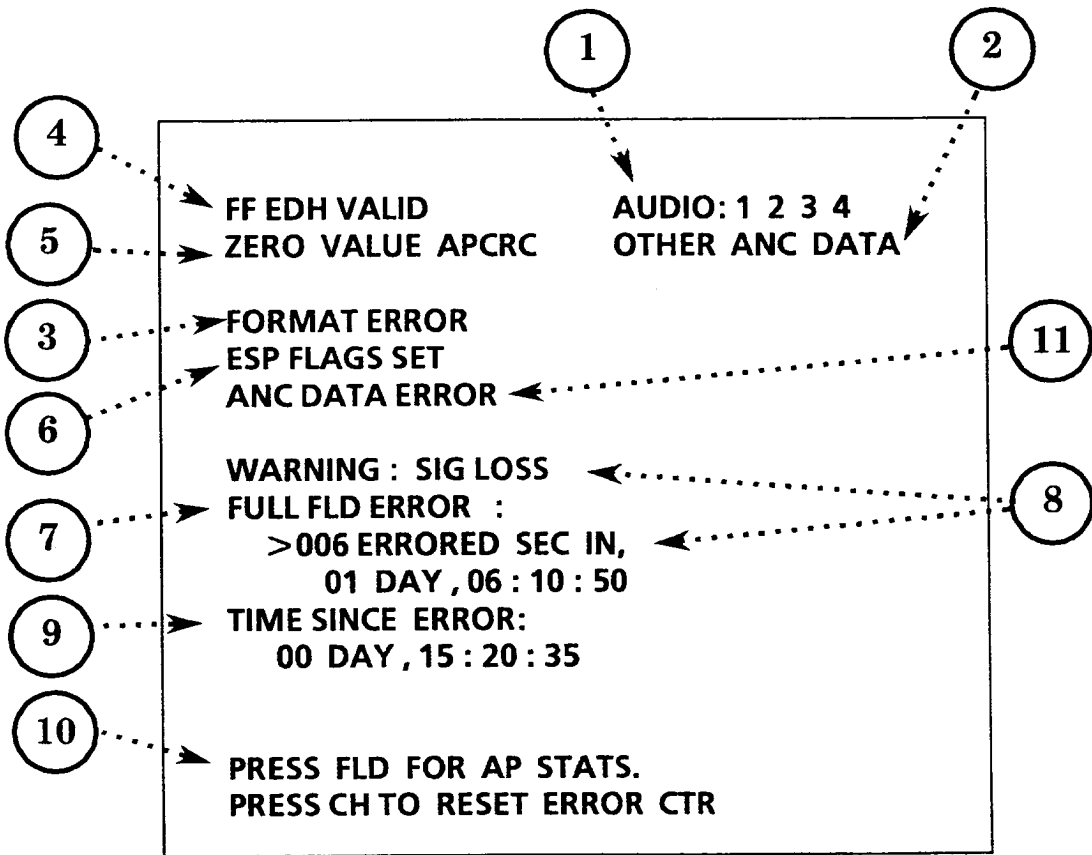


Figure 2-12: Full Field EDH readout screen

**4. FF EDH VALID** (Full Field screen only)

Indicates that valid EDH information exists to detect Full Field (FF) errors. If this information does not exist, FF EDH INVALID will be indicated and Full Field error statistics (7) will not be accumulated.

**AP EDH VALID** (Active Picture screen only)

Indicates that valid EDH information exists to detect active picture (AP) errors. If this information does not exist, AP EDH INVALID will be indicated and error statistics will not be accumulated unless a ZERO VALUE APCRC (5) is present.

**5. ZERO VALUE APCRC**

Indicates that at least 3 consecutive fields during the past 1 second had Active Picture CRC (APCRC) values of zero. Otherwise this message is cleared. Some signal sources, such as the Tektronix TSG 170D, Option 1S, have the capability to alter the last several data words in the video field so

that a CRC calculation yields zero. This processed signal can be used by the 1730D as an alternate means of calculating active picture error rate, by looking for fields where the APCRC is non-zero.

## 6. ESP FLAGS SET

Indicates that EDH Error Status Packet (ESP) flags are set. Source equipment can set these to indicate that certain types of errors have occurred. ESP flags are part of the EDH error system. If ESP flags have not been set, then this message is cleared.

## 7. FULL FIELD ERROR (Full Field screen only)

Indicates the number of program seconds containing at least one full field error and the length of time (days – hours – minutes – seconds) over which the error statistics were collected. All data values in the television field (including ancillary data) are monitored, except for samples in lines 10 through 12. The display is set to zero by pushing the INPUT channel button while the readout screen is displayed, or by a power up reset. Up to 999 errored seconds over 99 days can be monitored. If FF EDH INVALID (4) is indicated, the message “Full field error information not available” will appear. If the serial signal is absent, the message “Loss of signal” will appear.

### ACTIVE PIX ERROR (Active Picture screen only)

Identical to FULL FIELD ERROR, except that only the active picture area samples are monitored. There are three different operating modes, depending on the state of indicators (4) and (5):

AP EDH VALID : Conventional EDH. Compares the source-generated CRC check word to that calculated in the 1730D to determine errors.

AP EDH VALID, ZERO VALUE APCRC: Same as above.

AP EDH INVALID, ZERO VALUE APCRC : Checks to see if the 1730D CRC calculation is non-zero to determine errors.

AP EDH INVALID : No error statistics. Prints the message, “Active Picture information not available.”

## 8. > and WARNING

The accuracy of the error statistics can be affected if the serial signal temporarily goes away (no statistics gathered), if EDH becomes invalid (no statistics gathered), or if a serial channel switch occurs (compiling statistics from two different sources). If any of these conditions occur, a > symbol is placed in front of the errored seconds readout to warn that it may be inaccurate. A warning message will appear, identifying the event(s) that occurred:

SIG LOSS : Serial signal absent.

EDH INVALID : EDH became invalid (Full Field and Active Picture tracked separately, depending on the screen being viewed).

CH SW : Serial Channel 1/2 switch has occurred.

The warnings are removed when the error display is reset.

## 9. TIME SINCE ERROR

Indicates the elapsed time, in days – hours – minutes – seconds since the last error occurred. As with the errored seconds display, data is separately compiled for full field and active picture errors. Upon each new error, the timer resets to zero and begins to count up. If no errors have occurred, the time fields are filled with “-”.

If FREEZE ON ERROR is enabled (see “EDH Configure Selections”) and a selected error condition occurs, the TIME SINCE ERROR resets to zero and begins to count up. This makes it possible to determine when the freeze occurred.

## 10. PRESS. . .

Pressing the FLD switch toggles between the full field and active picture screens. Pressing CH (under INPUT) will reset the error counter and elapsed time readings for both screens.

---

**NOTE.** *To eliminate the possibility of accidentally resetting the error counters, the 1730D error counters can only be reset by pressing the CH switch while viewing the readout screen or powering down.*

---

## 11. ANC DATA ERROR

Indicates an ancillary data checksum error.

It is always best to enter the READOUT from a serial mode: SER, EYE, or EQ. By observing the state of the channel switch, it is obvious which channel the information is gathered from.

## Graticules

The graticule used by the 1730D is a 525 line/60 Hz NTSC Composite scale. The graticule pattern is internal with edge illumination.

Because the internal graticule is on the same plane as the CRT phosphor, it eliminates viewing and photographic parallax errors. The graticule is illuminated, using a front-panel SCALE adjust control, so that the level of graticule brightness can be adjusted to optimize for viewing or photographing needs.

### NTSC Composite Video Graticule Vertical Scales

The NTSC graticule has two main vertical scales to facilitate typical measurements. See Figure 2–13. The left side scale is marked in IRE units and extends from –50 to +120 IRE in 10-IRE increments. An IRE unit is equal to 7.14 mV. Black level setup is denoted by a dashed line at 7.5 IRE.

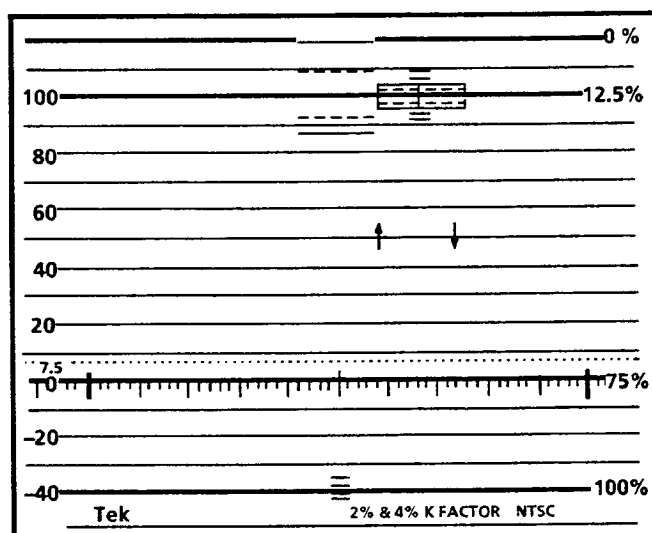


Figure 2–13: NTSC graticule

There are  $\pm 2$  IRE and  $\pm 4$  IRE markings at the center of the –40 IRE line (sync tip) to assist in measuring sync amplitude. This scale is designed to be used with the 2 LINE or 2FLD Sweep rates.

The scale on the right side of the graticule is for measuring depth of modulation. The scale extends from 0% at the 120 IRE line to 100% at sync tip (–40 IRE line).

The boxed area slightly to the right of center at the 100 IRE level is scaled in 2% and 4% increments for precise tilt measurements. This structure is designed to work with an 18  $\mu$ s, half-amplitude duration (HAD) 2T bar. The set of solid and short dashed lines to the left of the bar tilt measurement structure is used to

measure pulse-to-bar ratio; they are weighted to include K-Factor ratings of 2% and 4%.

**Making Measurements.** To use the NTSC vertical scale to make line-time distortion and pulse-to-bar ratio measurements, set the signal blanking level at the graticule blanking line (0 IRE) and position the leading edge of the Composite Test Signal bar to the ascending arrow (just right of graticule center). Check to see if insertion gain is unity. If it is not, adjust the 1730-Series VAR for exactly 100 IRE of signal amplitude from baseline to the middle of the white bar. Check to see that the negative-going bar transition passes through the descending arrow.

To measure the K-Factor line-time distortion, measure the largest deviation of the bar top (tilt or rounding) within the structure. The structure is designed to ignore the first and last 1  $\mu$ s of the bar where short-time distortions (ringing, overshoot, undershoot, etc.) occur. The solid outer box equals a 4% K-Factor, while the dashed line inner box equals a 2% K-Factor. (For signals with a bar half-amplitude duration that exceeds 18  $\mu$ s, measure the bar top in increments by positioning the bar to the left or right from the leading or trailing edge. Note that when the leading or trailing edge is on the appropriate arrow, the first or last 1  $\mu$ s is automatically excluded from the measurement.)

Pulse-to-bar K-Factor measurements are made using the solid and short dashed lines to the left of the line-time distortion structure. These lines are scaled according to the following formulas:

$$\frac{1}{(1 - 4K)} \text{ and } \frac{1}{(1 + 4K)}$$

Where:            K=0.02 for 2% K-Factor (dashed lines)  
                       K=0.04 for 4% K-Factor (dashed lines)

Calibrated 5X Gain increases resolution to 0.4% and 0.8%.

This scaling is described in detail in CCIR Standard Volume 5, 1966.

Make sure that the center of the bar is at 100 IRE when blanking level is at 0 IRE (use VAR to adjust gain, if necessary). If necessary, use the HORIZONTAL Position control to place the 2T pulse over the measurement area and measure its amplitude. The top of the pulse falling within the dashed lines equals less than 2% K-Factor.

**Horizontal Scales for NTSC Graticules**

The Horizontal reference line is the baseline at 0 IRE. This timing line is 12 divisions long, and takes on different timing intervals depending on the sweep rate selected. In 2 LINE Sweep each major division is 10  $\mu$ s, and when magnified (X10), each major division equals 1  $\mu$ s. In 1 LINE Sweep each major division is equal to 5  $\mu$ s, and when magnified (X25) each major division equals

0.2  $\mu$ s. In 2FLD Sweep the timing scale is of no real value, since this is a monitoring mode; however when 2FLD Sweep is magnified (X25) the entire vertical (field) interval can be displayed.

## RGB/YRGB Display

RGB staircase signals, either 3- or 4-step, are input to the 1730D through the rear-panel REMOTE connector. A 10 V input will provide a horizontal sweep length between 7.6 and 10.4 major graticule divisions. An adjustment on the Main circuit board (A3R170) can be used to adjust for offsets in various staircase signals. RGB sweep is enabled by a TTL low, which can be a ground closure applied to pin 2 of the rear-panel 15-pin connector. (There is a connector drawing in Section 8, *Installation*, of this manual.) The staircase signal is input through pin 1 of the connector.

Field and line rate displays, controlled by front-panel SWEEP settings, are available. These sweep rates can be magnified (2 LINE X10 and 2FLD or 1 LINE X25). In addition, a low (ground closure) at pin 3, when 2FLD Sweep is selected, provides a 1 Field Sweep.

## Preset Front-Panel Measurements

The 1730D has four front-panel setups stored in internal memory. A TTL low (or ground closure) on one of the PRESET enables (pins 12 through 15 of the REMOTE connector) selects one of these pre-programmed, front-panel setups. Table 2–1 shows the preset front panels that are stored in memory.

Table 2–1: Preset Front Panels

Front-Panel Control	Preset 1 (pin 13)	Preset 2 (pin 14)	Preset 3 (pin 15)	Preset 4 (pin 12)
INPUT				
Channel	ANLG – CH 1	ANLG – CH 1	ANLG – CH 1	ANLG – CH 1
REF	EXT	INT	INT	INT
FILTER	FLAT	FLAT	FLAT	FLAT
VERTICAL				
GAIN (VAR)	off	off	off	off
GAIN (X5)	off	off	off	off
DC REST	OFF	OFF	SLOW	SLOW
HORIZONTAL				
FIELD	FLD1	—	ALL	FLD1
SWEEP	2FLD	2 LINE	1 LINE	2 LINE

Table 2-1: Preset Front Panels (Cont.)

Front-Panel Control	Preset 1 (pin 13)	Preset 2 (pin 14)	Preset 3 (pin 15)	Preset 4 (pin 12)
MAG	off	off	off	off
FIELD		ALL	ALL	
LINE SELECT				
ON/15LINE	off	15LINE	ON	off
LINE		100	19	

## Remote Sync

Pin 10 of the REMOTE connector is a remote sync input. A 30 or 60 Hz square wave signal with an amplitude of 2 to 5 V will trigger the 1730D 2FLD Sweep. In addition, a 4 V composite sync signal can also be used as a remote sync signal. Pin 4, when pulled low (TTL low or ground) enables the Remote Sync triggering.

## 90 Hz NTSC Trigger

Pin 10 of the REMOTE connector (/REM SYNC IN) is also used as the input for 90 Hz triggering associated with D2 VTRs. The internal remote Sync Polarity jumper (A3J5) has to be moved to accept this trigger signal. See *Installation*, beginning on page 8-7.

When the internal jumper has been reset and pin 4 (/REM SYNC EN) is grounded, the 90 Hz triggering is enabled. Once the jumper is enabled and 2FLD Sweep is selected, a 2 V or greater 90 Hz square wave, applied to REMOTE connector pin 10 (/REM SYNC IN), will trigger a 1-field sweep.





# Reference



# Measurement Applications

The 1730D is designed to work in a broad variety of composite video applications, both analog and digital. This monitor supports all of the analog measurement capabilities of the familiar 1730 Waveform Monitor. It also features 10 bit parallel and serial video inputs which are converted to analog by a high quality Digital-to-Analog Converter (DAC), allowing inspection of these signals in the familiar composite domain. Rear-panel DAC OUT and PIX MON OUT outputs allow for connecting this monitor to other measurement and monitoring equipment.

For serial video signals, this monitor has additional measurement features to help troubleshoot and maintain the digital link itself. The EYE mode provides an eye pattern display of the bit stream. Eye patterns are formed by triggering an oscilloscope at some fraction of the clock frequency while applying the bit stream to the vertical channel. The resulting overlaid display shows the region over which the transmitted levels can be unambiguously separated, called the “eye opening” of the signal. Eye patterns can help diagnose signal source and transmission channel impairments.

The 1730D also features serial error rate monitoring, based on the Error Detection and Handling (EDH) system. Error statistics are compiled for both the active picture and the entire video field, including ancillary data. A unique mode, zero Active Picture Cyclical Redundancy Code (APCRC), allows error monitoring in parallel domain equipment. Limited digital format checking is also provided. The freeze on error mode gives the instrument glitch capture capability, holding the error and allowing determination of when the error occurred. These features are described in the *1730D Configure Menus* on page 2–10 and *EDH Readout* on page 2–19. The following applications information is intended to highlight some of the serial digital measurements that can be made with this instrument.

## Where To Use The Serial Digital Monitor

The serial digital monitor can operate almost anywhere in the distribution system due to its high impedance, bridging, loop-through design. However there are specific measurement applications, in the serial distribution system, that require specific connections of the monitor to be effective.

Because most serial equipment employs a receiver and then later regenerates the output signal, routing the incoming serial signal through one of the loop-through inputs, while connecting the output of the device to the other loop-through (for either further distribution or termination) allows a check of both the incoming signal and the equalized regenerated output signal. See Figure 3–1.

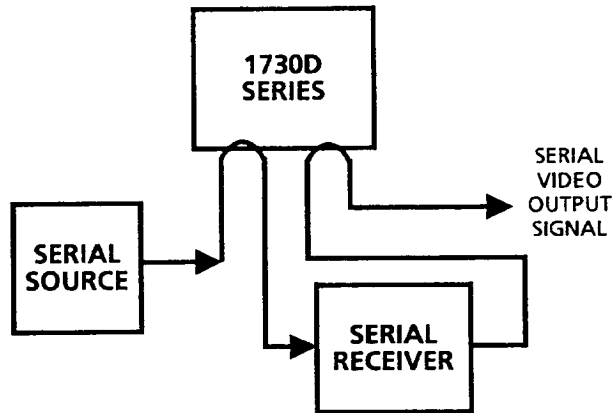


Figure 3-1: Monitoring the video bit stream into and out of a serial receiver, such as a VTR

The 1730D monitor can be used to check serial digital signals around a routing switcher. It is possible to look at all the inputs to the switcher with the use of a patch panel and the serial monitor. See Figure 3-2.

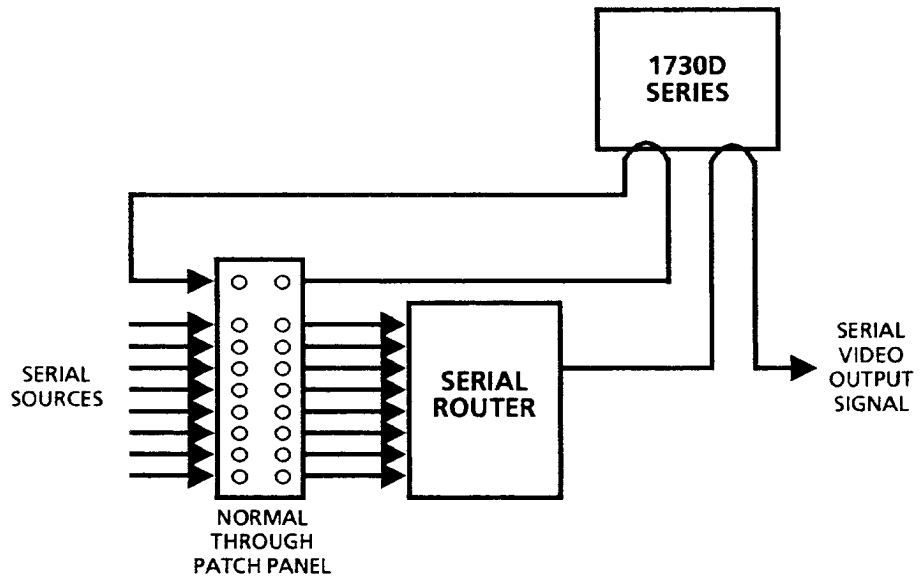


Figure 3-2: A method to check out both serial inputs and the output of a routing switcher using a single serial monitor

## Line Termination

The 1730D uses passive loop-through serial inputs, similar in concept to those commonly found in baseband video equipment. Accordingly, the loop-through must be terminated externally. It is important that this external termination meet accuracy and return loss requirements.

If the instrument is installed to monitor an operating link, with the serial source on one side of the loop-through and the destination receiver on the other side, the destination receiver (and the cable between it and the loop-through) serves as the termination. This is the preferred monitoring connection because the performance of the entire serial path can be inspected. The return loss of the 1730D is sufficiently high that, in most cases, the system return loss will be set by that of the destination receiver.

In cases where the 1730D is placed at the end of a link, a BNC termination must be installed on the other side of the loop-through. This connection might be used to measure a source, for example. The termination must be 75  $\Omega$ , and its return loss should exceed 20 dB from 10 kHz to 270 MHz. It is preferable that it be DC coupled (good return loss extends to DC). Good return loss is most important from 1 MHz to 150 MHz; 25 dB or better in these frequency ranges is preferred. Terminators meeting these specifications are available from several manufacturers. Be aware that good return loss at baseband video frequencies (DC to 6 MHz) does not guarantee good high frequency return loss.

A terminator can be inspected for return loss problems using the 1730D and a serial source with low aberrations, such as the TEKTRONIX TSG170D, Option 1S Digital Composite Generator. Connect the generator serial output to one side of the 1730D loop-through and place the terminator on the other side. Select the EYE mode and observe the eye pattern, paying particular attention to leading edge aberrations.

Figure 3–3 shows the eye pattern with a good return loss terminator and Figure 3–4 shows the eye pattern of a terminator having only 13 dB return loss at 100 MHz (capacitive). Terminations causing aberrations of under 10% should be acceptable.

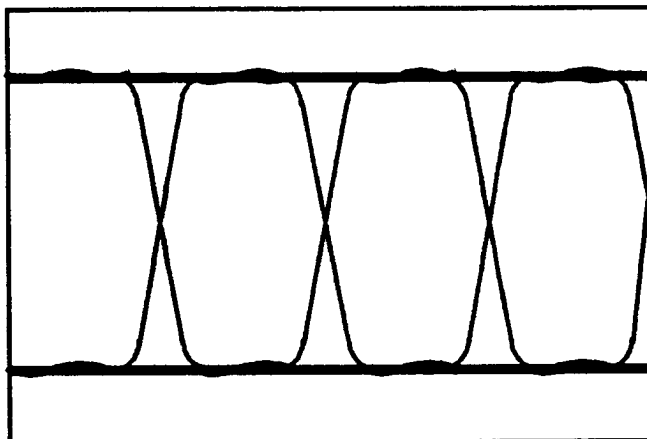


Figure 3-3: Eye pattern display of a termination with good return loss

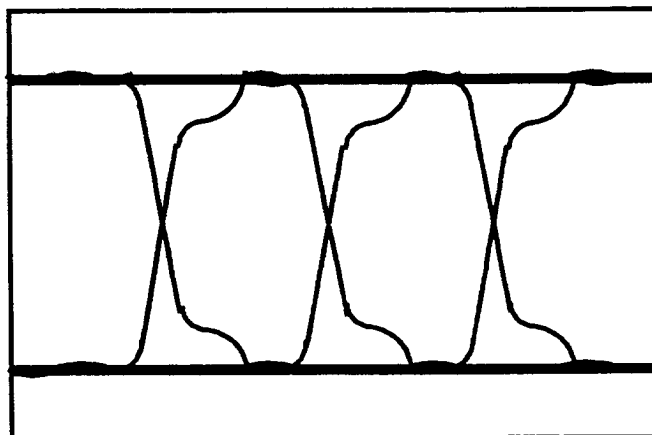


Figure 3-4: Eye pattern display of a termination with poor return loss

One final note: Most video equipment BNC connectors, whether 50  $\Omega$  or 75  $\Omega$ , use a 50  $\Omega$  standard center pin. Some laboratory 75  $\Omega$  BNC connectors use a smaller diameter center pin. The BNC connectors on the 1730D are designed to work with the 50  $\Omega$  standard (large diameter) center pins.

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**NOTE.** Do not use connectors or terminators with the smaller center pins. They could cause an intermittent connection.

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## Using The Eye Pattern

The eye pattern display allows viewing and characterization of the serial bit stream. The amplitude, risetime, jitter, and pulse shape of this signal can be examined. Two modes of operation are provided by the EYE and EQ EYE displays.

In EYE mode the serial signal, as it appears at the rear-panel loop-through input connector, is displayed. Accurate assessments of pulse shape can be made in this mode. For example, a serial source can be examined for proper wave shape by connecting it to the 1730D with a short (<2 meter) cable.

In situations where the monitor is installed near the end of a long cable run, the EYE mode will show what appears as a band of noise. The serial signal is still there, but has been heavily attenuated by the coaxial cable loss. Serial receivers compensate for this by employing equalization. Ideally, this restores the wave shape to what it was at the source. In EQ EYE, the output of the monitor's serial receiver equalizer is displayed. This allows the eye pattern to be viewed even after several hundred meters of coax.

The EQ EYE mode is most useful for establishing signal continuity in a long cable. It can also help indicate severe pulse distortion, perhaps caused by cabling problems. Small distortions are masked in this mode because of the cable loss and band limiting in the receiver equalizer. Since the equalizer output signal amplitude is virtually constant over a large range of cable loss, no determination of input signal amplitude can be made. EQ EYE should be regarded as an uncalibrated, qualitative measurement mode.

A good rule of thumb is to use EYE mode whenever possible. This allows calibrated amplitude measurements, and pulse distortions are generally most visible in this mode. Use the EQ EYE mode when EYE mode fails to provide a useful signal.

## Measuring Signal Sources

Tentative standards for the serial system specify the output waveform of signal sources. See Figure 3–5. The EYE mode can be used to make many of these measurements. Connect the signal source to the monitor with a short length of 75  $\Omega$  cable (<2 meters). High quality, low loss coaxial cable, such as Belden 8281, should be used. A 75  $\Omega$  terminator having a return loss of at least 20 dB to 150 MHz should be placed on the other side of the loop-through input. Figure 3–6 shows a representative test connection.

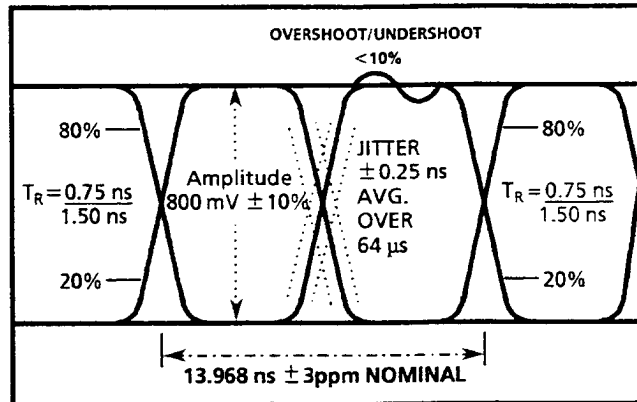


Figure 3-5: Serial Waveform Specifications: simulation of a typical serial generator output as shown with an eye pattern.

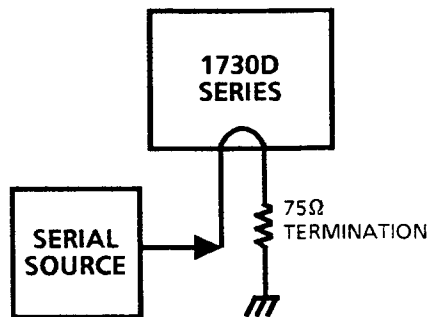


Figure 3-6: Measuring a video source

**Amplitude Measurements**

Select the desired input channel. Check that the vertical gain is calibrated (not in X5 or VAR). Verify the vertical calibration with the monitor’s internal calibrator; displayed calibrator amplitude should be 140 IRE (1 volt). Next return the monitor to the EYE display. The display is calibrated at 100 mV per division.

Signal sources should measure 800 mV p-to-p ±10%. Signal amplitudes outside of this range can degrade receiver performance. Experience has shown that proper amplitude is important.

**Risetime Measurements**

Adjust the monitor VAR GAIN for a display of exactly 10 major divisions in amplitude. Position the bottom of the display to the -20 IRE and use the HORIZONTAL Position control to place a rising transition on a major horizontal graticule mark. Without moving the HORIZONTAL Position control, use the VERTICAL Position control to move the top of the display down to +20 IRE.



Measure the interval from the original major graticule mark to where the crossing now occurs. See Figure 3–7. This is the risetime from 20-80%. Horizontal calibration is 2 ns per major division (0.4 ns per minor division).

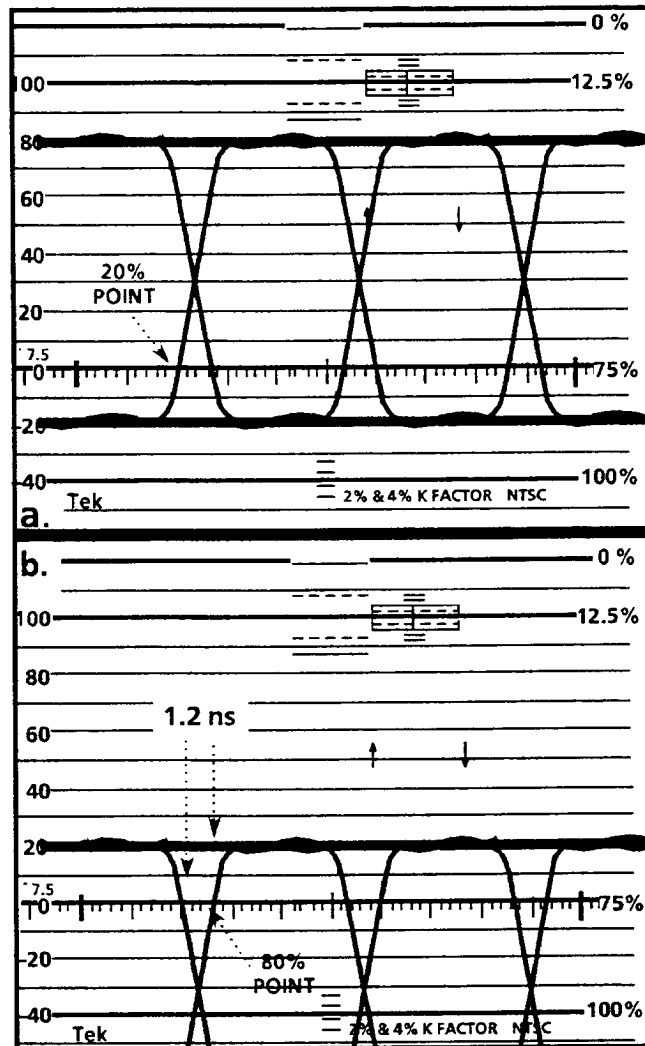


Figure 3–7: A simulation of the eye pattern risetime measurement: a. aligning the 20% point. b. Waveform shifted down to measure the 80% point

The 1730D eye pattern display has a –3 dB bandwidth of at least 225 MHz. This is a 20-80% risetime of just under 1.0 ns. Signal sources should have a risetime of 0.75 to 1.5 ns (20-80%). This will be displayed as 1.1 to 1.8 ns due to the instrument bandwidth. Proper risetime is not particularly critical; experience has shown little difference in receiver performance with up to 2 ns risetimes. Falltime is measured in exactly the same manner as risetime.

### Jitter Measurements

Timing jitter is the deviation of individual rising and falling transitions from the reference clock transitions. Ideally all transitions should occur at equal intervals. But additive noise, pulse distortion, and variations in bit patterns all combine to cause jitter. Jitter results in eye closure along the time axis, or narrowing the window in which the data values can be accurately determined. Data errors result if the eye opening becomes too small.

The 1730D serial receiver extracts the clock signal and uses it to lock a crystal oscillator in the eye display time base. The result is a heavily averaged, highly stable trigger for the eye display. The time base does not follow jitter in the recovered clock, except for components below 20 Hz, which means all serial signal jitter above 20 Hz is displayed.

To measure jitter, position an eye crossing to the graticule baseline. (The measurement is easier to make if the 1730D X5 Vertical Magnifier is turned on.) Measure the width of the transitions at the eye crossing. Horizontal calibration is 2 ns per major division (400 ps per minor division).

Tentative jitter standards specify 500 ps p-to-p, averaged over 64  $\mu$ s. This averaging time was picked because most receiver clock recovery circuits have at least 15 kHz bandwidth and will follow lower jitter frequencies. The 1730D uses a significantly longer averaging time to allow the viewing of any jitter components above 20 Hz. If jitter in the 20 Hz to 15 kHz range is present, the 1730D will give a pessimistic answer when compared with a 64  $\mu$ s averaged measurement.

Serial system sensitivity to jitter is dependent on several factors: clock recovery bandwidth, the frequency and Probability Density Function of the jitter, the number of repeaters in the system, and pulse distortion. Accordingly, the 500 ps specification does not guarantee that a system will work, only that it will behave similarly on a variety of sources. Experience to date has shown that if wideband jitter, as indicated by the serial waveform monitor, is less than 1 ns p-to-p, there will be no performance degradation.

### Aberration Measurements

Serial sources should produce good signal transitions, with a minimum of overshoot and ringing. Although there is no specification for this, aberrations should be kept to 10% of the signal amplitude. At this level they are not likely to degrade system performance.

To measure aberrations with the 1730D Serial Waveform Monitor, use the Variable Gain to obtain a 10 division display. Aberrations should not exceed  $\pm 1$  division.

Since the Eye display bandwidth is 225 MHz, it will not faithfully display aberrations that are faster than this. But most receiver circuits are band limited and usually ignore very fast transients. Accordingly, the 1730D Serial Waveform Monitor is a good predictor of problem sources in most systems.

## Monitoring Transmission Channels

The high bit rate of the serial system (143 Mb/s, NTSC) places severe demands on a coaxial channel. Impedance discontinuities in the cable path will create reflections, causing pulse distortion and eye pattern closure. Further, the coax loss, expressed in dB, is assumed to increase with the square root of the frequency. Variations in this loss characteristic can cause problems for receiver equalizers.

The 1730D can help locate channel problems. Its passive loop-through allows monitoring an operating system at a variety of points. By observing the system at several locations, from the signal source to the destination receiver, channel problems can be discovered and pinpointed. This is especially useful when you check a newly installed system.

Different kinds of faults have different eye pattern signatures. Figures 3–8 through 3–13 show the effects of some typical channel faults.

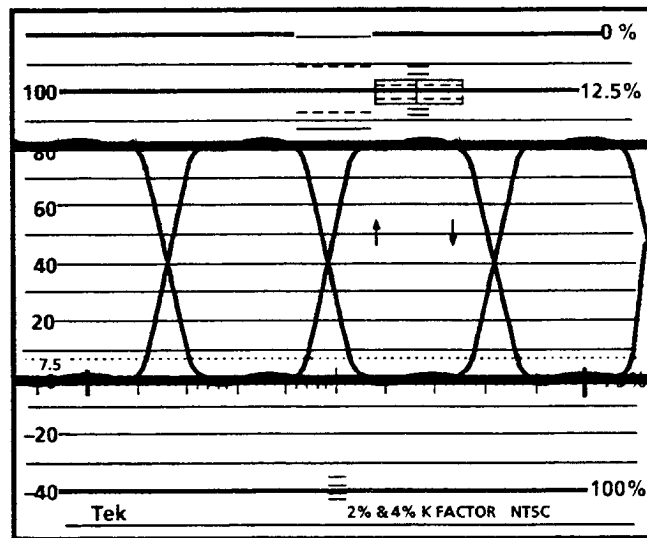


Figure 3–8: Normal eye pattern display

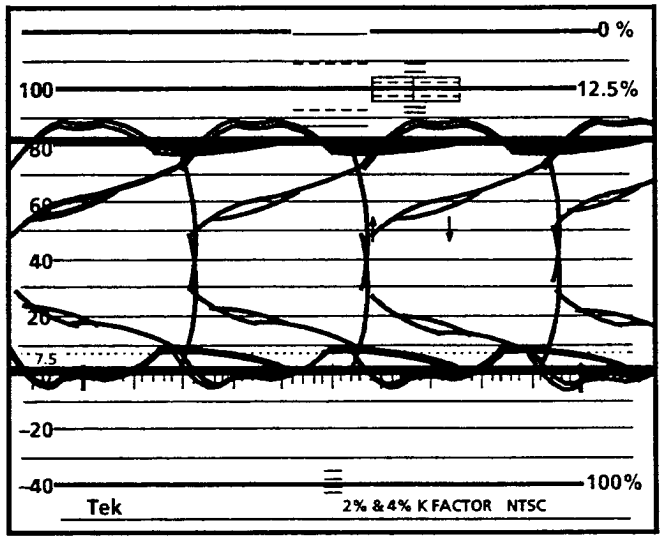


Figure 3-9: The effect of an 18 inch open stub

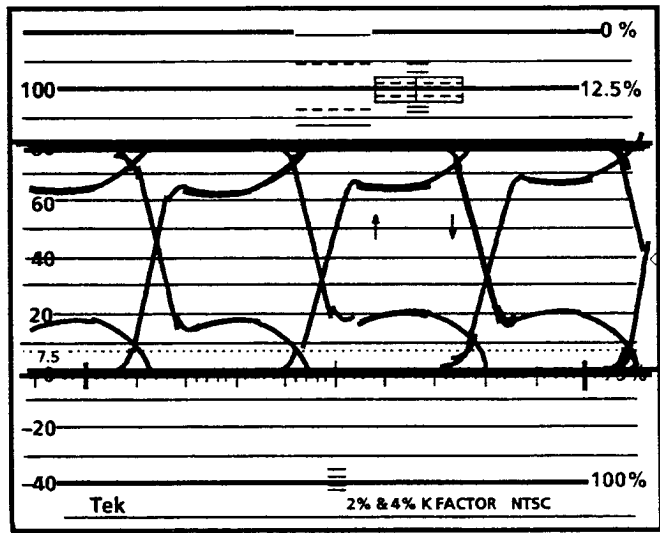


Figure 3-10: Effects of an 18 inch, 50 line section, installed between the destination receiver and the 1730D Serial Waveform Monitor

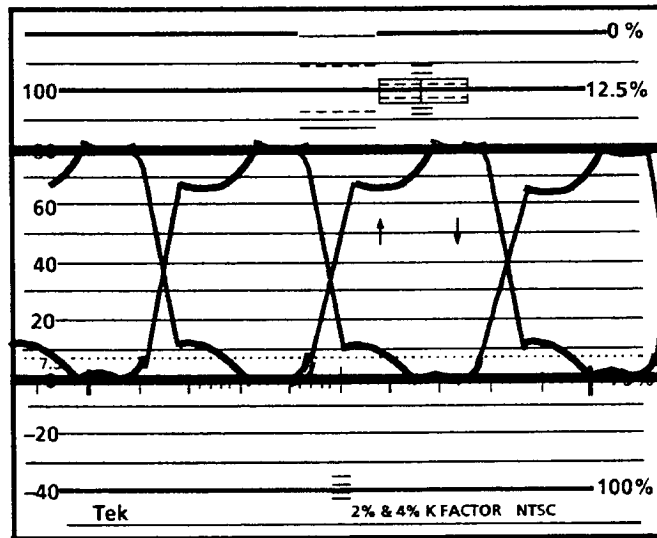


Figure 3-11: Poor return loss at the destination receiver (capacitive shunt)

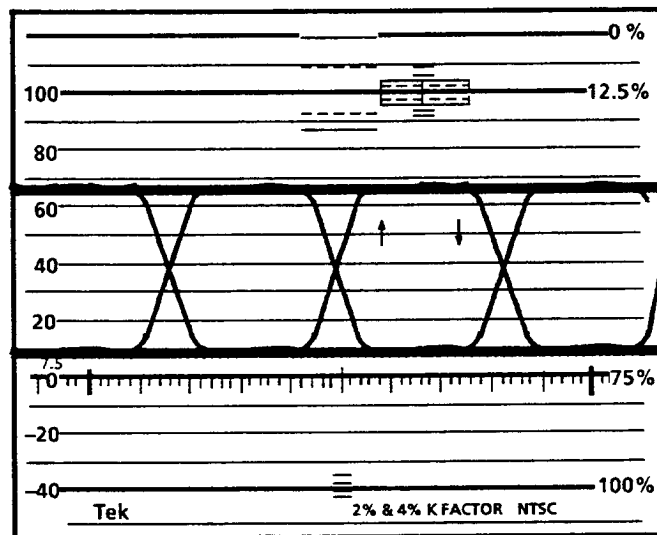


Figure 3-12: Broadband attenuation (not  $1/\text{Sq. Rt frequency}$ ) in the channel, shown in EYE mode

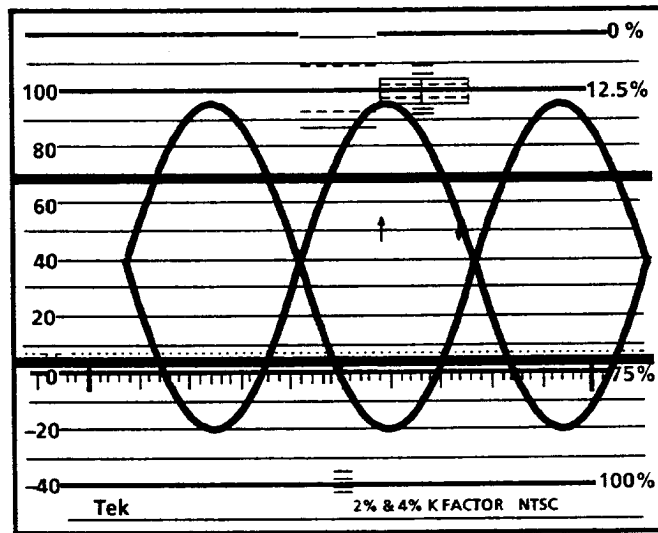


Figure 3-13: Broadband attenuation in the channel in EQ EYE mode. Note the high frequency peaking

## Using EDH

The 1730D can help determine the error rate in a serial system, along with providing limited digital diagnostics. Many of these features are explained in the *EDH Readout* discussion earlier on page 2-19. Some representative test and monitoring connections are described here.

### Point-to-Point Error Rate Measurement

Connect the equipment as shown in Figure 3-14. The source must insert the EDH signal. If the source does not contain EDH, an alternate source, such as the TEKTRONIX TSG 170D Option 1S generator, can be used. This substitution is allowed because the output waveforms of sources are standardized. The 1730D is connected to the regenerated serial output of the destination receiver. This output must pass ancillary data present on line 9. Active picture and full field error information can then be observed with the EDH readout.

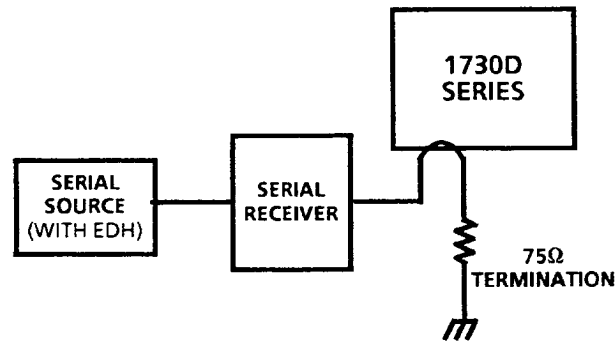


Figure 3–14: Equipment connections for point-to-point error measurements

This measurement method assumes that the regenerated serial output contains the same errors that occur in the destination receiver. This is generally true because the regenerated serial output is usually derived from the equalized and detected input signal, and it is in this signal processing block that most detection errors occur.

### Error Rate Measurement for a Chain of Repeaters

Connect the 1730D serial input to the output of the last repeater in the chain. The repeaters must all pass ancillary data on line 9 and the signal source must contain EDH. Observe errors with the EDH Readout.

### Error Rate Measurements for Bit Parallel Equipment

The EDH system relies on a transmitted CRC check word that is carried as ancillary data in the serial signal. Ancillary data is not allowed in bit parallel composite signals. Parallel equipment, or serial equipment that strips off incoming ancillary data will not support standard EDH error measurements.

An alternative way to measure error rate in these situations is with the Zero-Value APCRC. At the signal source, the last several data words in the active picture area are modified so that a CRC calculation for the active picture yields zero. This preprocessing of the signal eliminates the need for sending a CRC with each field of video; only fields containing errors will give a non-zero CRC at the receiver.

The 1730D supports Zero-Value APCRC measurements, when used with a properly coded source such as the Tektronix TSG 170D Option 1S generator. The EDH readout will indicate if an incoming Zero-Value CRC is present and therefore if this mode is available. See “EDH Readout,” in Section 2.

The 1730D Zero-Value APCRC error measurements are only available for the serial inputs. To measure bit parallel equipment, a Parallel-to-Serial converter is necessary. See Figure 3–15.

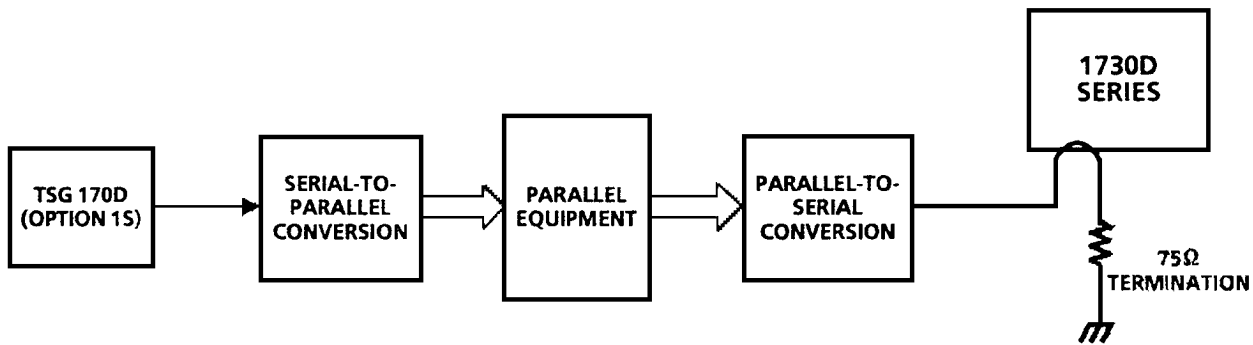


Figure 3-15: Connections for measuring parallel equipment

### Connecting a 1720-Series Vectorscope

A vectorscope can be connected to the 1730D for more complete composite signal monitoring. The TEKTRONIX 1720-Series is recommended, because while in Auxiliary mode, it can be controlled by the 1730D. (The 1720 SCH-Series is suggested if SCH monitoring is needed.) These recommended connections are discussed in the following paragraphs.

#### Analog Only Signal Monitoring

Loop the first video signal through the 1730D rear-panel CHANNEL 1 ANALOG loop-through and connect it to the 1720-Series rear-panel CH A input. Terminate with a 75 Ω termination. Connect the second video signal to the rear-panel CHANNEL 2 ANALOG loop-through and on to the 1720-Series CH B input. Terminate with a 75 Ω termination. See Figure 3-16.

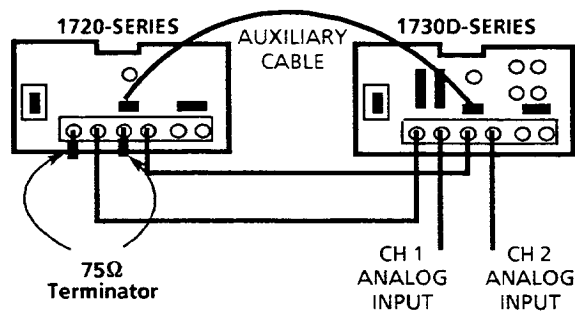


Figure 3-16: Connections to slave the vectorscope input to the waveform monitor for AUXILIARY operation



Call up the 1730D Configure menu and set the 1720 CH A/B Select to CH 1 / 2. The vectorscope input selection will follow the waveform monitor input selection, when the 1720-Series is operated in the Auxiliary mode.

### Analog and Digital Signal Monitoring (Preferred Operating Mode)

Loop the analog video signal through the 1730D rear-panel CHANNEL 1 ANALOG loop-through and connect it to the 1720-Series rear-panel CH A input. Terminate with a  $75\ \Omega$  termination. Connect the 1730D DAC OUT to the 1720-Series rear-panel CH B input. Terminate with a  $75\ \Omega$  termination. See Figure 3–17.

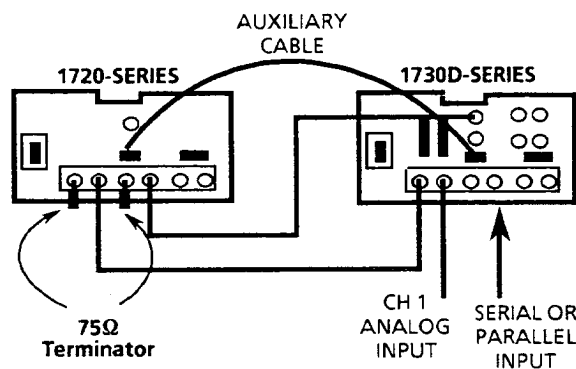


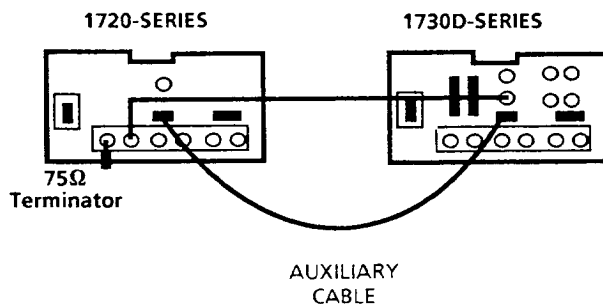
Figure 3–17: Connections to slave the vectorscope to analog / digital operation when using AUXILIARY mode.

Call up the 1730D Configure menu and set the 1720 CH A/B Select to ANLG / DGTL. In the AUXILIARY Mode the 1720-Series will automatically switch to CH A when the waveform monitor INPUT is switched to an analog (ANLG) input. When you select PRL, SER, EYE, or EQ (EYE) INPUT, the vectorscope switches to CH B and the digital signal that has been converted to analog is displayed.

Only one analog input can be monitored with these connections. If two analog inputs must be monitored, then use the 1730D PIX MON OUT to drive the 1720-Series CH A input. Performance will be poorer in this mode, however, due to differential gain and phase in the picture monitor out signal.

### Analog and Digital Signal Monitoring (Alternate Operating Mode)

The PIX MON OUT on the 1730D can be used as a video source to drive the vectorscope, using the waveform monitor INPUT switches as a signal router. Connect the PIX MON OUT to either the 1720-Series rear-panel CH A or CH B input. See Figure 3–18.



**Figure 3-18: Connections to use the 1730D input switching as a signal router**

Call up the 1730D Configure menu and set the 1720 CH A/B Select to OFF. In this mode the 1720-Series input channel will not change when the 1730D INPUT is changed. If the Line Select bright-up strobe on the Picture Monitor Output signal causes difficulty, it can be turned off with the 1730D Configure menu.

While this is a convenient way to connect the 1730D to other instruments, such as a vectorscope, critical measurements should not be made unless the frequency response, differential gain and differential phase of this output are acceptable. See the PIX MON OUT specifications in Section 1.



# Specifications



# Specifications

The following tables describe the performance of the 1730D instrument. Performance Requirements are generally quantitative and can be tested by the Performance Verification Procedure. The Check Step number in the right hand column corresponds to the “Performance Check Procedure,” in Section 6, that verifies the Performance Requirement. The Supplemental Information column provides useful information, but in many cases is not quantitative and therefore can not be verified by the Performance Verification Procedure.

**Performance Conditions** The Performance Requirements listed in the Electrical Specification apply over an ambient temperature range of 0°C to +50°C. The rated accuracies are valid when the instrument is calibrated at an ambient temperature range of +20°C to +30°C, after a warm-up time of 20 minutes. Test equipment used to verify Performance Requirements must be calibrated and working within the limits specified under the Equipment Required list.

**Table 4–1: Vertical Deflection System**

Characteristic	Performance Requirements	Supplemental Information	Check Step
Frequency Response			
1 V Full Scale or X5 Gain			
FLAT Filter		Specifications apply for full screen height video input signal, with VARIABLE GAIN off.	
Analog X1	50 kHz to 6 MHz, within 2% of response at 50 kHz.		13
Analog X5	50 kHz to 6 MHz, within 5% of response at 50 kHz.		13
Serial/Parallel X1	50 kHz to 4.2 MHz, within 3% of 50 kHz response.		22
Serial/Parallel X5	50 kHz to 4.2 MHz, within 5% of 50 kHz response.		
LOW PASS	At least 40 dB attenuation at 3.58 MHz NTSC.	Response at 15 kHz does not vary between FLAT and L PASS by more than 1%.	18
CHROMA			
NTSC	Nominal Bandwidth 1 MHz. Attenuation at 7.2 MHz, 20 dB or greater.	Upper and Lower –3 dB points are approximately ±350 kHz from 3.579545 MHz.	19
	Response at 3.58 MHz does not vary between FLAT and CHROMA by more than 1%.	For 15 to 35°C operating temperature.	19
Deflection Factor			

**Table 4–1: Vertical Deflection System (Cont.)**

Characteristic	Performance Requirements	Supplemental Information	Check Step
1 V Full Scale	140 IRE (1.0 V) within 1% with 1 V input.	20–30°C, Flat Response selected. (Vertical Gain temperature coefficient is 0.3% / 10°C.)	9–21
X5	Gain Accuracy $\pm 5\%$ .	1 V input signal.	9
Transient Response			
1 V Full Scale or X5 FLAT (using 2T pulse and 2T bar) Preshoot	1% or less.	Specifications apply for full screen height video input, with VARIABLE GAIN off.	16
Pulse-to-Bar Ratio			
Analog Inputs	X1: 0.99:1 to 1.01:1. X5: 0.98:1 to 1.02:1.		16 17
Serial/Parallel Inputs	X1: 0.99:1 to 1.01:1. X5: 0.98:1 to 1.02:1.		16 17
Overshoot	X1: 2% or less. X5: 4% or less.		16 17
Ringing	X1: 2% or less. X5: 4% or less.		16 17
Tilt			
Field Rate Square Wave or Vertical Window	1% or less.		16
25 $\mu$ s Bar	1% or less.		16
Overscan	Less than 2% variation in baseline of 100 IRE 12.5T modulated pulse as it is positioned over the middle 80% of the screen.		16
Differential Gain	Displayed differential gain is 1% or less with 10% to 90% APL changes.	Chroma filter must be selected. Baseline at 50 IRE and displayed subcarrier adjusted to 100 IRE with VAR gain.	
Variable Gain Range	Input signals between 0.8 V and 2 V can be adjusted to 140 IRE display. 160 mV and 400 mV for X5 Gain.		9
Position Range	1 V signal can be positioned so that peak white and sync tip can be placed at blanking level, with the DC REST ORER on, regardless of gain setting.	Applies to calibrated gain positions only.	
PIX MON			

Table 4-1: Vertical Deflection System (Cont.)

Characteristic	Performance Requirements	Supplemental Information	Check Step
Frequency Response	50 kHz to 6 MHz, within 3% of response at 50 kHz.	Terminated in 75 $\Omega$ .	14
Differential Gain (50% APL)	Within 1.5% with a 140 IRE unit display.		
Differential Phase (50% APL)	Within 1.5° with a 140 IRE unit display.		
DC Level on Output	0.5 V or less into 75 $\Omega$ load.	No input signal.	11
Intensification (Bright-up)		During line select. Active video of selected lines has a DC offset of approximately 180 mV.	11
Output Impedance		75 $\Omega$ (Nominal).	
Return Loss (75 $\Omega$ )	At least 30 dB, 50 kHz to 6 MHz.	With instrument turned on.	20
Input to PIX MON Output Gain Ratio	1:1 $\pm$ 2% at 3.58 MHz.		15

Table 4-2: Analog Video Interface

Characteristic	Performance Requirements	Supplemental Information	Check Step
Type		Passive loop-through, 75 $\Omega$ compensated.	
DC Input Impedance	>15 k $\Omega$ .		
Return Loss (75 $\Omega$ )	$\geq$ 40 dB, 50 kHz to 6 MHz.	Loop-through terminated in 75 $\Omega$ . Input in use or not, instrument power on or off. All deflection factor settings.	20
Crosstalk (between channels)		>50 dB of isolation between channels. Measured at $F_{SC}$ between CH 1, CH 2, and External Reference inputs.	
Loop-through Isolation		>80 dB of isolation between channels. Measured at $F_{SC}$ between CH 1, CH 2, and External Reference inputs.	
Absolute Maximum Input Level	$\pm$ 5 VDC + Peak AC.	Displays in excess of 200 IRE may cause frequency response aberrations.	

**Table 4–3: Parallel Digital Video Interface**

Characteristic	Performance Requirements	Supplemental Information	Check Step
Type		Reclocked active loop-through.	
Format		Bit parallel composite, 4 F <sub>SC</sub> sample rate (complies with SMPTE 244M).	
Input Impedance	110 Ω, ±10 Ω.		
Digital Input	10-bits plus clock.	Differential ECL.	
Differential Input Voltage	185 mV minimum.		
Common Mode Voltage Limits	±1.0 V.		
Loop-through Output			
Termination Impedance	110 Ω, nominal.		
Skew: Clock to any data bit	±1 ns.		
Output High	Maximum = -0.81 V. Minimum = -0.96 V.	T = 25° C.	
Output Low	Maximum = -1.65 V. Minimum = -1.95 V.	T = 25° C.	

**Table 4–4: Serial Digital Video Interface (CH 1 & CH 2)**

Characteristic	Performance Requirements	Supplemental Information	Check Step
Format		143 Mbit/sec. composite, 10-bit scrambled NRZI. Complies with SMPTE 259M	
Serial Inputs			
Type		Passive loop-through, 75 Ω compensated.	
Input Level	800 mV peak-to-peak ±10%.	Input voltages outside this range may cause reduced receiver performance.	
Loop Through Isolation		>50 dB to 200 MHz. Measure between CH 1 and CH 2.	
Return Loss (75 Ω)	≥15 dB, 1 – 270 MHz.	Loop-through terminated in 75 Ω. Power on or off.	
	>20dB 1 150 MHz (1730D).	Typically 25 dB to 200 MHz. Loop-through terminated in 75 Ω, power on. Measured with a termination having a return loss at least 5 dB better than the Performance Requirement.	



Table 4-4: Serial Digital Video Interface (CH 1 &amp; CH 2) (Cont.)

Characteristic	Performance Requirements	Supplemental Information	Check Step
Insertion Loss	<1%.		
Transmission Bandwidth	50 kHz 200 MHz $\pm 1$ dB. (-3 dB at not less than 300 MHz.)	Loop-through termination is 75 $\Omega$ with >30 dB return loss to 300 MHz. Power on or off. Channel selected or not.	
Serial Receiver Equalization Maximum Range	Proper operation with up to 18.5 dB loss at 71.5 MHz, using coaxial cable having a $1/\sqrt{f}$ loss characteristic.	>250 meters (820 ft) using Belden 8281 coaxial cable.	48
Eye Pattern Display Type		Equivalent Time Sampler.	
Bandwidth	50 kHz to 225 MHz +1 dB, -3 dB.		47
Risetime		1 ns	
Aberrations	<10%.	800 mV step.	44 – 45
Time Base Jitter		<200 ps, peak-to-peak.	
Jitter Attenuation		<10% for frequencies > 20 Hz.	
Deflection Factor Vertical	80 IRE, $\pm 5\%$ with an 800 mV p-to-p input.	100 mV / 10 IRE	42 – 43
Horizontal	2 ns/div $\pm 3\%$ , measured over at least 7 divisions.		46

Table 4-5: DAC Output

Characteristic	Performance Requirements	Supplemental Information	Check Step
DAC Output			
Luminance Amplitude Accuracy	$\pm 1\%$ .	100 IRE signal.	24
Blanking Level	0 VDC, $\pm 5$ IRE	Blanking Level code word 0F0.	25
Frequency Response	50 kHz to 4.2 MHz, $\pm 1\%$	100 IRE signal.	28
Linearity Error	1% Maximum.	100 IRE 5-step staircase.	26
Transient Response 2T Pulse and Bar			
Preshoot and Overshoot	<1%.		23
Pulse Ringing	<2% p-to-p.		23
Pulse-to-Bar Ratio	1:1, $\pm 1\%$ .		23
25 $\mu$ s Bar tilt	<1%.		23
Field Square Wave Tilt	<1%.		23

**Table 4–5: DAC Output (Cont.)**

Characteristic	Performance Requirements	Supplemental Information	Check Step
Chrominance-to-Luminance Gain	±1%.		27
Chrominance-to-Luminance Delay	<10 ns.	<1% p-to-p baseline variation with 12.5T sin <sup>2</sup> pulse.	27
Differential Phase, 50% APL	<0.3°.	40 IRE F <sub>SC</sub> .	29
Differential Gain, 50% APL	<0.6%.	40 IRE F <sub>SC</sub> .	29
SCH Phase Error	<10°.		30
Return Loss	>36 dB, 50 kHz to 5 MHz.		20

**Table 4–6: Serial Video Diagnostics (EDH)**

Characteristic	Performance Requirements	Supplemental Information	Check Step
Video Error Detection Type		Active picture and full field. Field rate resolution. Uses CRC check-word system. System is known as EDH (Error Detection and Handling) in industry literature.  Complies with proposed SMPTE RP 165.	
Reporting Means		Front panel ALARM lamp, rear-panel TTL line, and CRT readout.	
Error Statistics		Asynchronous errored seconds, time since last error. Active picture and full field statistics are separately compiled.	
Diagnostics Embedded Audio		Identifies the presence of up to 4 channels of AES/EBU digital audio.	
Ancillary Data		Identifies the presence of ancillary data (other than audio and EDH). Also indicates if a checksum error has occurred.	

Table 4-6: Serial Video Diagnostics (EDH) (Cont.)

Characteristic	Performance Requirements	Supplemental Information	Check Step
Format Errors		Warns that a serial signal format error has occurred.  Detected Errors <ol style="list-style-type: none"> <li>1. TRS missing.</li> <li>2. TRS placed incorrectly.</li> <li>3. Line or Field ID incorrect.</li> <li>4. Line too long (&gt;910 words).</li> <li>5. Field too long.</li> <li>6. Reserved values used improperly.</li> <li>7. Bad line / field ID parity.</li> </ol>	
Signal Lost		Reports absence of serial video signal.	

Table 4-7: DC Restoration

Characteristic	Performance Requirements	Supplemental Information	Check Step
DC Restorer Clamp Time		Back Porch.	
Frequency Response at 60 Hz	SLOW 20% or less. FAST 90% or greater.	Attenuation of 60 Hz on Input signal.	12 12
Blanking Level Shift with 10% to 90% APL Change	APL changes from 50% to either 10% or 90% will cause blanking level shift of 1 IRE unit or less.		12
Blanking Level Shift Due to Presence or Absence of Burst	1 IRE unit or less shift from no color burst to presence of color burst.		12

**Table 4–8: Calibration**

Characteristic	Performance Requirements	Supplemental Information	Check Step
Calibrator Signal			
Frequency	100 kHz, $\pm 100$ Hz. Synchronizes in 2H and 1H sweep.	Crystal controlled. Timing accuracy is 10 $\mu$ s, $\pm 0.01$ $\mu$ s. Can be used as 10 $\mu$ s and 1 $\mu$ s timing calibrator.	3
Amplitude	140 IRE within 1%.		10
Position		Top of calibrator waveform must be between 80 IRE and 120 IRE on graticule when Back Porch of video signal is positioned to 0 IRE line with DC RESTORER on.	

**Table 4–9: Horizontal Deflection System**

Characteristic	Performance Requirements	Supplemental Information	Check Step
Sweep	Sweep will occur in all Horizontal mode settings with or without synchronization.		5
2FLD Sweep Repetition Rate	Equal to frame rate of applied video or external sync.		5
2FLD Sweep Magnification		Approximately X25.	
1LINE Sweep Repetition Rate	Equal to line rate of applied video or external sync.		5
2LINE Sweep Repetition Rate	Equal to half line rate of applied video or external sync.		5
Sweep Length		2LINE and 2FLD sweep length is nominally 12.5 divisions.	
Timing Accuracy		All timing and linearity specifications exclude the first and last major divisions of the unmagnified display. Timing can be adjusted $\pm 5\%$ with front-panel H CAL.	
1 $\mu$ s/div.	To within 2%.		6
0.2 $\mu$ s/div.	To within 3%.		6
Integral Linearity		0.1 div. or less offset of any one marker from its graticule mark, measured over the 10 center divisions.	
10 $\mu$ s/div.	To within 2%.		6
Sweep Magnifier Registration		Magnification occurs about the center of the screen.	

Table 4-9: Horizontal Deflection System (Cont.)

Characteristic	Performance Requirements	Supplemental Information	Check Step
Horizontal Position	Any portion of a synchronized video sweep can be positioned on screen in all sweep modes.	Displays the selected line in 1LINE. Displays the selected line first in 2LINE.  Intensifies selected line in 2FLD.  In 15-LINE, displays overlaid lines in 1LINE or 2LINE, intensifies the selected 15 lines in 2FLD. A small 15 is added to the bottom of the CRT readout in 15-LINE mode.	6
LINE SELECT			
Read Out			
Field 1		Lines 1 to 263.	
Field 2		Lines 1 to 262.	

Table 4-10: 90 Hz Field Triggering

Characteristic	Performance Requirements	Supplemental Information	Check Step
Remote Sync Amplitude	2.0 to 5.0 V square wave.	A3J5 (Remote Sync Sweep Trigger Polarity) must be in the INVERTED position (pins 2 & 3).	8
Trigger Frequency	90 Hz, $\pm 15\%$ .		8

Table 4-11: Synchronization

Characteristic	Performance Requirements	Supplemental Information	Check Step
Input Requirements		Analog inputs and serial and parallel digital inputs, upon conversion to analog.	
Internal Reference	Composite video or black burst with sync amplitudes 40 IRE $\pm 6$ dB.		4
EXTernal REFerence	Sync amplitude between 143 mV and 4 V will synchronize sweeps.		4
EXT REF Input			
DC Input Impedance (Unterminated)	Greater than 15 k $\Omega$ .		

Table 4–11: Synchronization (Cont.)

Characteristic	Performance Requirements	Supplemental Information	Check Step
Return Loss (75 $\Omega$ )	At least 40 dB from 50 kHz to 6 MHz.	Loop-through terminated in 75 $\Omega$ , instrument power on or off.	20
Absolute Maximum Input Voltage		$\pm 12$ VDC plus peak AC.	
Remote Sync Amplitude	2.0 to 5.0 V square wave or 4.0 V composite sync.	Input and enabled through rear-panel REMOTE connector.  Input impedance 1 M $\Omega$ .  30/60Hz square wave will sync 2FLD sweep.	
Sweep Trigger Polarity		Internal jumper selects polarity.  Normal: Negative-going edge line sync, positive edge of field sync.  Inverted: Positive-going edge line sync, negative edge of field sync.	

Table 4–12: RGB/YRGB Mode

Characteristic	Performance Requirements	Supplemental Information	Check Step
RGB/YRGB	Will display either a 3-step or 4-step RGB /YRGB parade or overlaid display.	Internal jumper is used to change from 3-step to 4-step capability. Factory set to 3-step.	7
Staircase Amplitude RGB or YRGB	A 10 V input will result in a horizontal display of 9 divisions $\pm 1.4$ major divisions.	12 V p-to-p AC component. Signal voltage not to exceed $\pm 12$ VDC plus peak AC.  Internal adjustment offsets any incoming signal DC component between $\pm 12$ V.  Input Impedance 1 M $\Omega$ shunted by approximately 3 pF.	7
Sweep Repetition Rate	Field or line rate of displayed video or external sync signal as selected by front-panel HORIZONTAL controls.	Field or line rate, if enabled from the REMOTE connector.	7

Table 4-12: RGB/YRGB Mode (Cont.)

Characteristic	Performance Requirements	Supplemental Information	Check Step
Control		RGB/YRGB mode and Parade/Overlay selected by applying ground (TTL low) at the RGB Enable pin on the rear-panel REMOTE connector.  RGB components may be overlaid with normal sweep length by not activating RGB Enable.	7
MAGnifier		Approximately X25 for 2FLD, X10 in 1LINE or 2LINE.	
Sweep Length	3-step: 3.4 4.1 div. 4-step: 2.5 3.1 div.	Field or line rate sweeps. 1FLD sweep is selected by grounding the 1FLD/1LINE pin of the rear-panel REMOTE connector.	7 7

Table 4-13: CRT Display

Characteristic	Performance Requirements	Supplemental Information	Check Step
CRT Viewing Area		80 × 100 mm. Horizontal = 12.5 div. Vertical = 170 IRE units.	
Accelerating Potential		Nominally 13.75 kV.	
Trace Rotation Range	Greater than $\pm 1^\circ$ from horizontal.	Total adjustment range is typically $8^\circ$ .	
Graticule		Internal, variable illumination.	

Table 4-14: Power Source

Characteristic	Performance Requirements	Supplemental Information	Check Step
Mains Voltage Ranges 90 to 250 V	90 – 250 V.		2
Mains Frequency Range	48 Hz to 66 Hz.		
Power Consumption		90 VA maximum (55 Watts typical).	

**Table 4–15: Environmental Characteristics**

Characteristic	Supplemental Information
Temperature	
Non Operating	55°C to +75°C.
Operating	0°C to +50°C.
Altitude	
Non Operating	To 50,000 feet.
Operating	To 15,000 feet.
Vibration Operating	15 minutes each axis at 0.015 inch, frequency varied from 10–55–10 Hz in 1-minute cycles with instrument secured to vibration platform. Ten minutes each axis at any resonant point or at 55 Hz if no resonant point is found.
Shock Non Operating	30 g's, 1/2 sine, 11 ms duration, 3 shocks per surface (18 total).
Transportation	Qualified under NTSC Test Procedure 1A, Category II (24-inch drop).

**Table 4–16: Physical Characteristics**

Characteristic	Supplemental Information
Dimensions	
Height	5 1/4 inches (133.4 mm).
Width	8 1/2 inches (215.9 mm).
Length	18 1/8 inches (460.4 mm).
Weight (Gross Shipping)	Approximately 15.7 lbs (approximately 7.2 kg).

**Table 4–17: Certification**

Characteristic	Supplemental Information
Safety/EMI	Designed to meet or exceed:  UL1244–1980 Factory Mutual – 3820 CSA Bulletin 556B IEC 348 FCC EMI Compatibility (FCC Rules Part 15 Subpart J, Class A) VDE 071.5 Class B



Table 4-18: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity – EMC	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union:</p> <p>EN 50081-1 Emissions:  EN 55022                      Class B Radiated and Conducted Emissions</p> <p>EN 50082-1 Immunity:  IEC 801-2                      Electrostatic Discharge Immunity  IEC 801-3                      RF Electromagnetic Field Immunity  IEC 801-4                      Electrical Fast Transient/Burst Immunity</p> <p>1    High quality shielded cables must be used to ensure compliance to the above listed standards</p> <p>2    This product complies when installed into any of the following Tektronix enclosures:  1700F00 Standard Cabinet  1700F02 Portable Cabinet  1700F05 Rack Adapter</p>
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.
Installation (Overvoltage) Category	<p>Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:</p> <p>CAT III    Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.</p> <p>CAT II    Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.</p> <p>CAT I    Secondary (signal level) or battery operated circuits of electronic equipment.</p>
Pollution Degree	<p>A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.</p> <p>Pollution Degree 1                      No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.</p> <p>Pollution Degree 2                      Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.</p> <p>Pollution Degree 3                      Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.</p> <p>Pollution Degree 4                      Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.</p>

**Table 4–18: Certifications and compliances (cont.)**

Category	Standards or description	
Safety Standards		
U.S. Nationally Recognized Testing Laboratory Listing	UL1244	Standard for electrical and electronic measuring and test equipment.
Canadian Certification	CAN/CSA C22.2 No. 231	CSA safety requirements for electrical and electronic measuring and test equipment.
European Union Compliance	Low Voltage Directive 73/23/EEC, amended by 93/69/EEC	
	EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Additional Compliance	IEC61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Safety Certification Compliance		
Temperature, operating	+5 to +40° C	
Altitude (maximum operating)	2000 meters	
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 1010-1, Annex H) – grounded product	
Overvoltage Category	Overvoltage Category II (as defined in IEC 1010-1, Annex J)	
Pollution Degree	Pollution Degree 2 (as defined in IEC 1010-1). Note: Rated for indoor use only.	

**WARNING**

*The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all safety summaries before performing any service.*





# Theory of Operation



# Theory of Operation

The Tektronix 1730D accepts and displays signals in both serial and parallel digital formats along with analog baseband composite video. In order to introduce these display concepts, there are three levels of theory of operation. First there is a very brief overview utilizing a simple block diagram to introduce the instrument. This is followed by a somewhat more detailed discussion related to the two block diagrams found at the back of this manual. And finally, there are detailed circuit descriptions discussing the individual schematic diagrams, also located at the back of this manual.

## Instrument Overview

The 1730D is a specialized analog/digital oscilloscope, designed to monitor and measure composite analog, serial digital and parallel digital television baseband signals. Signals from the rear-panel analog and digital inputs are displayed on a bright CRT, capable of displaying one line per field. Combinations of analog and digital inputs can be viewed simultaneously. In LINE SELECT mode, an alpha-numeric line and field readout is provided on the CRT. See Figure 5-1.

The 1730D has an internal DAC that converts the rear-panel digital inputs to an analog signal that drives the waveform monitor. The parallel digital signal is regenerated and output through the rear-panel digital loop-through connector. The converted parallel digital signal can be viewed by pressing the PAR INPUT button; serial digital is viewed by pushing the SER INPUT button. Both the serial and parallel converted outputs are also available at the 75  $\Omega$  DAC OUT connector. The DAC OUT signal is independent of any front-panel instrument settings, except parallel/serial input switching.

Front-panel mode switching offers a choice of CH 1, CH 2, (Analog or Serial Digital) or Parallel Digital. Dual input switching, enabled by pushing and holding the push button, offers a choice of CH 1 & CH 2 (Analog or Serial Digital), CH 1 Analog and Parallel Digital or CH 1 Analog & CH 1 Serial Digital. Switching is accomplished by a series of push-button switches whose status is constantly polled by a microprocessor that controls switching functions and circuit gains so that the instrument can perform as a monitor or be used to make specific measurements.

The Low Voltage Power Supply is a high-efficiency switching type. The High Voltage Power Supply provides 13 kV acceleration potential. The DAC Power supply converts the +40 V supply to a -5.2 V supply for the ECL devices in the digital circuitry.

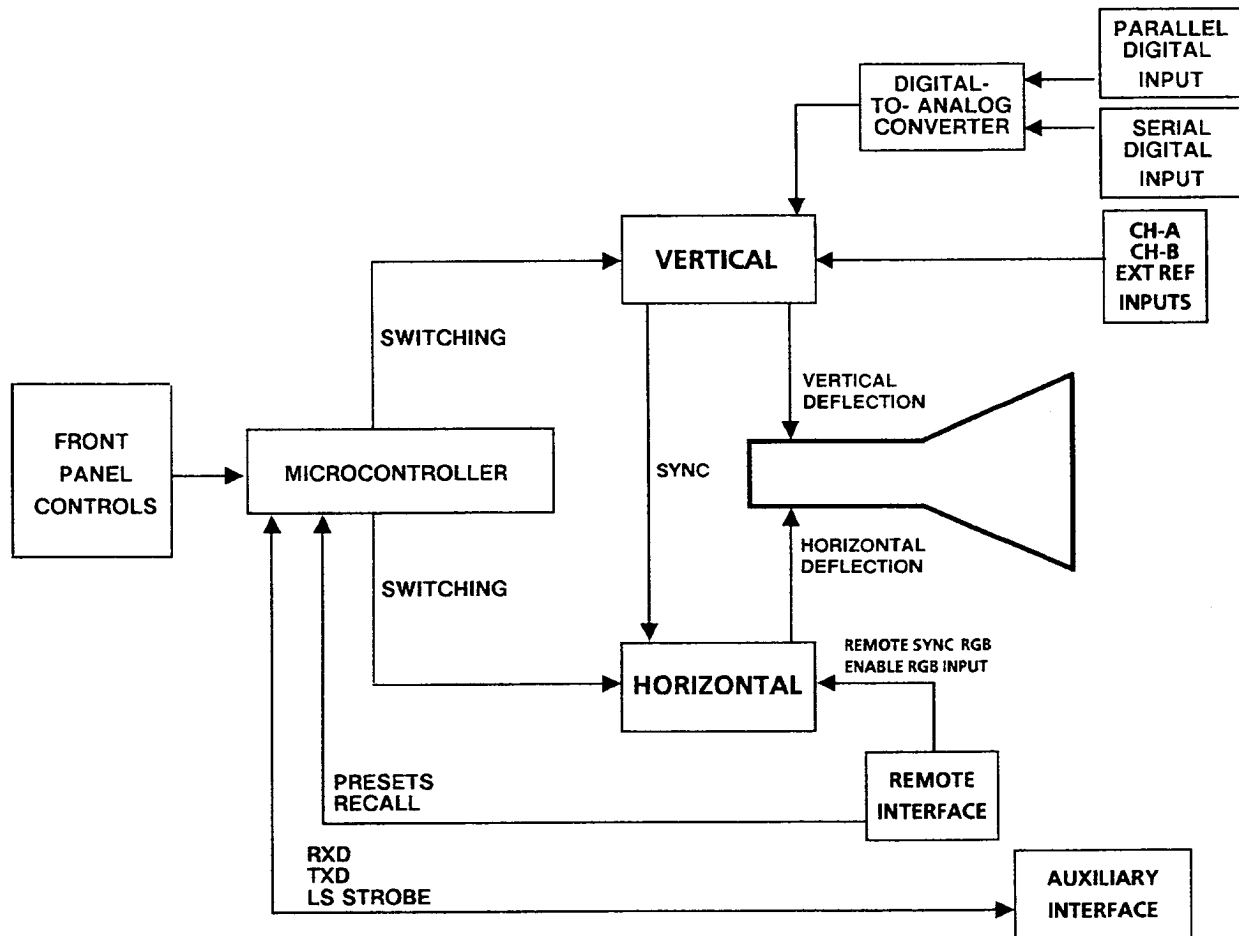


Figure 5-1: Simplified representation of the 1730D Waveform Monitor

## Block Diagrams

The block diagrams, at the back of this manual, show more detail and associate individual circuit blocks with their corresponding schematic diagrams.

**Vertical** The serial digital video signal is input through buffered high impedance bridging loop-through circuits. After Deserializing, the signal is level shifted to TTL levels and input to a Co-processor. The now parallel output of the Co-processor is again level shifted, back to ECL levels, and loaded into an output latch which is clocked out to a Multiplexer for the Digital-to-Analog Converter (DAC).

The Co-processor also recovers the encoded check word from the ancillary data area and compares it to the check word that it calculates from the incoming data stream. This comparison is the basis of the Error Detection and Handling (EDH) monitoring.



The parallel digital input is buffered and multiplexed into the DAC. DAC output (from either serial or parallel input) is filtered and drives output amplifiers, that drive both the rear-panel DAC OUT and, when switched in, the waveform monitors vertical channel.

Analog video signals are input through high impedance bridging loop-through inputs. The input amplifiers contain sample-and-hold-type clamps that are timed by a Back Porch Sample.

Switching at the input to the filters determines which input signal or combination of signals will be displayed. In the combination modes, the Channel 1 signal is displayed on the left of the CRT. The clamped signal, without any filtering, drives the rear-panel Picture Monitor Output. In LINE SELECT modes, a brightup strobe is added to the Picture Monitor Output to identify the selected line (or lines in 15Line).

Front-panel switching selects a Flat (unfiltered), Low Pass, or Bandpass filtered signal for display. Low-pass filtering can be used with Flat as part of a dual filter mode for all sweep modes. In the dual filter mode, the low-pass filtered signal is displayed on the left. When the calibrator signal is selected at the front panel, a 1 volt, 100 kHz signal is applied to the input of the Gain Cell instead of input video. The calibrator signal is used to set up both Vertical Gain (Volts Full Scale) and Horizontal Gain (Sweep rate) from a self-contained source.

Signal amplitude can be adjusted at the Gain Cell using either the front-panel VCAL or VARIABLE gain control. The output signal from the Gain Cell drives another clamped amplifier. See Block Diagram 2. This second clamped amplifier has a loop-compensated sample-and-hold circuit that provides the fast clamping needed for the Fast DC Restorer. Clamping occurs at the back porch.

A Vertical Positioning voltage, along with the conditioned video signal, is input to the Switchable Gain Amplifier. Amplifier gain and positioning range are increased by a factor of 5 when X5 Gain is selected at the front panel. The limiter stage that follows this amplifier prevents over driving of the Output Amplifier.

The conditioned video signal and the Y component of the Readout (from the Microprocessor) are input to the Vertical Output Amplifier, which matches impedances and normalizes gain (approximately 40 V for 8 cm of vertical deflection) to drive the CRT vertical deflection plates.

In addition to the normal display modes, the 1730D has an additional display mode that provides an Eye pattern. See the Input block diagram. When Eye Pattern is selected, the serial digital input is inverted and input to the driver amplifier for the Sampler Bridge. When the EQ Eye Pattern is selected, an output from the Deserializer is inverted prior to input to the driver amplifier for the Sampler Bridge. Strobe for the bridge is generated by a VCO that is frequency offset from the recovered clock signal. This provides for a sequential sampled display of the serial digital input.

**Horizontal** Composite video from either internal or external reference has all active video stripped away by the Sync Stripper to leave only sync for the Sweep Trigger. Remote sync bypasses the Sync Stripper and triggers the sweep directly when enabled.

A plug jumper determines the polarity of the remote sync for internal triggering. Normal Polarity setting provides line-rate triggering on a negative edge and field-rate triggering on a positive edge. Inverted Polarity provides the opposite: line-rate triggering on a positive edge and field-rate triggering on a negative edge.

The output of the Sync Stripper (or remote sync) drives the Back Porch Generator, Vertical Sync Recognition, and Horizontal AFC. Outputs from the Vertical Sync Recognition and Horizontal AFC are used by the Field ID and Trigger Select to trigger the Sweep Generator. If Calibrator is selected, the Cal Drive signal from the Cal Oscillator provides the triggering signal instead.

The Horizontal AFC output, in conjunction with Microprocessor control, drives the Line Select, whose output provides a pulse that:

1. Drives the Z-Axis Control to unblank the CRT at selected line(s).
2. Provides a bright-up strobe at the selected line(s) for 2 Field Sweep.
3. Provides the Picture Monitor Output bright-up strobe.
4. Generates the Auxiliary Blanking strobe that is used by a companion 1720-Series for line select.

The ramp signal output by the Sweep Generator drives the Mag Amplifier, which has three gain ranges: X1, X10, and X25. The Horizontal Positioning offset voltage is input to this amplifier guaranteeing sufficient range to position any part of the display onto the graticule.

In 1 Line Sweep, 1 div. = 5  $\mu$ s in the unmagnified X1 display and 0.5  $\mu$ s in X10 Mag. In 2 Line Sweep, 1 div. = 10  $\mu$ s in X1 and 1  $\mu$ s in X10 Mag.

In 2 Field Sweep, X25 Mag, the full vertical interval is displayed.

When the RGB Parade display is enabled, the sweep is shortened and is offset by the RGB Staircase input signal to produce three short ramps which are displayed in sequence as a normal-sized sweep.

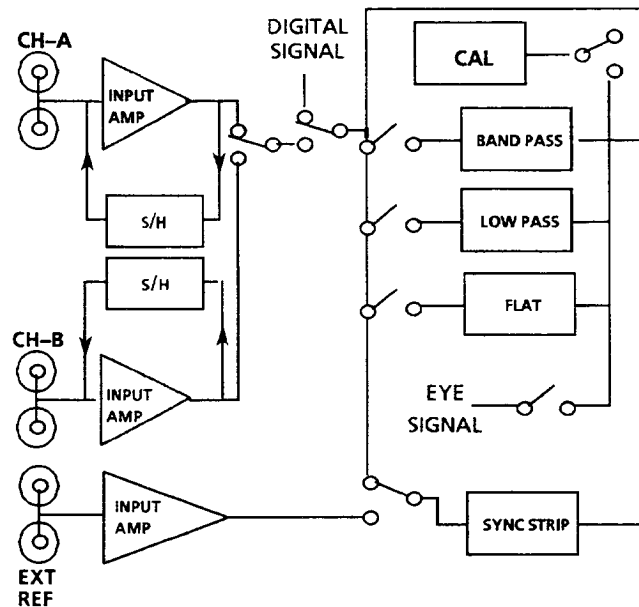
The output of the Mag Amplifier and the X component of the Readout (from the Microprocessor) drive the Horizontal Output Amplifier, which matches impedances and normalizes gain (approximately 100 V for a 10-cm sweep length) to drive the CRT horizontal deflection plates.

**CRT, Unblanking, and High Voltage**

The blanking signal (from Line Select) and the Intensity and Readout voltages are used by the Z-Axis Control to unblank the CRT during sweep time; when sweep is magnified, the off-screen portion of the sweep is blanked to increase contrast ratio. The Focus Amplifier, controlled by the front-panel control, provides a voltage to the CRT focus ring.

Trace Rotation provides compensation for the magnetic field surrounding the CRT. The CRT is of the Post Acceleration type, which requires a relatively high potential difference between the cathode and post anode. The boost in 2nd anode voltage is provided by an encapsulated 4X Multiplier.

## Diagram 1 Vertical Input



The composite analog video signal is input to the waveform monitor through amplifiers that can be clamped at back porch time. Once buffered by the input amplifiers, whose gain is  $-1$ , a Channel Switch selects the input to be filtered, drives the picture monitor output, serves as the internal sync source, and eventually is displayed on the CRT.

Digital signals, from the Digital-to-Analog Converter, are also input through an analog/digital mode switch.

When an external reference (sync) source is used the composite signal is input through an AC-coupled amplifier, which also has a gain of  $-1$ . Selection of the sync source is accomplished by a switch that is made up of a common base pair and switching diodes. A clamped sync stripper is used to remove active video information and regenerate a composite sync signal for use by time related monitor circuits.

An accurate 100 kHz waveform from the Microcontroller is amplified and its amplitude set and controlled by the Calibrator. Calibrator output is enabled and output through the vertical amplifier low-pass filter. The calibrator enable is also generated by the Microprocessor.

### Input Amplifiers

The rear-panel Channel 1 and 2 analog inputs are high-impedance bridging loop-through inputs compensated for use in  $75 \Omega$  systems. Each amplifier has its

own DC Restorer that is controlled by the front-panel restorer switch. Restorers are either both on or off; the ONDCR pulse enables (disables) both U49C (pins 10 & 11) and U49D (pins 14 & 15). When U49C and D close they couple the back porch sample DC level, from the input amplifier output, to the amplifier inputs. See Timing (Diagram 3) for more information about the generation of the BACKPORCH signal.

The CH 1 Input Amplifier is an inverting feedback operational amplifier with a gain of  $-1$ . The input resistor ( $R_i$ ) is R424 and the feedback resistor ( $R_f$ ) is R407. A plug and jumper is provided to select input coupling. J21 is factory set to the 1–2 position for AC coupling; it can, however, be moved to the 2–3 position to provide DC coupling by bypassing C154, the AC coupling capacitor. C147 is the input compensation adjustment.

The CH 2 Input Amplifier also has a gain of  $-1$ . The input resistor is R432 and the feedback resistor is R418. The input coupling jumper is J24 and the AC-coupling capacitor is C164. C144 is the input compensation adjustment.

### DC Restorer

The DC Restorer is a feedback sample-and-hold circuit. When the DC Restorer is enabled (/BCKPORCH), it is enabled for both the CH 1 and CH 2 analog input amplifiers. Sampling occurs when U49A (pins 2 & 3) and U49B (pins 6 & 7) close at back porch time. When the switch closes, the hold capacitors (C160 & C161) charge up to the DC level of the amplifier output. If ONDCR, from the Microprocessor (Diagram 5) is present, U49D (pins 14 & 15) and U49C (pins 10 & 11) close and the loop-compensated Buffer Amplifiers (U50A and U50B) drive the Input Amplifier input summing junctions through R406 and R395. The time constant of the restorer does not attenuate 50/60 Hz hum by more than 10%. The choice of fast or slow DC restorer time constant is accomplished loop compensating the 2nd DC Restorer shown on Diagram 2.

### Channel Switch

The Input Amplifier output signals drive the channel switch, U46, through pins 2 & 3. The signal selection is determined by the level of the CH-2 signal at U46 (pin 10). When CH-2 is low, CH-2 is selected, and when its high CH-1 is selected. The Channel Switch output (pin 6) drives a current mirror with three current sources.

A second current switch, formed by U47, selects between the output of the analog CH1/CH2 switch and the output of the DAC (located on Assembly A4). The switch position is determined by the state of the DAC SEL line. DAC SEL is low in the parallel or serial input modes, and switches the DAC output into the vertical channel. In the analog mode, DAC SEL is high, and either analog CH1 or CH2 input is displayed.

One current source, through Q67, drives the rear-panel Picture Monitor Output Amplifier (SIG 2). C145 adjusts the frequency response of this output. Q65 is the current source for the remainder of the vertical. With a 1 V input signal there will be 1.11 mA of signal current flowing through R383 (or R384) into the

channel switch. This signal current is available to drive the vertical through Q65 and the PIX MON OUT through Q67.

### External Sync Input and Source Switch

The external sync signal from the rear-panel EXT REF loop-through is buffered by an operational amplifier consisting of U51A and B. It has a gain of  $-1$ , which is determined by the combination of input resistor ( $R_i$ ) R436 and feedback resistor ( $R_f$ ) R435. The operational amplifier output drives Q73, which is one current source for the Source Switch (U51D).

The internal sync current source, for the other side of the common emitter Source Switch (U51D), is Q66. It provides signal current through pin 5 of U51D which also forward biases CR63 when the switching signal (EXT) is high. CR66 keeps CR63 from conducting when external sync input is selected.

When external sync is selected, EXT (from the Microprocessor, Diagram 5) goes low, turning on U51D (pins 1, 2, & 3) so that signal current from Q73 (the external sync current source) forward biases CR64. The 0.5 mA of signal current from Q73 (external) or Q66 (internal) drives into a common base stage, Q76 which develops a 1 V video signal across R420.

### Sync Stripper

The Sync Stripper removes the active video portions of the signal to generate the sync required for timing signals. The circuit detects the sync tip, stretches it (amplifies that portion of the signal), and generates a clean sync signal. The circuit responds well to pulses up to 1 MHz, then rolls off to eliminate any effect from subcarrier or high frequency noise at the sync level.

The Sync Stripper circuit consists of a two-stage amplifier and a clamp (or DC restorer). Figure 5-2 shows a simplified schematic of the circuit. Both amplifier stages feed back sync level information to the clamp.

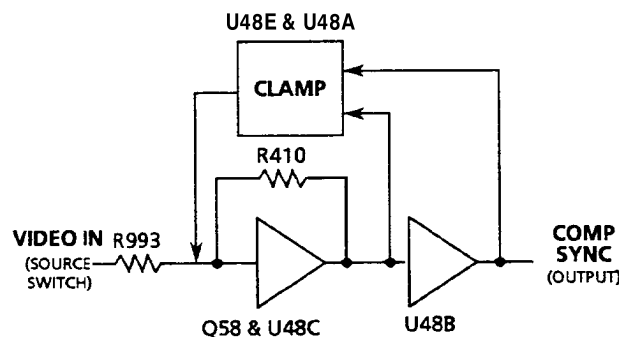


Figure 5-2: Simplified block diagram of the Sync Stripper

The first stage of the amplifier inverts the video signal and clips it near the sync tip. (The bandwidth of the Sync Stripper keeps the circuit from clamping to high

frequency components of the video signal.) This operational amplifier stage is made up of Q68 and U48C. The gain setting resistors R411 ( $R_i$ ) and R410 ( $R_f$ ) let the amplifier provide high gain to the sync tip portion of the signal, but clip any signal components slightly above the sync level.

During sync time, the clamp circuit maintains the output of the first amplifier stage at about +5 V, which is fed back to the clamp circuit, through CR65, to maintain the proper level.

During non-sync times (active video), CR61 and CR62 are both on to shunt U48C and greatly reduce the gain. Shunting the active video limits the saturation of U48C, which allows it to respond quickly to the next sync transition.

An inverting amplifier, U48B, is the second amplifier stage. It provides negative-going sync and cleans up any remaining noise or active video on the signal. Output of the second stage is also fed to the clamp.

The clamp circuit is formed around U48E and U48A. U48E and CR65 form a current switch. When the first stage output level is at sync tip, current flows through U48E, which charges C132. At the same time U48B pulls down on CR60 to provide a discharge path for C132. The result of these opposing actions is to establish an equilibrium voltage on C132. At the end of sync time, U48C saturates and pulls down on CR65 to shut off U48E.

## Filter Selection

The two analog filters are driven from current source Q65 through one of the analog switch sections of U44. Only one switch section will be closed at a time, as dictated by its enable, from the Microprocessor (Diagram 5) going low. The Chrominance filter is clamped to ground when low-pass filtering or flat is selected by Q50.

When the chrominance filter is turned on an additional bias current for the AC-coupled filter is required. It is supplied by pulling the cathode of CR47 low with the Microprocessor-generated enable signal, which turns on Q43 to saturate Q41. When Q41 saturates its collector goes to +11.8 V. Signal current from the enabled filter drives the emitter of a common base amplifier input to the Gain Cell (Diagram 2). At a 0 V DC level 2 mA of bias current is added to 1 mA of signal current that drives the input of the Gain Cell.

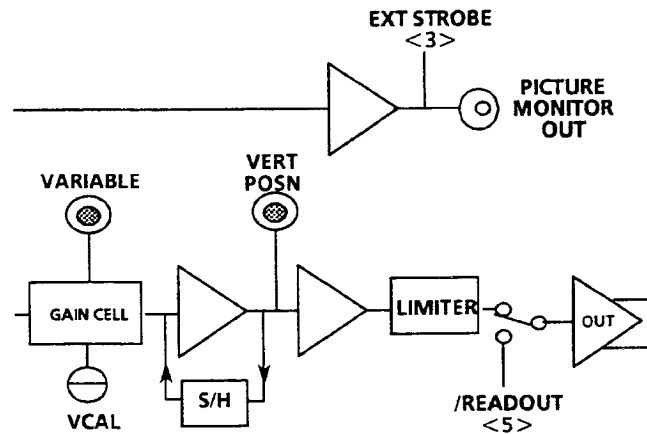
In addition to the two filters (Low Pass and Chrominance) and unfiltered video (Flat), the sampled serial digital Eye Pattern signal is filtered and input through the Filter Selection matrix.

When dual filter or dual input display is selected a blanking signal is required to mask any potential switching transit that might occur. Whenever CH 2, DAC SEL, or FLAT goes active an RC circuit consisting of C92 (CH 2), C91 (DAC SEL) or C90 (FLAT) and R302 and R330 generates a pulse through Q36. Q38 inverts the blanking pulse, which is input to the blanking circuitry on Diagram 4.

**Calibrator** The Calibrator is a common base amplifier, Q59, that is driven by a 100 kHz square wave from the Microprocessor (Diagram 5). It is switched at the 100 kHz rate. The gain is set by adjusting R359, the Cal Amp. The emitter current drives the Low-Pass filter through an analog switch, U42C, which is activated by the Microprocessor-generated CAL.



## Diagram 2 Vertical Output



The filtered video signal drives the signal input of a gain cell whose gain is controlled by the front-panel V CAL, and when selected VAR VERTICAL GAIN. The gain normalized video signal then drives an amplifier that can be clamped at back porch time with either a fast or slow time constant clamp which is also a front-panel selection.

The Switchable Gain Amplifier input is the DC level shifted (Vertical Position) output of the Gain Cell Amplifier. Amplifier gain is switchable between X1 and X5 as selected by the front-panel X5 VERTICAL GAIN. Amplifier output drives a Bridge Limiter that prevents the Vertical Output Amplifier from being overdriven.

The Vertical Output Amplifier is driven by the processed video signal or by the Y-Axis portion of the readout signal. The output amplifier has enough gain to drive the CRT deflection plates, while providing the compensation for the deflection plate capacitance.

The picture monitor out signal from the Channel Switch (Diagram 1) is amplified and compensated to drive a 75  $\Omega$  load by the Pix Mon Out amplifier. In addition, a bright-up pulse is added to the picture monitor output signal.

### Gain Cell

Q58 drives the Gain Cell. It is a low impedance (to terminate the filters) common base amplifier. The signal voltage off collector is approximately 0.5 V.

The Gain Cell (U40) is driven differentially; pin 1 is the signal input with a  $-3.0$  VDC level plus the signal voltage. R284 determines the maximum gain of the Gain Cell. The amount of gain is controlled by varying the difference between the bases of the two transistor pairs controlling the signal current flowing out of pin 6 or pin 12. The front-panel VCAL control, R3, sets an input

DC level on pin 10 of the Gain Cell. When Variable Gain is selected, the front-panel GAIN control alters the DC level on pin10 through an analog switch, U42B. The switch is closed only when Variable is selected.

The current flowing out of pin 6 drives the Gain Cell Amplifier, while the current flowing out of pin 12 drives into a collector load, R300.

### Gain Cell Amplifier

The Gain Cell Amplifier is a clamped inverting operational amplifier driving both the Switchable Gain Amplifier and the 2nd DC Restorer. It consists of Q40, Q45, and Q46, with Q40, an emitter follower, operating as the output stage. Amplifier gain is approximately 2V/mA of input signal.

### 2nd DC Restorer

The DC Restorer clamps the output level of the Gain Cell Amplifier to the DC level occurring at back porch time. DC Restorer drive is coupled through R241 into an analog switch (U39B) that is activated by the BACKPORCH signal. U39B closes during back porch time to charge the hold cap, C128. U42A is normally closed, except during A1/P or A1/S1 input modes, where it is open while the digital signal is displayed. The Error Amplifier (U43) drives a current summing point at the input of the Gain Cell Amplifier through U42D. For slow restorer, R347 is in the loop compensation. However, for fast DC restorer, R347 is shorted to ground through U39C to speed up the loop time constant.

### Switchable Gain Amplifier

The Switchable Gain Amplifier consists of Q47, Q48, and Q52, with Q39 as the switching element. When the base of Q39 is pulled low through R254, amplifier gain is  $-1$ . Operational amplifier  $R_i$  is R242 and  $R_f$  is the sum of R222 and R223. When its base is high, Q39 saturates and grounds the collector end of R238 to put an attenuator in the feedback path and increase gain by a factor of five. The output, at the collector of Q47, drives a bridge limiter circuit comprised of CR50 and CR51. See Figure 5–3 for a simplified diagram of the limiter.

The purpose of the limiter is to prevent the Vertical Output Amplifier from being over driven. The bridge limiter circuit, encompassing CR50 and CR51, is quiescently balanced (equal current through all arms) with no  $V_{in}$ . When there is a signal voltage ( $V_{in}$ ) applied to the bridge (CR1-CR2), the output signal voltage (CR3-CR4) is approximately equal to the input. When  $V_{in}$  moves away from the quiescent state, the current in the bridge arms becomes unbalanced.

When the bridge unbalances, the current through the diodes changes, with more current flowing into the load through either CR3 (positive excursion) or CR4 (negative excursion), which turns the diode on harder. At the same time current flowing through the complementary input diode CR1 (positive excursion) or CR2 (negative excursion) is reduced and the diode starts to turn it off. If the change in  $V_{in}$  is large enough, the output diode takes all of the current (which turns off the input diode) and disconnects the input from the output.

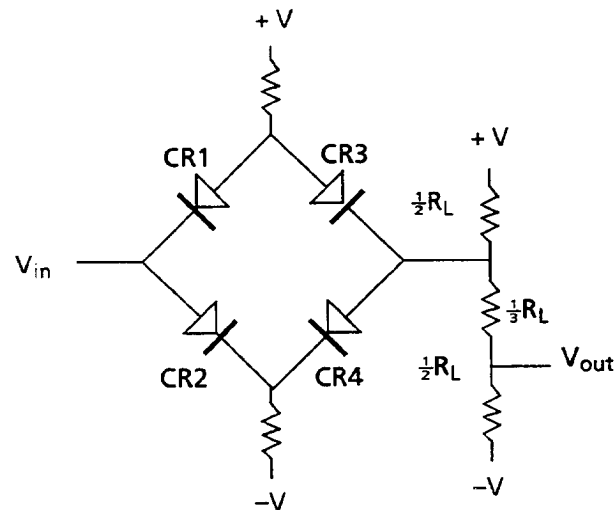


Figure 5-3: Simplified illustration of the Bridge Limiter Circuit

The bridge load, R304, R306, and R279, is also a voltage divider that sets the input DC level for the Vertical Output Amplifier at approximately  $-2$  V.

### Vertical Output Amplifier

The level shifted input signal drives the base of Q56 during active video signal time. The active video signal is disconnected while readout is displayed (U39D). Q56 is driven by the Y-Axis signal, through U39A, when the vertical component of the readout is displayed. The Y-Axis signal is enabled through the switch when ROEN goes low.

The combination of Q55 and Q56 forms a shunt-feedback amplifier. Q55 amplifies and inverts the collector current flowing in Q56 to provide most of the signal current through R335. Because the current through Q56 is nearly constant, the input-signal voltage is applied directly across its emitter resistor, R335, with very little distortion. Negative feedback is employed to improve linearity and reduce the thermal distortions introduced by Q56. In addition, negative feedback increases the input impedance. A series compensation network consisting of R334 and C114 provides improved bandwidth and stability.

The combination of Q57 and Q60 form a shunt-feedback amplifier, identical to Q55 and Q56. The signal current for this amplifier is input through R335. Signal current through Q60 is equal in value and opposite in phase to the current change in Q55. The Limit Center, R338, balances the bias current flowing in Q55 and Q60. R353 and C130 form another series compensation to improve bandwidth and stability. R337 and C131 provide high-frequency peaking to improve the flat response; R322 and C122 improve low-frequency transient response.

Q54 and Q62 are common-base stages that couple the complementary signal currents to the non-inductive CRT load resistors, R332 and R344. The resulting

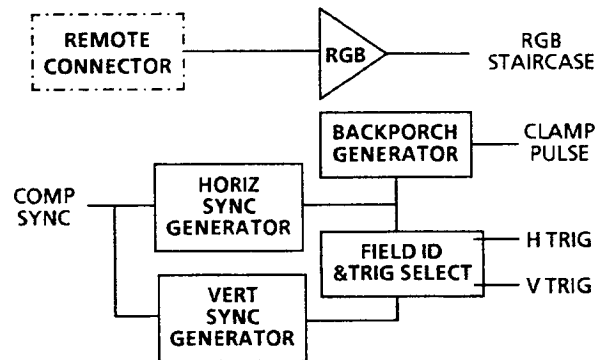
signal voltages drive the CRT vertical deflection plates. R320 and R351 shunt the load resistors to provide the proper load resistance for the high-bandwidth output signal. L6 and L9 are adjustable shunt-peaking coils to increase the vertical bandwidth and allow precise adjustment of flat response.

### **Pix Monitor**

The Picture Monitor Output Amplifier consists of U41 and Q53. The amplifier is driven from pin 2 of U41D by the SIG 2 input from Diagram 1. The output, that drives a 75  $\Omega$  load, is the emitter of U41A (pin 7). R318 and R319, on the amplifier input, develop the signal voltage of approximately 0.6 V.

The overall gain for this non-inverting amplifier is set by feedback divider resistors R446, R275, and R296. The signal amplitude at the emitter of U41A is 2 V. Q44 adds an offset to the video, for LINE SELECT operation, that provides the bright-up (or strobe) pulse. The amount of the offset is set by the value of R267.

## Diagram 3 Timing



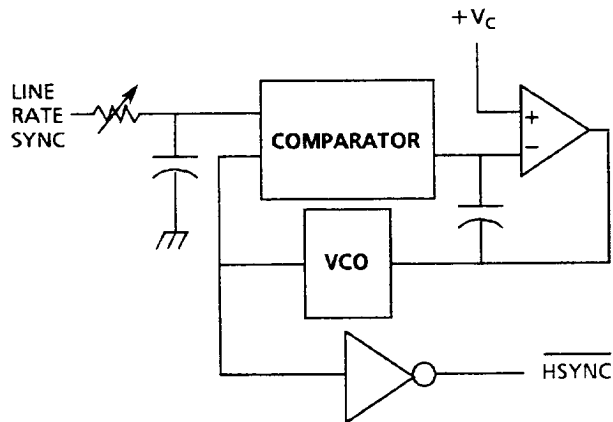
Composite sync from the Sync Separator (Diagram 1) is used to time the Horizontal and Vertical Sync Generators. Outputs from these generators are used to develop line- and field-rate signals that are used to display selected lines or fields of information. The Clamp Pulses used to time the vertical amplifier DC Restorers are generated by a Back Porch Generator driven by the Horizontal Sync Generator.

The input Staircase for the RGB/YRGB parade display is input to an operational amplifier through the rear-panel REMOTE connector. The compensatable (DC level and transient response) RGB Amplifier is enabled (RGB ENABLE) by a TTL low.

### Horizontal Sync Generator

The Comp Sync, from the Sync Separator on Diagram 1, drives the timing input to U20. U20 is a registered 16-input gate array that outputs line-rate enables and SYNC. The line-rate SYNC output drives U28B, a non-retriggerable one-shot that outputs a pulse wide enough to lock out the twice line-rate pulses in the vertical interval. The line-rate signal, output from pin 5 (Q), drives the Back Porch Generator (U28A), the Horizontal AFC phase-lock loop (U25), and the sweep trigger selector (U21).

U25 is part of a phase-locked loop. See Figure 5-4. In this application a second comparator, U29B, is used to drive the internal VCO. The circuit's input, through pin 14, is line-rate sync. R50 and C32 form an adjustable delay network that ensures filter or input switching occurs during H Sync time.



**Figure 5-4: Simplified representation of the AFC phase-lock loop**

U25 has a VCO as one of the onboard functions. Its timing components (C30, R73, and R74) keep the oscillator frequency near line sync rate. When there is line-rate sync, the output of the internal comparator will be approximately equal to the U29B + input DC level and no correction voltage will be input to the VCO. If line-rate sync is interrupted, the VCO runs at or near line-rate until sync is restored. When line-rate sync is restored, it will be out of phase with the VCO and the internal comparator (U25) will have an output indicating that the loop is unlocked. With an unbalanced input, the second comparator outputs an error signal that will:

1. Attempt to charge the loop filter.
2. Drive the VCO voltage input.

When the VCO output changes to a new frequency, the comparator output changes; however, the charge on the loop filter reduces the effect of this change on the comparator in order to slow the loop response. When the loop nears lock the amount of change is very small.

Having H Sync generated by this AFC circuit allows the 1730D Line Selector to work properly with noisy or occasional missing sync pulses. U26D is used as an inverter to output the required HSYNC.

The DC Restorer back porch pulse is generated by a one-shot, U28A. U28A is driven by half-shot Q5, which delays the trigger for U28A from the leading sync edge to back porch U28A is held cleared while sync is true to avoid clamping on the vertical sync broad pulses. The output pulse from Q37, an emitter follower, is time coincident with the back porch of the input sync signal.

**Vertical Sync Generator**

U29A is an integrator whose output is normally low. The broad pulse in the vertical interval will cause its output to ramp up. When the broad pulse ends, and the equalizing pulses begin, the output starts ramping back down. This negative-going signal is coupled through C52 to comparator U32B, to output the vertical rate sync pulses (VSYNC).

**RGB Amplifier**

Under normal operation the base of Q21 is pulled down by CR32, which causes Q20 to saturate and ground the amplifier output. When exerted the RGB ENABLE, from the REMOTE connector, is inverted by U26C and reverse biases CR32, which enables the RGB Staircase Amplifier.

The staircase signal from the REMOTE connector drives an operational amplifier composed of Q21 and Q20, whose gain is approximately 0.5. The amplifier is compensated, for optimum step definition (transient response), by C56. R170, the RGB Offset adjustment, compensates for input DC level variation.

**Field ID and Trigger Select**

U21 is a 16-input, registered gate array containing a D-type flip-flop. line-rate sync (from U20) drives its Data input, which is clocked through by vertical sync from U32B. Because of the half-line offset between fields, in the vertical sync, alternately a high or a low line-rate sync level is clocked out to enable the flip-flop outputs. FIELD is a frame rate square wave that is high for one field and low for the other, that provides field-rate timing information to the Micro-processor. The VTRIG output triggers the Field Rate Sweep Generator. There is no field identification for RGB and Remote Sync operating modes.

Non-standard sync inputs may cause the field identifying circuit to stop producing a field-rate trigger signal for the Sweep Generator. When this happens, VSYNC is automatically used for triggering (without any field identification taking place). Q2, C9, and R37 detect the absence of field identified vertical sync. The field pulse U21 pin 14, normally keeps Q2 on, which holds pin 19 of U21 high when there is field identification. This allows normal frame rate triggering.

Q2 is off, however, when field ID fails or Q3 is on (90/100 Hz mode selected). In this case a field-rate trigger is passed to the sweep system.

VTRIG is the frame or field-rate trigger signal enabling the Sweep Generator, which is positive edge triggered. Field 1 or Field 2 sweep triggering is selected by the FLD1/FLD2 control line from the processor. A positive edge is output at the start of the selected field.

In addition, U21 decodes instructions for selecting either the applied sync (CAL high) or the Calibrator (CAL low) for the source of line-rate sync (HTRIG).

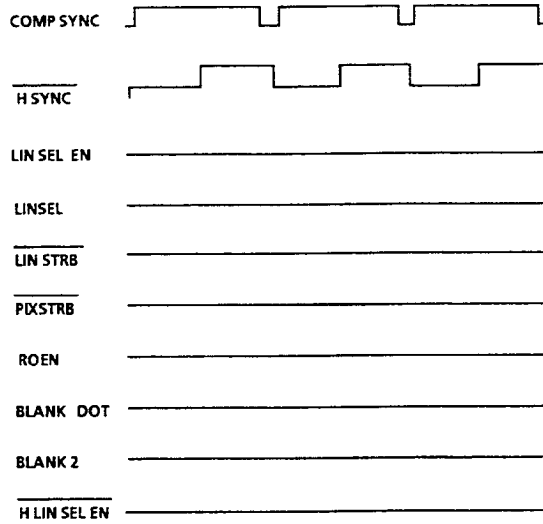
Displaying the appropriate lines in the LINE SELECT mode is achieved by blanking the CRT beam the rest of the time. The LIN SEL signal from the

Microprocessor is used by U20 to generate LINSTRB, which is the blanking signal, and PIXSTRB, which is the strobe signal for the rear-panel Picture Monitor Output. See Figure 5-5 for timing details.

Figures 5-6 and 5-7 are timing diagrams that show the signal relationships for 2 Line and 1 Line sweep rates in the LINE SELECT mode.



**a.**



**b.**

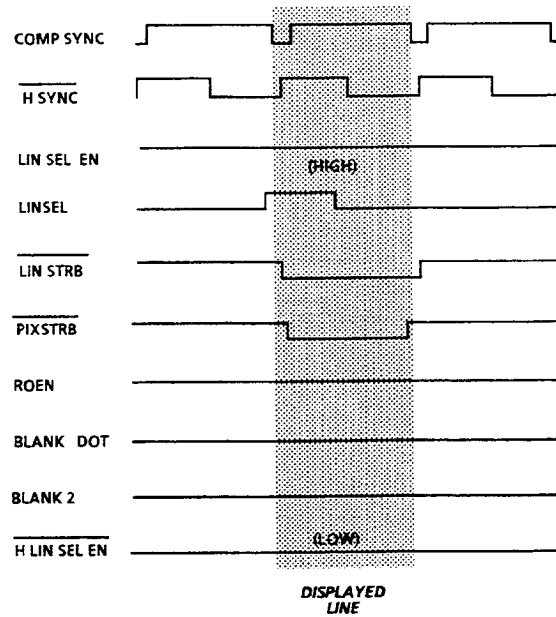


Figure 5-5: Elements for line select timing: a) Line select off b) 2 Field line select

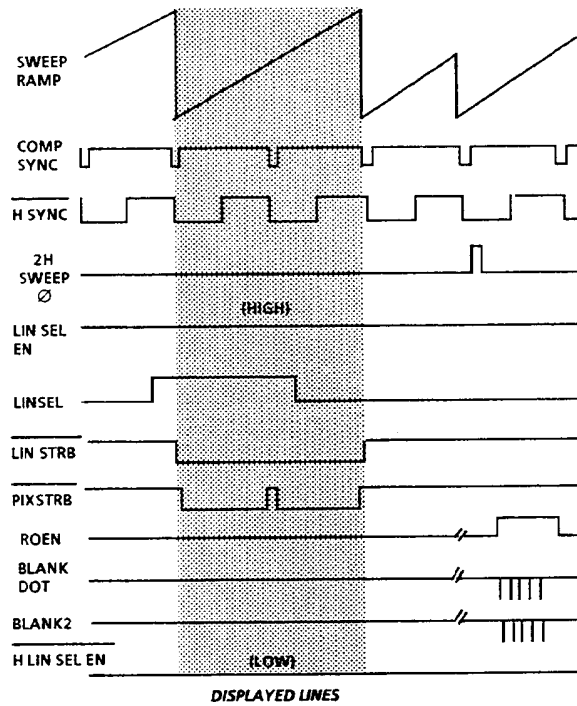


Figure 5-6: Relative line select timing elements for the 2 Line display

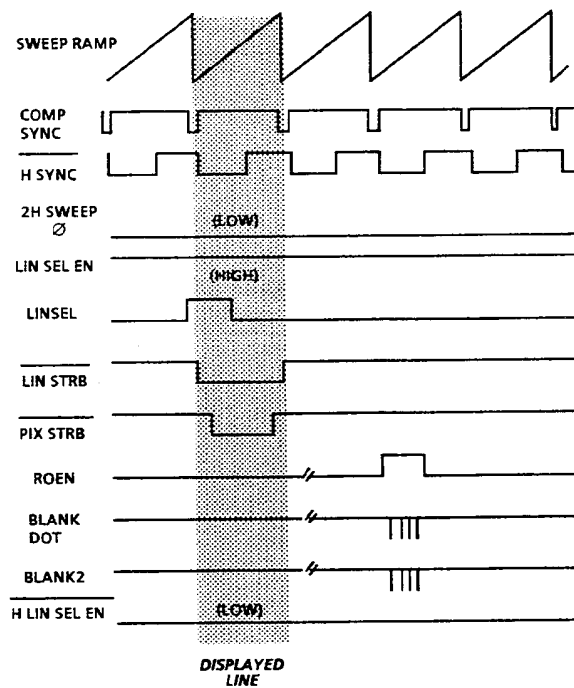
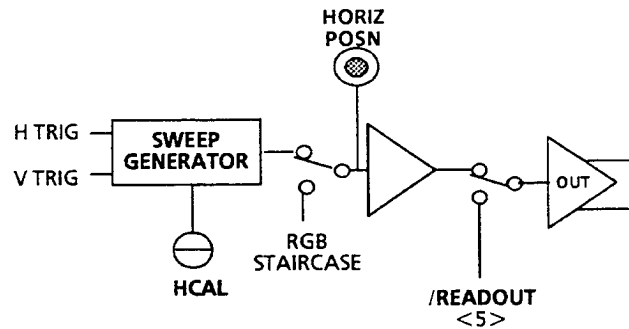


Figure 5-7: Relative line select timing elements for the 1 Line display

## Diagram 4 Sweep Generators and Horizontal Output



Horizontal and vertical triggering signals enable integrator sweep generators, by dictating when retrace occurs. The output of the selected sweep generator drives a Magnifier Amplifier, which provides sweep magnification, RGB staircase input, and positioning control. The output of the Magnifier Amplifier drives the Output Amplifier to match gain and impedance for the CRT deflection plates. When 1- or 2-line Line Select is displayed readout is switched into the Output Amplifier, for CRT display, on a time sharing basis with the sweep information.

### Sweep Generator

U31B (line-rate Sweep Generator) and U31A (Field Rate Sweep Generator) are integrators, one of which is disabled while the other is running. The selection is controlled by the H and V Trigger signals from the Sync Generators (Diagram 3) and the LIN/FLD control line from the Microcontroller. When a trigger arrives, for the selected sweep, the D-type flip-flop (U23A or B) is clocked high and turns on Q18 or Q17, which discharges the integrating capacitor (C51 or C50). See Figure 5–8. The Q output of U23A or B going high also starts a one-shot (U24A or B) which pulls the flip-flop Preset low which assures at least 2  $\mu\text{s}$  (line-sweep one-shot time constant) of discharge (retrace) time. Field sweep one-shot time constant is 500  $\mu\text{s}$ . At the end of the time constant, Preset goes high and Clear goes low, causing the flip-flop Q output to go low and turn off Q18 or Q17 to start charging the integrating capacitor.

Timing resistors R129, R130, and R140 provide current for the integrators. They are referenced to the junction of R132 and R143, nominally 6 V. When a one line or field sweep (including RGB parade) is selected, pin 3 of U32A is pulled low and effectively shorts out R132 to provide more current for a faster sweep. Q19 provides a compensation for 50 Hz sweep by taking away a small amount of current when operating with 625/50 Hz sweep rates.

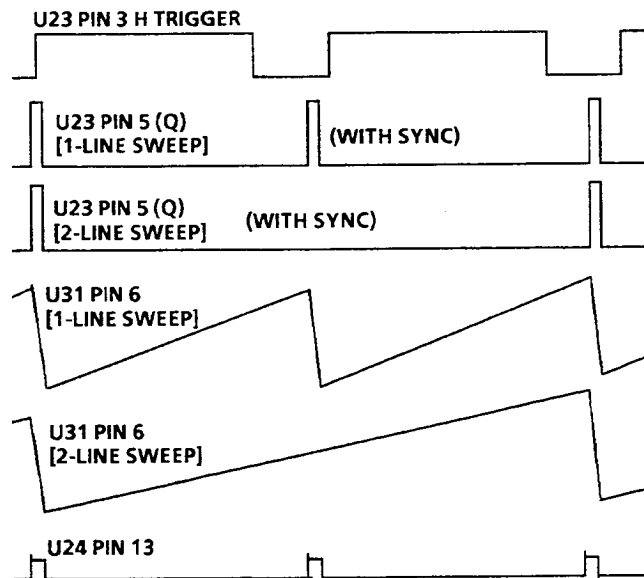


Figure 5-8: Timing signals for 1-line and 2-line sweep

If there is no H or V Trigger, the output of the running Sweep Generator is self retriggered. When the ramp amplitude reaches about 120% of its maximum amplitude, U27B trips and sets the flip-flop Preset high to turn on Q18 or Q17 to start retrace. U27A inhibits ramp retriggering until the sweep is 80% complete.

The Microcontroller-generated 2H SWP PH retriggers the line-rate Sweep Generator by turning on Q18 (which discharges the integrator capacitor, C51) to synchronize the sweep for Line Select or when dual filtering or input switching is selected.

The output of both one-shot and LINSSEL BLNK is gated through U18B to become the blanking enable, which ensures that the CRT will be blanked during retrace and unblanked during the portion of active sweep that is to be displayed.

### Magnifier Amplifier

An operational amplifier consisting of U36D and Q35 positions and magnifies the sweep signal. R181 and R196 are the central elements of the feedback resistor network. The value of the network is altered by R151 (1  $\mu$ s Cal) and R161 (0.2  $\mu$ s Cal) when magnified sweep rates are selected. The junction of input resistance (R182) and the feedback resistance network (R181 and R196) is the amplifier input summing junction.

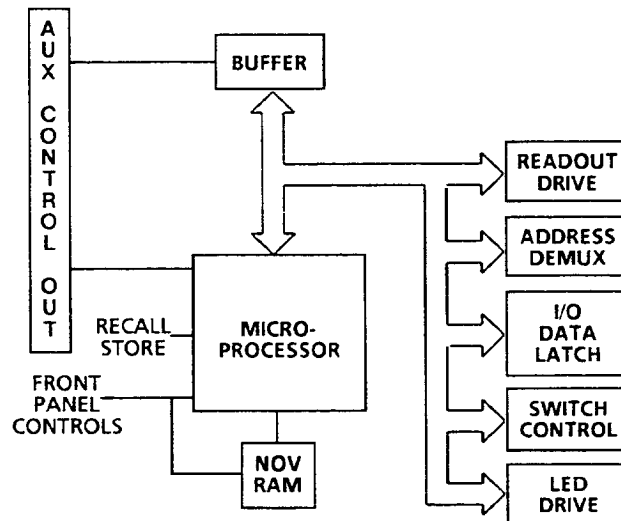
Horizontal positioning voltage is input to an operational amplifier, U33B, which drives the Magnifier Amplifier summing point (along with the RGB staircase signal, when RGB/YRGB operation is selected). The length of the sweep, in RGB mode, is set by jumper J10 to accommodate either 3- or 4-step sweeps (for RGB and YRGB modes).

U37A and U37B are comparators used to sense when the output of the Magnifier and Position Amplifier have driven the CRT beam to the edge of the CRT screen. When the beam is horizontally overdriven, the input to U17C is pulled low to generate the BLANK enabling level for the Z-Axis Amplifier (Diagram 6).

### **Horizontal Output Amplifier**

The Horizontal Output Amplifier is composed of Q24, Q28, Q30, and Q33, with Q31 and Q34 serving as current source loads. R189 provides the differential mode feedback; R187 and R201 provide the common mode feedback that biases the outputs to approximately 50 volts. The gain of the amplifier is adjusted by R166 (Sweep Length) and its offset is set by R185 (Mag Reg). For screen readout Q29 and Q32 switch out the horizontal sweep and switch in the horizontal X-Axis component of the line select readout.

## Diagram 5 Microcontroller



The Microcontroller is the brain of the 1730D Waveform Monitor. It monitors the front panel, Store/Recall functions, and the Remote interface. Changes to any switch setting or remote line is converted into appropriate control levels for circuits in the rest of the monitor.

### Microprocessor

The Microprocessor (U4), used as the 1730D Microcontroller, contains 16K of ROM. The onboard ROM holds the Microprocessor machine instructions. Crystal-controlled oscillator frequency is 12 MHz.

The processor operates with an eight-bit multiplexed address/data bus that interfaces through Port 0 (pins 32-39). Front-panel switches and Recall selections are sensed by Port 1 (pins 1-8). Each front-panel momentary contact switch (along with the Recall switches) has a specific row and column address. Functions are changed by simply pushing (to toggle) or pushing and holding a front-panel momentary contact switch. As an example: When row 1 and column 1 are connected together (by switch closure) the sweep rate toggles between the 2-line and 2-field sweep rate; however, if the switch is held in for a discernible interval the processor will switch sweep rate to 1 line.

The I/O Port 2 provides eight additional interface lines. Pin 25 is the U53 Chip Enable, while pin 24 is the Chip Enable for U8. Three lines (pins 26-28) output high levels to drive analog switching functions (BLANK DOT, LINSEL, and 2H SWP PH). Pin 22 is the Serial Clock/Load to the Switch Control (U52).

Pins 12, 13, and 14 input horizontal (line) sync and vertical (field) sync, to decipher line select data and real-time switching functions (A/B and Low-Pass/Flat switching). Jumper J2 sets the field rate to 50 or 60 Hz.

Pins 10 and 11 are the Auxiliary bus (TXD pin 11 and RXD pin 10) through U52, a Multiplexer. U5B and C are buffers for the Auxiliary bus structure, which connects directly to a 1720-Series through the rear-panel AUXILIARY connector. The TXD and RXD lines also write to A5U24 on the Serial circuit board. The EDH data is read from the co-processor through this bus, at around line 26 in each field, so that the EDH readout can be updated.

Pin 17 (RD) is the remote input enable for U16, the REMOTE input buffer and U5A, the REMOTE STORE buffer. Pin 16 (WR) enables readout DAC (U10), clocks the Port A I/O Data Latch (U19), the Port B I/O Data Latch (U12), and enables the internal registers in the LED Driver (U2)

The functions of the control lines, originating on the Microcontroller diagram, are shown in Table 5–1. The active condition of the line, and the expected result, when active, are detailed here.

**Table 5–1: Control Line Functions**

Signal Line	State	Result
X5	High	Enables 5X Vertical Magnifier. (U19)
BLANK DOT	High	Blanks between dots in Line Select readout. (U4)
LINSEL	High	Unblanks the CRT for Line Selected line. (U4)
2H SWP PHASE	High	Resets 2H Sweep Generator for Line Select and real-time switching functions. (Q4)
RXD	----	Used in serial port diagnostics and Auxiliary. (U52)
TXD	----	Sends data to companion 1720-Series. (U52)
CAL DR		100 kHz pulse to Calibrator. (U15B)
CAL	Low	Enables Calibrator. (U12)
ROEN	High	Enables readout in Line Select. (U12)
LIN/FLD	High Low	1 or 2 Line display. 2 Field display. (U12)
TWO /ONE	High Low	2 Field or 2 Line display. 1 Line (no single field display possible). (U12)
MAG	High	Enables Horizontal Magnifier. (U12)
EXT	High Low	Enables internal sync reference. Enables external sync reference. (U12)
FLD 1 /FLD 2	High Low	Field 1 trigger in 2 Field Sweep. (U12) Field 2 trigger in 2 Field Sweep.(U12)

**Table 5-1: Control Line Functions (Cont.)**

Signal Line	State	Result
LIN SEL EN	High	Blanks CRT for Line Select, except during LINSEL high. (U12)
X-AXIS	----	Analog signal to horizontal deflection amplifier for Line Select readout. (U14A)
Y-AXIS		Analog signal to vertical deflection amplifier for Line Select readout. (U14B)
CH B	High Low	Enables CHA input. Enables CHB input. (U45)
ON DCR	Low	Enables DC Restorer. (U45)
CHROMA	Low	Enables NTSC Chrominance filter. (U45)
EYE SEL	Low	Enables the Eye Pattern display (U45)
LPASS	Low	Enables Low Pass filter. (U45)
FLAT	Low	Enables Flat (no filter). (U45)
VAR	Low	Enables vertical variable gain. (U19)
DAC SEL	Low	Enables DAC output to the Vertical input switching. (U45)

**NOVRAM**

U8 and U53 form the Non-Volatile Random Access Memory (NOVRAM) used to retain the current front-panel status and the status for the Stored Recalls (Auxiliary). Data is written in and read out through pins 3 and 4; pins 24 and 25 of U4 enable the chips.

The NOVRAM serial clock is from the COL 0 line. The Data In/Data Out, and Chip Enable are active when:

1. Power is turned on.
2. Any front-panel switch is pressed.
3. A Store or Recall is requested.

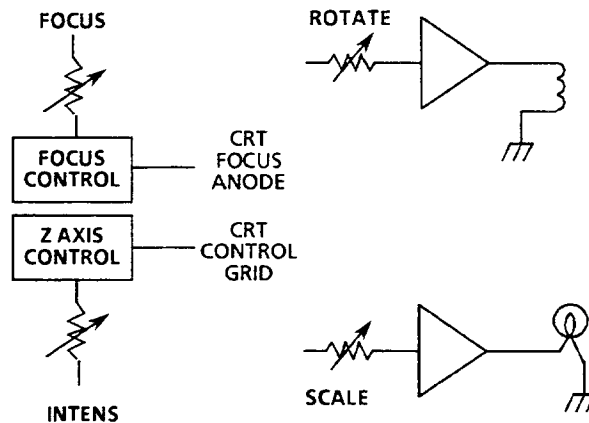
If instrument power is lost, a DC detector (U9) detects the loss of power in time for both of the NOVRAM chips (U8 and U53) to execute a save operation. When the +5 V supply drops a few hundred millivolts, U9 pulls pin 7 of both NOVRAMS low, which causes them to Store their current status. The front-panel and Auxiliary (Store/Recall) data is saved in a matter of milliseconds when the power starts to drop below safe operating levels. U13 is a three-terminal regulator operating from the +15 V supply, which comes onto the circuit board from the main Power Supply. As soon as the +15 V raises enough to provide a +5 V output from U13, U8 and U53 recall the data saved so that it will be available to the Microprocessor when all supplies are up to their operating tolerances.



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<b>Switch Control</b>	U45 is a serial-in/parallel-out register that is loaded with the real-time switching data from the Microprocessor serial port (pin 10) whenever the Serial Clock from U52 is asserted. When the Serial Clock line is high, the serial input of U45 is enabled and the external communications input, through U5B, is disabled. The eight bits of serial data now in the internal register are clocked out, in parallel, by the leading edge of H (line) Sync, which is the clock signal driving U45 pin 12.
<b>Address Demux</b>	U11 is the Address DE-MUltipleXer (Demux) used to decode the lower eight bits of the address line. Even though both addresses and data share the same Microprocessor port, only addresses are present when U11 is clocked by the Microprocessor ALE output.
<b>Readout Drive</b>	U10 through U14A and B drive the X and Y axes of the dot-scanned CRT readout. U10 is a dual D/A Converter (DAC) whose internal registers are loaded from the Data/Address bus and clocked by the Microprocessor WR output.
<b>I/O Data Latch</b>	U12 and U19 are data latches outputting control signals to the 1730D non real-time switching and the readout enable (ROEN). The addresses are loaded from the Address Demux (U11) and clocked out by the Microprocessor WR output. The ROEN operates in conjunction with the Microprocessor Blank Dot output (pin 26) in order to display the data output from U10 on the CRT.
<b>Cal Drive</b>	U15 divides down the Microprocessor ALE output to generate the Cal Drive. U15 is enabled by the CAL from the I/O Data Latch, U12.
<b>LED Drive</b>	The front-panel LEDs are driven in six common banks by U2. U1 provides a common current drain that is enabled by U2. Data registers in U2 are written into by the Microprocessor over the eight-bit address bus and read out to front-panel LEDs when WR goes low.

## Diagram 6 Control Circuit



Blanking signals, for video and readout, are input to an intensity switching matrix along with a DC voltage level set by the front-panel INTENS control. Focus level, for the CRT focus anode, is set by regulating the current through a transistor current source. The amount of focus current through the transistor depends on the setting of the front-panel FOCUS control. The effects of small variations in the magnetic field surrounding the instrument are compensated for by an adjustable magnetic field placed around the CRT bulb. Scale illumination for the CRT face plate is set by controlling the output amplitude of a triangle generator that drives the scale illumination bulbs.

**Focus Control** The Focus control operation must also control two different display criteria. In the normal mode of operation, the Focus voltage will be selected by the control setting only (Q7 is off). When a Line Select Un-Blanking pulse occurs, U22B turns off and additional current flows through Q7. R101, the LS Focus adjustment, is adjusted for optimum focus in LINE SELECT at the normal display focus setting.

**Z-Axis Control** U30 is a transistor array with two of the transistors connected as a differential current switch. The static output level (pin 8) is set by the front-panel INTENS intensity control using Q9 (in the Focus Control) as a current source. The Blanking signal is input to the transistor switching array through U30B (pin 9). When it goes high, the current output, collector of U30A (pin 8), is shut off and the Z-Axis Amplifier (Diagram 9) blanks the CRT. See Figure 5-9.

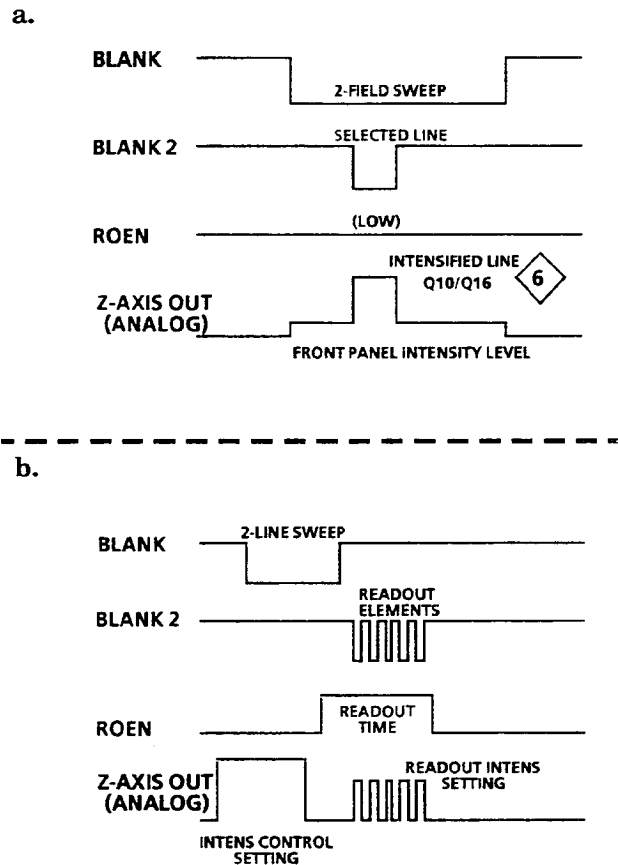


Figure 5-9: Z-Axis timing for readout: a. 2 Field display intensifies the line (lines) to provide a bright-up strobe. b. In 1- or 2-line sweep, alpha-numeric readout in the upper left corner of the CRT is used to convey the number of the first selected line

In LINE SELECT mode, the intensity setting has to change to brighten up the line or lines. This is accomplished by increasing the current through the current source (Q9). U22A is an open collector, dual comparator whose output goes low during Line Select Blanking to allow the full current available, across R70 and R87, to flow in the circuit.

### Trace Rotation

Trace rotation compensates for changes in the magnetic field surrounding the 1730D. Q6 and Q8 are emitter followers that provide the Trace Rotation current to the CRT surrounding coil located inside the CRT shield. Current amplitude and polarity are controlled by the front-panel ROTATE screwdriver adjustment.

**Graticule Illumination**

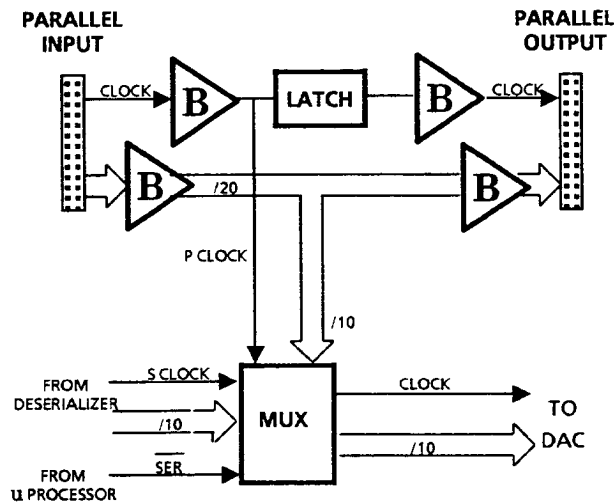
U34A is a triangle generator whose output is compared to the front-panel SCALE control output level by U34B (a comparator). Whenever the output of U34A is higher than the level from the front-panel SCALE control, Q25 is turned on and current is drawn through the bulbs (DS100, DS200, and DS300) to ground. The duty cycle of Q25 is determined by the level set by the front-panel SCALE control. Q77 turns off the bulbs during screen readout.

J100 is normally in the 1–2 (Lights Enabled) position. In the 2–3 position, the graticule scale illumination is disabled.

**+/-11.8 V Regulators**

The + and -15 V supplies generated by the Low Voltage Power Supply are further regulated to meet the power requirements of the Main (A3) circuit board. U35 is the -11.8 V regulator; its reference level is set by R208, the -11.8 V Adjust. U38 is the +11.8 V supply regulator and its reference level is set by R219, the +11.8 V Adjust.

## Diagram 7 DAC Loop-Through & MUX



Digital information from either the parallel loop-through input or the deserialized data from the serial input is multiplexed and output to the DAC. The Parallel input and output is an active loop through, in that the data is buffered in and latched out.

### Rear-Panel Input

The rear-panel digital input at P1 consists of 10 bits of differential ECL data and a clock. There are eleven input buffers (U1A through U4C). The input buffers act as line receivers. Using U4A as an example, if the positive input at pin 5 is 185 mV greater than the negative input at pin 4, the output at pin 3 appears as a logic 1, or high. The inverted output at pin 2 appears as a low. Conversely, if the negative input is 185 mV greater than the positive input, the positive output signal is a logic 0, or low. R1 through R10 are line terminating resistors.

### Output of Line Receivers

After the line receivers, the differential signal, from the input buffers, drives a set of latched buffers, U5. At U5A, the incoming data is latched and output through the rear-panel DIGITAL PARALLEL OUT. The differential parallel clock signal controls the latch as well as being buffered through U5A. The output signals from the buffered latch require the receiving equipment to be differentially terminated in 110  $\Omega$ .

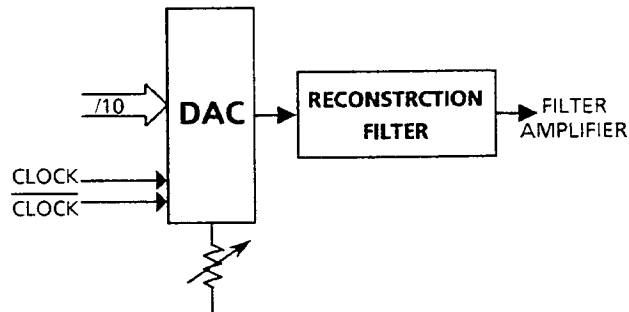
### Multiplexer

U6, U7, and U8 form a 10-bit (plus differential clock) multiplexer. The A input is driven by the non-inverting output of the parallel input buffers and the B input is driven by the deserialized output from the Serial circuit board. Differential clock signals from either the deserialized serial signal or the parallel signal are

selectively switched by U8. The multiplexer is controlled by the  $\overline{\text{SER}}$  signal driving the A/B switching input of the Multiplexer.  $\overline{\text{SER}}$  is developed from the Microprocessor generated SERIAL control line (Diagram 12). With plug P7 in the 1–2 position and Serial input selected from the front panel, the line is held low by the voltage set by the voltage divider (R19, R20, and R21), which puts the Multiplexer in the  $\overline{\text{B}}$  (B inputs). When the plug jumper is in this position and Parallel is selected from the front panel, the line is pulled up to about  $-0.9\text{V}$ , which switches the Multiplexer to the A inputs. When the plug is in the 2–3 position the Multiplexer A/B input is always held at  $0.9\text{V}$  (set by the voltage divider) and the Multiplexer is in the Parallel position regardless of front-panel selection.

The 10-bit output, from the Multiplexer, drives the 10-bit DAC on Diagram 8.

## Diagram 8 D/A Converter

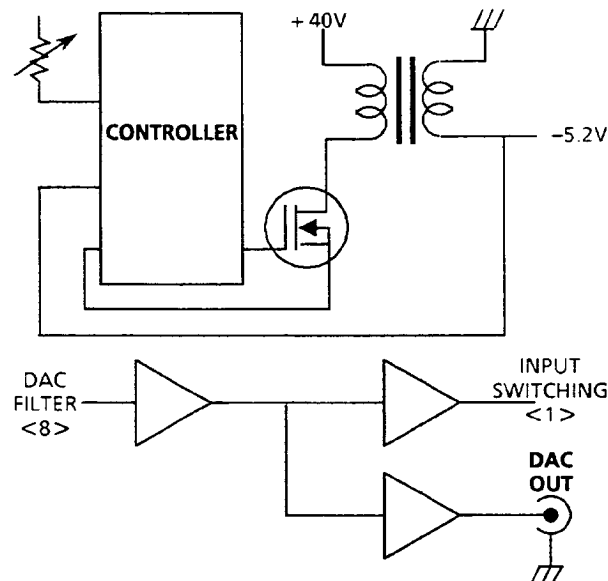


The D/A Converter changes the latched in data bits to an analog current output. If the input digital signal is a usable TV signal, the output of the reconstruction filter will be a composite video signal.

**DAC** The Digital-to-Analog Converter (DAC), U9, converts the 10-bit digital signal to an output current. The magnitude of the output current at pins 17 and 18 is a function of the digital word value and reference current input to the DAC through pins 38 and 39. A DC offset is added to the output current by a voltage reference network (U10 and U11). This offset is adjusted by R34 (DAC Offset), and is set so that the blanking level (data word 0F0 hex) of the rear-panel DAC OUT signal is at 0 V. The offset voltage, measured at pin 15 and pin 16 of U9, is nominally 750 mV.

**Reconstruction Filter** The Reconstruction Filter smooths out the discrete steps output by the DAC. It consists of a 7-pole elliptical filter and a 2nd order delay equalizer. The delay equalizing stage consists of T1, L1, and the series and shunt capacitance. T1 and L1 are adjusted for optimum group delay compensation. The remainder of the filter (L2, L3, and L4) is adjusted for optimum 2T pulse response. R38 terminates the filter in 75  $\Omega$ .

## Diagram 9 DAC Amplifier and Power Supply



Three amplifiers are used to interface the DAC Reconstruction Filter to the subsequent analog processing. The Filter Amplifier terminates the Filter and provides  $\text{Sin}^x/x$  correction. The Output Amplifier drives the rear-panel DAC OUT. The Input Driver modifies the gain and frequency response to match the 1730D analog input.

The DAC Power Supply generates  $-5.2\text{ V}$  to power the ECL circuits on the DAC and Serial circuit boards.

### DAC Power Supply

The DAC Power Supply converts the  $+40\text{ V}$  supply from the Main board to  $-5.2\text{ V}$  to drive the ECL devices U1, U2, U3, U4, U5, U6, U7, U8, and U9. There are three noise suppression networks consisting of L6 and C55; L9 and C60; and L7 and C57.

The  $5\text{ V}$  supply is generated by a continuous mode flyback-type switching supply, which uses the  $+40\text{ volts}$  as a power source. Q14, a Field Effect Transistor (FET) switch, is chopped at a  $100\text{ kHz}$  rate. Its duty cycle, which is determined by the Controller (U12), sets the output voltage. Pin 16 of U12 is internally set to  $+5\text{ V}$ , and is the chip reference. This reference voltage is divided down to  $+2.5\text{ V}$  by R90 and R93 to drive the internal error amplifier inverting input (pin 1 of U10). The  $-5.2\text{ V}$  output is divided by R87 and R89 to drive the non-inverting input (pin 2) of the internal error amplifier. The duty cycle of the output waveform (pin 11) is adjusted so that voltage on pin 2 is at  $+2.5\text{ V}$ , which makes the voltage output  $-5.2\text{ V}$ .



CR2 and C60 clamp any voltage spikes at the drain of Q14 to 100 volts. CR4, R99, and C61 form a snubber circuit to lessen the rise time on the drain of Q14 to lower radiated noise from the supply.

L8, C56, and C58 are the  $-5.2$  V supply output filter. CR1 is the output rectifier. C62 and R96, connected to pin 9 of U12, compensate the error amplifier. R97 and C63 are the timing elements (pins 6 and 7) that set the operating frequency to 100 kHz. R86, R94, and R98 limit current to prevent a secondary overload from destroying Q14. When pin 4 of U10 is equal to or greater than  $+0.2$  volts, the Controller shuts off.

### Filter Amplifier

The Filter Amplifier is a feedback operational amplifier, consisting of Q1, Q2, Q3, Q4, and Q5. It is driven by the Reconstruction (low pass) filter shown on Diagram 8. The Filter Amplifier gain is nominally 5, and is set by the combination of R46, R50, and R57; R57 as the DAC Gain adjustment. C43 peaks the amplifier to compensate for the SIN X/X sampling loss. The output of this amplifier is a 2 V peak-to-peak video signal, at the emitter of Q4, that drives the Output and Input Driver Amplifiers.

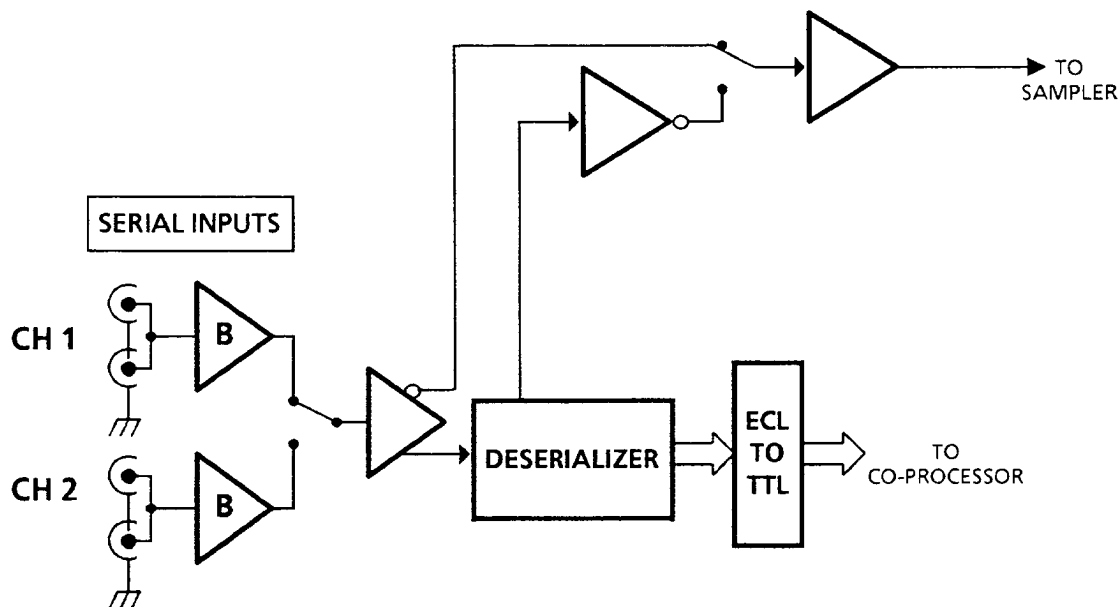
### Output Amplifier

The Output Amplifier is a X1 amplifier, providing power gain to drive the  $75\ \Omega$  rear-panel DAC OUT connector. Its active devices are Q6, Q7, and Q10. R78 is the “build-out” resistor that sets the output impedance to  $75\ \Omega$ , to produce a 1 V peak-to-peak video signal into a  $75\ \Omega$  termination. L5 improves the return loss of the amplifier at high frequencies.

### Input Driver

The Input Driver takes the Filter Amplifier output, inverts it, and drives the input switching circuitry (located on the Main circuit board). It is an inverting X1 Operational Amplifier, whose active devices are Q8, Q9, Q11, Q12, Q13. The  $-1$  gain of the amplifier is set by the combination of R58, R74, and R80; R80 is the Gain adjustment. C47 is adjusted to compensate the high frequency response and R63 (Input Offset) sets the output DC level.

## Diagram 10 Serial Input & Deserializer



The circuits on this schematic include a passive loop-through input for the serial video signal, input switching, and conversion to parallel video (deserialization). It also provides two selectable drive signals for the sampler; the buffered serial signal, and a version of the input signal that has been equalized for the coax cable loss.

### Serial Digital Input

The rear-panel Serial Inputs are high return loss, passive loop-throughs, similar to those used on analog video equipment. This allows “in line” monitoring of a serial path. Q1 (or Q2 for Ch 2) presents a high input impedance to the loop-through. Q1 and Q2, along with board parasitics, presents a small capacitance to the loop-through. A coupled inductor configuration, called a T-coil, is used to cancel this capacitance so that the loop-through bandwidth and return loss are relatively constant with frequency. Diodes CR2 and CR5 (CR4 and CR6 for Ch 2), along with transistor Q3 (Q6), form a switch. When transistor Q3 (Q6) is off, current from resistor R25 (R14) forward-biases the diodes, and the switch conducts. When channel 2 is selected, transistor Q4 turns on, saturating transistor Q3. All of the current from R25 now flows through Q3, and both diodes become reverse-biased, shutting off the switch. Any switch blow-by, through CR2, is shunted to ground by Q3, improving the isolation of the switch. Conversely when channel 1 is selected, Q5 turns on, saturating transistor Q6. All of the current from R14 now flows through Q6, and both diodes reverse-bias to shut off the switch. Blow-by, which is through CR4, is shunted to ground by Q6.

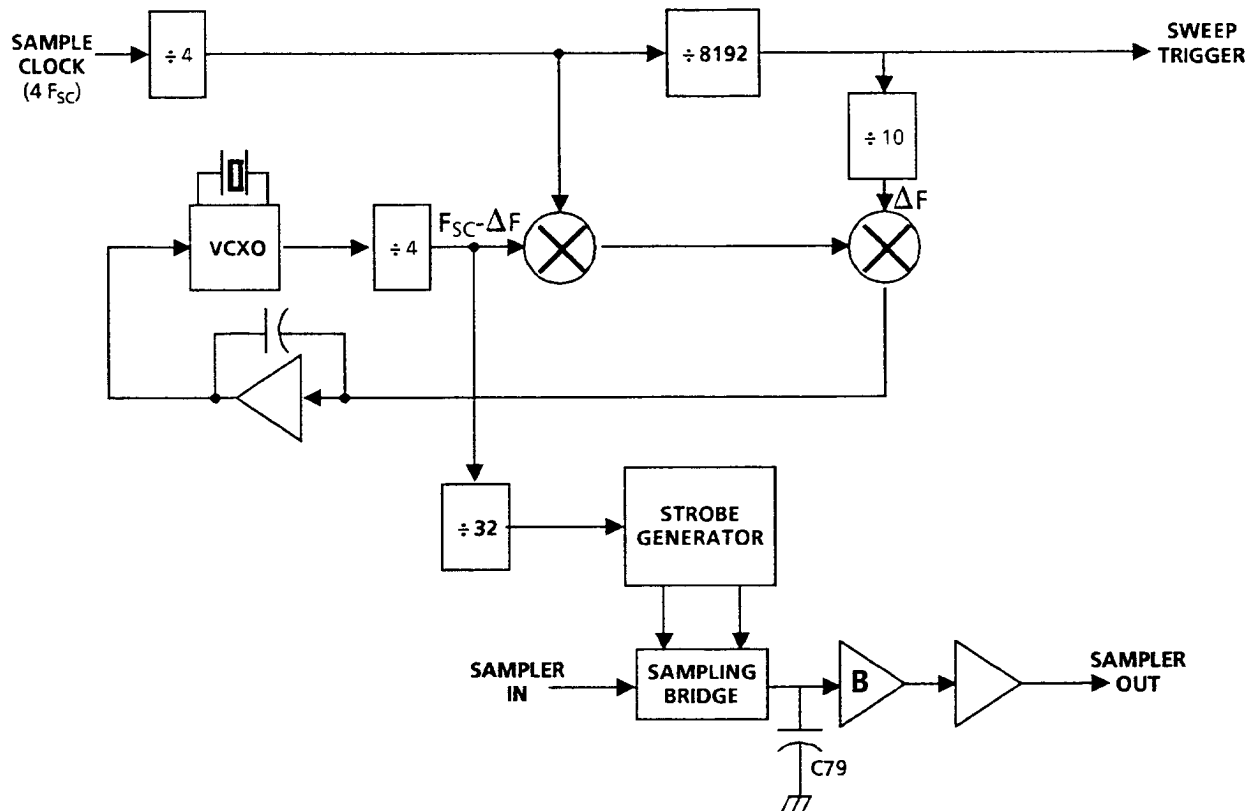
Q11 and Q12 form a coupled emitter, differential output amplifier. The collector of Q11 is a current source drive for the Deserializer (U1), and is terminated at U1 by R65. The gain from the loop-through input to this point is unity. The collector of Q12 provides the drive signal for the Eye display sampler. Q9 and Q29, along with R33, R34, and R44, bias the amplifier so that a 3 V drop occurs across R44. This provides about 10 mA of current flow in Q11.

**Deserializer** U1 equalizes the applied serial signal for coax cable loss, recovers the data clock, and converts the serial data to parallel data. R64 sets the free run frequency of the internal VCO. Q20 and associated components set the bandwidth of the U1 phase lock loop. Under normal operation, the signal, at pin 20, toggles each time word sync (TRS) is detected by U1. This generates a square wave, with a 2 line period. The square wave is peak detected by CR9 and CR10 and charges C23 to several volts above ground. When the charge on C23 reaches 0 V, Q20 shuts off and pin 5 falls to -5 V. When pin 5 falls the phase lock loop switches to narrow band mode to help reduce bit slip when clock information is low. If word sync is not detected, the absence of the square wave at pin 20 allows C23 to discharge through R67 and eventually, turn on Q20. When Q20 turns on, it switches the phase lock loop to wide band mode to allow the deserializer to re-acquire the signal. The presence of an input signal at pin 26 of U1 sets pin 35 to approximately 0 V which turns on Q21. Its drain will be near 0 V to indicate a “signal present” condition to the serial co-processor (schematic 12). With no serial input, pin 35 is at 5 V, which turns off Q21, and sends a +5 V “no signal” message to the co-processor. U2, U3, and U4 convert the ECL outputs of the deserializer to TTL levels.

**Sampler Drive** The Eye display sampler (schematic 11) is driven from one of two different current sources. One is the collector of Q12, which provides a unity gain, inverted replica of the applied serial input, when it is terminated in the 75  $\Omega$  sampler input resistor (R153). The other is the collector of Q17, which is an inverted replica of the applied signal after equalization for cable loss. U1 contains the cable equalizer, and outputs a 250  $\mu$ A p-to-p signal through pin 31. Q14, Q15, Q17, and Q18 invert and amplify this current approximately 50 times, so that 12 mA p-to-p flows in the collector of Q17. When EQ EYE mode is selected, this current is switched into the 75  $\Omega$  sampler input resistor. R31 adjusts the current gain of the amplifier so that an 800 mV p-to-p signal results. The EQ EYE display is always approximately 800 mV, regardless of the serial input signal amplitude, because of the equalization and AGC action of U1.

CR7, CR8, Q10, and Q16 form the current switch that selects between the collector currents of Q12 and Q17. When EYE mode is selected, Q8 is turned on, saturating Q16. This reverse biases CR8 and shunts the Q17 collector current to +12 V. Meanwhile, CR7 is forward biased by the Q12 collector current, which then flows into sampler input resistor R153. When EQ EYE mode is selected, CR7 is reverse biased by Q10, and CR8 becomes forward biased, directing the Q17 collector current into R153.

### Diagram 11 Sampler



The circuitry on this diagram is centered around an equivalent time sampler that provides a voltage versus time display of the serial video bit stream. Equivalent time samplers are used where waveforms are repetitive. The waveform voltage is sampled at many different points at a rate much slower than the basic repetition rate of the signal. Over many cycles of the signal, a representation of the waveform is created. The serial bit stream may not be repetitive, but the overlay of the different bit patterns is. This concept provides the Eye pattern display for the 1730D.

The sampler consists of a time base, sample strobe generator, and a bridge diode sampler. The time base takes in a  $4F_{SC}$  parallel rate clock from the deserializer and generates a second clock at  $F_{SC} - \Delta F$ . This second clock gates the strobe generator to produce narrow pulses that briefly turn on the bridge diode sampler, which samples the voltage value at the sampler input. Because the sampler clock is running at a frequency slightly lower than a sub-multiple of the serial bit rate, the sampling point “slips” through the serial stream. In this manner, all phases of the serial bit period are eventually sampled, providing the Eye pattern display samples.

**Time Base** The  $4F_{SC}$  sample clock, from deserializer (U1), is applied to a reference divider chain consisting of U8, U12, U14, and U16. The output of the chain (TP4) is a square wave at a frequency  $\Delta F$ . See Table 5–2. This signal is one input of phase detector U17. Q23, Y1, CR18, and U9 form a voltage controlled oscillator (VCO) that runs slightly below  $F_{SC}$ . The VCO output is multiplied against an  $F_{SC}$  rate signal output from U8 by exclusive-OR gates U13A and U13D. The resulting output is low-pass filtered (R103, R104, C59, C82, and C84) and input to comparator U18, which functions as a limiter, to produce a square wave at the difference of the VCO frequency and  $F_{SC}$  (TP5). This square wave is applied to the second input of phase detector U17.

**Table 5–2: Reference Frequency ( $\Delta F$ )**

Instrument	Serial Number	$\Delta F$
1730D	B020000–To date.	43.7 Hz

In equilibrium, the two phase detector inputs will be at the same frequency and have a fixed phase relationship. Thus the VCO frequency should be lower than  $F_{SC}$  by  $\Delta F$ . If this is not the case, then phase detector U17 will output positive or negative voltage pulses at pins 5 and 10 to move the oscillator onto frequency. This voltage is integrated by loop filter U20, and applied to a varactor (CR18) that adjusts the frequency of the oscillator. C55 is set so that the oscillator runs on frequency with a nominal control voltage of 4 V at TP3.

The phase detector input connections produce a negative feedback control loop for the VCO as long as the VCO frequency is lower than  $F_{SC}$ . If the VCO frequency rises above  $F_{SC} + \Delta F$ , the phase detector action is inverted and the VCO will be pushed to a still higher frequency, eventually railing the error amplifier. To prevent this, while still allowing a wide frequency capture range, an ancillary circuit detects the “high side” lock condition and applies current to the error amplifier (U20) to push the loop back to “low side” lock. Mixers U13B and C multiply the VCO output against  $F_{SC}$  that has been retarded 90. Thus the signals at TP5 and TP6 should be identical square waves, but in quadrature. As long as the VCO frequency is lower than  $F_{SC}$ , the quadrature mixer (TP6) will lag the in-phase mixer (TP5), and a low will always be clocked into flip-flop, U21B. This keeps CR21 reverse biased, the normal operating condition. If the VCO frequency should rise above  $F_{SC}$ , however, the quadrature mixer will lead the in-phase mixer, and a “high” will be clocked into U21B. CR22 will become reverse biased, and current will flow through R131 and CR21 into the error amplifier, U20. This will cause its output to move toward ground, lowering the VCO frequency.

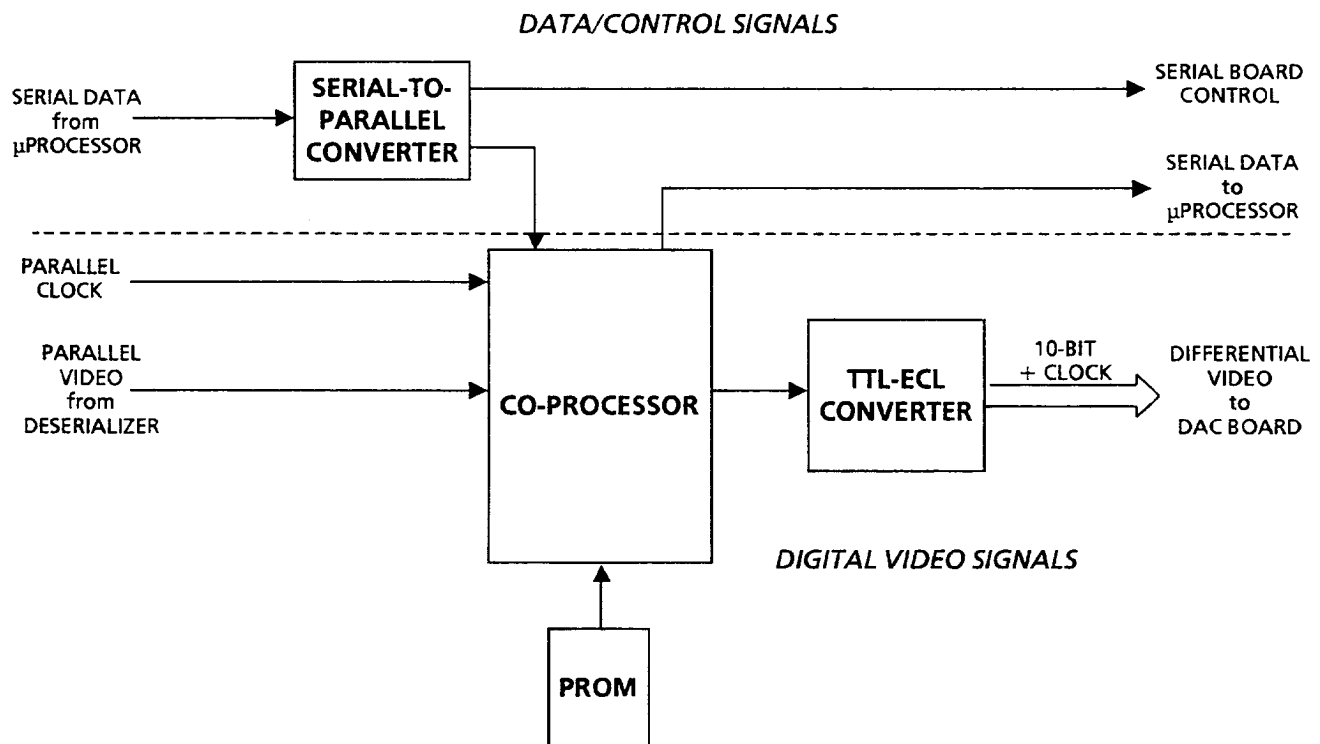
### Sample Strobe Generator

The VCO output is divided by 32 in U19, which outputs a 1  $\mu$ s pulse at a 110 kHz rate (140 kHz for 1731D). Q27 and Q28 amplify the pulse, and drive Q25 through T1. Q25 forms a high speed current switch, creating very fast steps at both the emitter and collector. These steps are coupled through C68, C69, and common-mode transformer T2 to the clipping lines, which produce approximately 500 ps pulses, which strobe the diode sampling bridge through transformer T3.

### Diode Bridge Sampler

Diode CR26, CR27, CR28, and CR29 form a bridge diode switch. The 800 mV peak-to-peak serial bit stream, centered around ground, is applied to the bridge input at the junction of CR26 and CR27. Normally, all of the diodes are reverse biased. R143 and R145 set the junction of CR27 and CR28 to +2 V, and R141 and R147 set the junction of CR26 and CR29 to 2 V. When the sample strobe generator fires, however, approximately 30 mA flows into the bridge, turning on the diodes. C79 will start to charge up to the same voltage as that at the bridge input. When the strobos turn off, the diode bridge again reverse biases, and the voltage on C79 is held. Unfortunately, C79 only gets partially charged during the short sampling time. U23 and C77 continue to charge C79 after the bridge turns off, pumping up the voltage to the desired level. R146 (Sampling Efficiency) adjusts this iterative charging process so that the sampler effectively reaches its final level in one sample time. RT1 (a thermistor) compensates the sampling efficiency for the temperature dependent diode bridge resistance. U22 inverts and amplifies the sampled signal. The signal at the output of U22 in a non-inverted, unity gain representation of the signal applied to the rear-panel serial video inputs. The signal is then output (through J18) to the Main circuit board (A3).

## Diagram 12 Co-Processor



The circuits on this diagram include the serial video Co-Processor that removes any timing or ancillary data that may have been added in the serialization process. In addition, the Co-Processor determines the serial video error rate (EDH system). Two serial data communication paths connect the Co-Processor to the main Microprocessor to control the operation of the Co-Processor and for the communication of serial error information. The digital video signal is converted to differential ECL for transmission to the Digital-to-Analog Converter.

### Co-Processor

The Co-Processor functions are implemented in a programmable gate array, U5. The gate array is programmed upon power-up from a Programmable Read-Only Memory (PROM) U7. The primary function of the Co-Processor is to create valid parallel video for the digital-to-analog conversion. During serialization a digital horizontal rate sync signal (TRS) is added, along with line and field identification signals, to the horizontal sync period. In addition, ancillary data such as audio may also be added during the horizontal sync interval. These signals must be removed so that a normal horizontal sync will result upon digital-to-analog conversion.

The Co-Processor also performs the Cyclic Redundancy Code (CRC) calculations on the incoming video data on a field-by-field basis, as part of the EDH error detection system. Other information about the serial signal, such as the presence of embedded audio, is also detected. This information is transmitted to the instrument microprocessor via a serial communications path. SERDAT2 (pin 77) is the serial data line. SERCLK2 (pin 76) is the serial data clock. SERCLK/LD (pin 75) is the parallel register clock.

**TTL-to-ECL Converter**

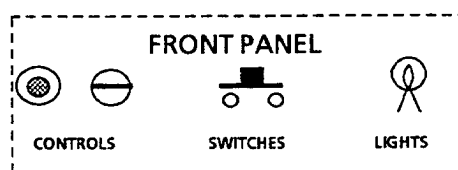
The TTL-to-ECL (differential) conversion of data from the Co-Processor is accomplished by U6. The output of U6, 10-bits of video plus clock (22 lines) is output to the Digital-to-Analog Converter (DAC) through J12.

**Serial Communication**

Control of the Co-Processor, U5, is through the serial communication line from the 1730D Microprocessor. U24 is a serial-to-parallel converter that takes the 8-bit long serial word and stores it in 8 1-bit latches. These outputs then form static control lines for the Co-Processor and other serial board functions. SERDAT1 (U24, pin 14) is the serial data line, SERCLK1 (U24, pin 11) is the serial data clock, and SERCLK/LD (U24, pin 12) is the parallel register clock.



## Diagram 13 Front-Panel



The front-panel indicators are driven from Microcontroller light driver register and LED drivers from Diagram 5. The front-panel switches are momentary closure (with some hold for additional function capabilities) that are monitored by the Microprocessor, which is also on the Microcontroller (Diagram 5). In addition a series of front-panel controls provide variable DC operating levels as a means of compensating for variable operating requirements and conditions.

### Indicators and Switches

The front-panel LED indicators are arranged in seven columns returned to a current source by four returns, designated as rows, in order to provide the Microprocessor with a set of column/row matrix addresses. An LED indicator lights when there is a complete circuit from the Light Driver (U2 on Diagram 5) through the LED and back to ground through the Light Driver transistor array (U1 on Diagram 5).

Switches complete a simple matrix that is read by Port 1 of the Microprocessor. Key condition (depressed front-panel switch) is detected using the Row/Column lines (ROW0-ROW3 and COL0-COL2). For this example, suppose that the MAG front-panel switch is depressed. To poll the switches, the Controller resets all of the Row lines low and sets all of the Column lines high. It then monitors the Column lines, waiting for one of them to be pulled low (indicating a depressed key condition).

To determine which key is depressed, the Controller first sets all Row/Column lines high except ROW0, which is reset low. Next, the Controller looks at the Column lines again. Since the INPUT, REF, and FILTER keys are tied to ROW0, and ROW0 is low, if one of those keys were depressed, the corresponding Column line would be pulled low. In this case, the Controller does not find a low on any of the Column lines, so it is known that the depressed key is not INPUT, REF, or FILTER.

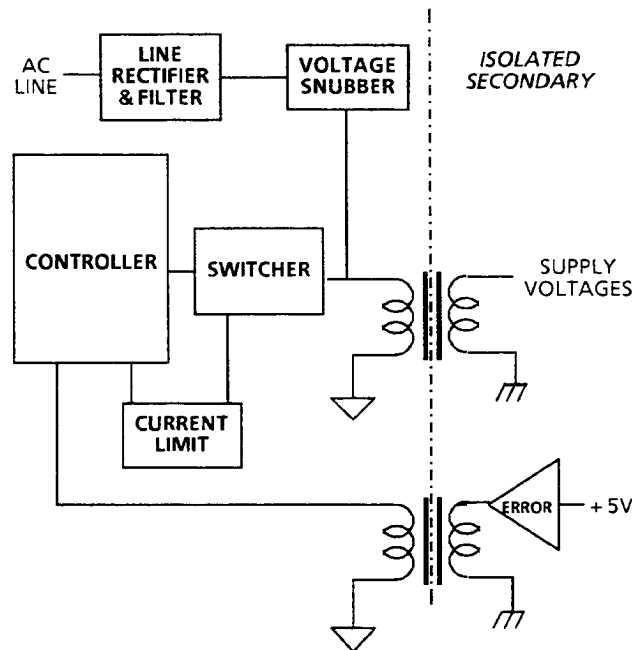
The Controller next sets ROW0 high and resets ROW1 low. Again it looks at the Column lines. Since one of the switches connected to ROW1 is depressed (MAG), the Controller finds that the corresponding Column line (COL2) has now been forced low. The Controller now knows that the depressed key is MAG, and responds by turning on the MAG front-panel LED and the associated Control I/O.

After finding a key condition, the Controller debounces and checks again.

**Controls** A set of variable controls consisting of the HORIZONTAL Position, VERTICAL Position, Vertical Calibration, Scale, and Focus controls select a DC voltage level between +11.8 V and -11.8 V.

The INTENSity control operates in conjunction with the Z-Axis Control circuit on Diagram 6. DC levels for Intens 1, Intens 2, and Intens 3 depend on the operating mode selected, which dictates the level on each of the leads.

## Diagram 14 Low Voltage Power Supply



The Low Voltage Power Supply converts the mains line voltage (between 90 or 250 volts) to supply the power requirements of the instrument. The low voltages supplied from the central power supply are +40 V, +15 V, +5 V, and -15 V.

### Line Rectifier and Filter

The input line voltage is filtered, in the rear-panel connector, to prevent any noise that is on the AC line from interfering with instrument performance. The filter also prevents any noise generated within the waveform monitor from getting back to the AC line. R125 and R131 are surge protection to limit initial turn-on current through the rectifier and capacitors.

The rectifier is a full-wave bridge. DS7, along with R129 and R130, form a line voltage indicator, with DS7 flashing whenever line voltage is present. In addition, C62 serves as a smoothing capacitor for the approximate 110 to 350 V (dependent on input mains voltage) rectifier output. R124, L8, and C44 provide additional EMI filtering.

### Controller

The Controller is a pulse width modulator using U4, a current-mode controller, to regulate the duty cycle driving the Switcher. C45 and R98, connected to pin 4, are the timing elements for an internal oscillator that sets the operating frequency to about 80 kHz. Pin 6 is the 80 kHz, variable duty cycle, square wave output

that drives the switcher. Pin 8 supplies a 5 V reference, and pin 3 is the current sensing of the switcher source current.

$V_{CC}$  for the Controller is supplied by a housekeeping supply when the switcher is running. CR20 is the coupling diode for this supply. Prior to start up of the Controller, C42 is charged from the line, through the parallel resistors (R200 and R201). Charging current is 2 mA to 7 mA, depending on the line voltage. When the voltage on C42 reaches approximately 16 V, U4 starts and provides the switcher driving waveform. Once the Switcher is operating, the 16 V housekeeping supply is provided from T2 through CR20.

### Switching Transistor

The Low Voltage Power Supply is of the flyback type. Q16 is the main switching transistor, switching at 80 kHz. When it is turned on, its drain voltage is near 0 V and the current is raising linearly, charging T2 with a current ramp. When Q16 turns off, the drain voltage “flies back” in a positive direction. This flyback action on the primary of the transformer drives the secondary windings with the correct voltage. The amount of power delivered to the secondaries is dependent on the duty cycle driving the gate of the switching transistor.

### Voltage Snubber

CR21 and C43 form a “lossless” voltage snubber to keep the voltage on the drain of Q16 from getting too high. CR24 and C49 slow the rising edge of the switching transistor pulse to reduce electrical noise. R85 provides a discharge path for C49.

When the switcher is running, a voltage ramp representing the source current of Q16, is applied to U4 pin 3. Pin 1 is the DC level output of an internal error amplifier. An internal comparator compares the current sense voltage ramp to the DC level at pin 1. R87 provides a negative feedback voltage from pin 1 to the current node at pin 2. The current into the pin 2 node is approximately 1 mA/–10 V of DC level, and is comprised of the power supply secondary error voltage, coupled through T3, and the negative feedback through R87. It holds the output of the power supply to 5 V.

The timing waveform for the internal 80 kHz oscillator is a sawtooth waveform whose repetition rate and slope are determined by C45 and R98.

### Shutdown Logic

Shutdown logic consists of three comparators that drive Q19. When the output of one or more of the comparators goes negative, Q19 pulls pin 3 of U4 high and shuts off the Controller. U5B, C, and D are all wired as comparators.

U5D provides short circuit protection. When the error voltage, at pin 2 of U4, falls below 2.2 V, C56 starts to discharge through R99. If the error voltage stays low, the output of U5D goes low and causes Q19 to turn off the Controller (U4). Once turned off, the supply will attempt to restart at a repetition rate of about once or twice a second. There will be an audible ticking sound when the supply attempts to start under shorted conditions.

U5C is the low line voltage disable. It outputs a low, that turns off the controller (through Q19) anytime the incoming line voltage drops below about 80 VAC. U5B shuts down the power supply if the “Housekeeping” supply falls below approximately +13 V.

### **Transformer Driver, Peak Detector, and Power Switch Receiver**

Secondary circuits are isolated from the primary by T2 and T3. T2 is the power transformer and T3 couples needed feedback from the power supply secondary circuits to the isolated primary side. The sawtooth waveform used for Controller timing is coupled to comparator U5A via emitter coupler Q17. U5A squares up the waveform and drives Q18 with an 80 kHz square wave. Current through Q18 is the primary current for T3. Q12, across the secondary, is driven by the Error Amplifier. The signal voltage on the primary is a reflection of the secondary loading and is detected by the Peak Detector.

The Peak Detector consists of CR23 and Q14. Its output is the negative feedback that controls the Controller output.

Q13 and Q15 form the Power Switch Receiver. When the instrument POWER switch is on, its contacts are open. With the switch contacts open, Q18 drives the primary of T3 positive and then allows the primary to “fly back.” When the primary flies back, Q13 is turned on and its collector goes low, keeping Q15 turned off. When the POWER switch is turned off (contacts closed), there is no signal voltage developed across the transformer, which causes Q13 to turn off and Q15 to turn on. The collector of Q15 pulls down and turns on Q19, which pulls pin 3 of the Controller (U4) high to turn it off.

### **Output Filters**

Two of the three secondary windings produce a single voltage level (+5 V and +40 V). The third winding is center tapped and outputs +15 V and -15 V. Each supply is rectified by a single diode (frequency is 80 kHz) and smoothed by an LC pi filter, consisting of a single inductor and two filter capacitors.

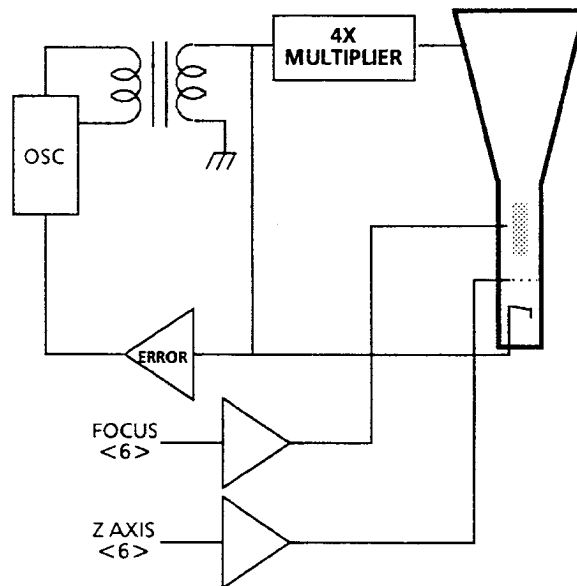
### **Over Voltage Protection**

Over Voltage Protection is provided to protect the instrument from damage if the supply fails to regulate. If the +5 V supply rises to approximately 5.8 V, VR1 conducts which causes Q11 to conduct and ground the +5 V supply, which in turn forces the supply into current limit and the controller is shut down.

### **Voltage Reference and Error Amplifier**

The internal reference for U3A is 0.2 V. R79 ( $R_f$ ) and R77 ( $R_i$ ) set the reference output to 2.5 V. U3B is an operational amplifier. R70 is the 5 V ADJ, which allows variations in the 5 V supply to modulate the secondary of T3 and generate the waveform sampled by the Peak Detector circuit. C41 and R76 dampen high frequency oscillations.

## Diagram 15 High Voltage Power Supply



The High Voltage Power Supply generates the heater, cathode, control grid, focus anode, and post accelerating potentials required to display the outputs of the Vertical and Horizontal Output Amplifiers.

### HV Osc and Error Amp

The High Voltage Power Supply is generated by a sine-wave oscillator and step-up transformer. Q7 and T1 are the principal elements of an Armstrong oscillator running at about 25 kHz. The Error Amplifier, U2, regulates the +100 V output, and keeps the High Voltage Power Supply constant under varying load conditions by controlling the base current to Q7, through Q9 and Q10. The +100 V output is monitored directly, while the High Voltage Power Supply is monitored through a feedback circuit.

R40, C15, R60, and R63 form the High Voltage Power Supply positive feedback circuit. As the current from the High Voltage Power Supply is increased, the voltage to the + side of the Error Amplifier (U2) increases, which reduces the base drive to Q7, the HV Osc. This positive feedback compromises the regulation of the 100 V supply to keep the high voltage constant with varying intensities.

C26 and Q8 are a start delay circuit that holds the Error Amplifier output low, through CR11, until C26 is charged from the 15 V supply. Delaying the start of the high voltage oscillator allows the Low Voltage Power Supply to start, un-encumbered by the load from the high voltage oscillator.

- Power Supply Outputs** CR6 is the high voltage rectifier. Smoothing capacitors C6 and C7 work with CR6 to provide  $-2750$  volts to the CRT cathode. U1 is a four-times multiplier, providing  $+11$  kV to the CRT anode.
- Focus Amplifier** Q2 and Q1 form an operational amplifier that sets the voltage at the bottom of the focus divider. The front-panel focus pot determines the voltage at the bottom of the focus divider. The Center Focus control, R10, is set for optimum beam focus, as viewed on the CRT, with the front-panel FOCUS control set to mid range. Once the Center Focus adjustment has been set, adjusting the front-panel FOCUS control changes the voltage at the bottom end of the divider and, consequently, the voltage on the CRT focus anode.
- Grid Drive Circuit** The grid and cathode of the CRT are at a  $-2750$  V potential with the grid effectively DC-coupled to the Z-Axis Amplifier by the grid drive circuit. The unrectified 25 kHz sine-wave output from the  $+100$  V supply winding is input to a modulating circuit, where it is clipped and rectified for use as CRT control grid bias.
- The sine wave from the 100V supply winding of T1 is coupled through C16 to a clipping circuit consisting of CR7 and CR8. Clipping level for the positive excursion of the sine wave is set by the CRT Bias adjustment, R52; negative clipping level is set by the INTENSity control through the Z-Axis Amplifier. The clipped sine wave is coupled through C11 to a rectifier made up of CR4 and CR5. The rectified, clipped sine wave is the CRT control grid bias voltage. C8 is a speedup capacitor for the fast transitions of the blanking signal from the Z-Axis Amplifier. DS1 and DS2 limit the CRT grid to cathode voltage at instrument turn on and off. DS4 limits the CRT heater-to-cathode voltage.
- Z-Axis Amplifier** This is a high gain inverting amplifier with feedback. R5 sets the gain of the Z-Axis Amplifier. The input is the summing junction at R9, which is set to  $+5$  V by R6 and R18, so that the Z-Axis Control circuit on the Main (A3) circuit board can drive this amplifier. When there is no input current from the Z-Axis Control, the amplifier output is set to  $+10$  V by R11. When there is input current, the output is driven more positive. Q3 is an emitter follower that drives Q4, which with Q6 forms a cascode pair for good high frequency performance. Q5 is a constant current source and is the collector load for Q6. The collector of Q6 is the output of the Z-Axis Amplifier. C12 speeds up the constant current source, Q5, for the fast transitions of the blanking pulses. DS3 and DS5 are neon bulbs intended to prevent damage to the Z-Axis Amplifier if there is a CRT high voltage discharge.







# Performance Verification



# Performance Verification

This section consists of two separate procedures. First is the Performance Check, used to determine compliance with the Performance Requirements in the Specification. Next is the Adjustment Procedure, used to return the instrument to operation within specifications.

In both procedures, controls and connectors on the 1730D front panel and rear panel are fully capitalized (e.g., 2LINE, DAC OUT). Control and connector names on test equipment, as well as internal controls and adjustments for the instrument under test, are initial capitalized (e.g., Time/Div).

Limits, tolerances, and waveforms given in this section are guides to adjustments and checks, and are not instrument specifications, except when listed in the Performance Requirement column of the Specification section of this manual.

## Recommended Equipment List

The following equipment and accessory items are required to do the Performance Check and/or Adjustment Procedures. Broad specifications are followed by an example of equipment that meets these specifications; in most cases, the recommended instrument was used in preparing the procedures that follow.

Table 6-1: Electrical Instruments

		For Example:
Test Oscilloscope		A TEKTRONIX 7603 Oscilloscope with a 7A18 Dual-Trace Amplifier, a 7A13 Differential Comparator (needed for use with the TEKTRONIX Return Loss Bridge), and a 7B53A Dual Time Base. A 10X probe, P6106 (Tektronix Part No. 010-6106-03), and a 1X probe, P6101 (Tektronix Part No. 010-6101-03).
Vertical Amplifier:	30 MHz Bandwidth, 1 mV Sensitivity.	
Time Base:	10 ns/div to 5 ms/div sweep speeds, triggering to 5 MHz.	

Table 6–1: Electrical Instruments (Cont.)

		For Example:
Television Signal Generator	Color test signals for the television standard of the monitor to be tested: Color Bar signal, Linearity Staircase with variable APL, Pulse and Bar (with 2T pulse, 2T bar, and modulated pulse signals, and Field Square Wave signal), Multiburst signal, and Black Burst signal.	<p>TEKTRONIX NTSC 1410 with Option AA and Option AB (modified SPG2 and TSG7), TSG3, TSG5, and TSG6.</p> <p><b>NOTE:</b> The 1410 generator with standard SPG and TSG modules can be used, but not all checks and adjustments can be made. A standard SPG2 or SPG12 module will not check lock to changes in sync amplitude, CW lock to changes in burst amplitude, or frequency lock to burst offset frequency changes.</p> <p>The 1410 is a mainframe with modified TSG7 and TSG11 Color Bar generators that provide more accurately controlled output amplitudes.</p> <p>The signal generator can be ordered with one or both options (AA and AB).</p> <p>The TSG3 and 13 are Modulated Staircase generators with variable APL.</p> <p>The TSG5 and 15 are Pulse and Bar generators with Modulated Pulse and Field Square Wave signals.</p> <p>The TSG6 and 16 are Multiburst generators.</p>
Composite Digital Signal Generator	With serial and parallel signal outputs, with Multipulse, Modulated Ramp, Pulse and Bar with Window, and Linearity Staircase.	A TEKTRONIX TSG170D Opt. 1S (NTSC)
Luminance Accuracy	±1%	
Line Sweep	500 kHz–5 MHz NTSC	
Modulated Ramp	258.7 mV NTSC	
Waveform Monitor	Frequency response bandwidth to 20 MHz.	A TEKTRONIX 1480-Series MOD W5F.
Vectorscope	Capable of measuring <0.1 Differential Phase and <0.4% Differential Gain.	A TEKTRONIX 1780R-Series Video Measurement Set.
SCH Measurement Device	Capable of ±5° accuracy.	A TEKTRONIX 1780R-Series Video Measurement Set.
Sine-Wave Generator	At least 250 kHz to 225 MHz.	<p>A TEKTRONIX SG503 Leveled Sine-Wave Generator installed in a TEKTRONIX TM500 Series Power Module.</p> <p><i>(Optional) Sine-wave generator, 50 kHz to 250 kHz, to check flatness at low frequencies. For example: SG502 in a TM500 Series Power Module.</i></p>

Table 6–1: Electrical Instruments (Cont.)

		For Example:
Function Generator		TEKTRONIX FG 503 Function Generator installed in a TEKTRONIX TM500 Series Power Module.
Sine-wave frequencies:	76 Hz to 115 Hz.	
Amplitude:	1 V p-p when loaded by 75 $\Omega$ .	
Voltmeter	Range, 0 to greater than 100 VDC; accuracy, $\pm 0.1\%$ .	A TEKTRONIX DM501A in a TM500 Series Power Module.
Frequency Counter	Range, 100 kHz to 20 MHz; accuracy, $\pm 0.001\%$ .	A TEKTRONIX DC503A in a TM500 Series Power Module.
Video Amplitude Calibrator (VAC)	Signal, adjustable square wave 0.0 to 999.9 mV p-p with a resolution of 0.1 mV and an accuracy of 0.05%; frequency approximately 270 Hz.	A TEKTRONIX 067-0916-00 in a TM500 Series Power Module.
Digital Sweep Generator	55 kHz to 5.9 MHz swept signal with $\pm 1$ bit flatness. Markers at 1 MHz, 2 MHz, 3 MHz, 3.58 MHz, 4 MHz, 4.2 MHz, 5 MHz, and 6 MHz.	A TEKTRONIX 067-1011-00 in a TM500 Series Power Module.
Peak-to-Peak Detector		Tektronix Part No. 015-0408-00 (includes one 015-0413-00 Peak-to-Peak Detector Head), installed in a TEKTRONIX TM500 Series Power Module.
Power Module	For powering and housing TEKTRONIX DM501A, DC503A, FG503, 067-0916-00, and 015-0408-00.	A TEKTRONIX TM506 Power Module.
Variable Autotransformer		General Radio Metered Auto Transformer W10MT3W. If 220 volt operation must be checked, a conversion transformer or appropriate 220 volt autotransformer is needed.

Table 6–2: Auxiliary Equipment

		For Example:
Step Attenuator	75 $\Omega$ constant impedance attenuator variable from 0 to 40 dB in 1 dB steps.	A Wavetek 75803 Step Attenuator.
Return Loss Bridge	Range, at least 46 dB return loss sensitivity, 50 kHz to 6 MHz.	A TEKTRONIX 015-0149-00.
75 $\Omega$ Terminators	Four required, two should be a feed-through type.	End-line, 75 $\Omega$ terminator (Tektronix Part No. 011-0102-00) and a feed-through 75 $\Omega$ terminator (Tektronix Part No. 011-0103-02).

Table 6–2: Auxiliary Equipment (Cont.)

		For Example:
High Frequency Terminator	75 $\Omega$ , >25 dB return loss, 1 – 200 MHz.	Tektronix Part No. 011-0163-00 (provided as a standard accessory with the 1730D).  Additionally; a 50/75 $\Omega$ 1/2W minimum loss attenuator, Tektronix Part No. 011-0057-00, with a 50 $\Omega$ 2W terminator, Tektronix Part No. 011-0123-00.
Precision 75 $\Omega$ Terminator		Tektronix Part No. 011-0102-01.
Coaxial Cable (Three required)		42-inch RG59U (Tektronix Part No. 012-0159-00).
10X, 75 $\Omega$ Attenuator		Tektronix Part No. 011-0061-00.
BNC to Alligator Clip Adapter		Tektronix Part No. 013-0076-00.
Dual Input Coupler	Matched BNC cable-T for making phase comparisons between two inputs. Matched length of the two arms within $\pm 0.1$ inch.	Tektronix Part No. 067-0525-02.
Precision 50 $\Omega$ Coaxial Cable		Tektronix Part No. 012-0482-00 (used with the SG 503).
A 50-to-75 $\Omega$ Minimum Loss Attenuator		Tektronix Part No. 011-0057-00.
Parade Display Test Connector	15-pin sub-miniature D-type connector	Tektronix Part No. 131-0459-00), modified to enable and test the RGB Parade input. See Figure 6–1.
90/100 Hz Test Connector	15-pin sub-miniature D-type connector	Tektronix Part No. 131-0459-00), modified to enable and test the 90 100 Hz triggering mode. See Figure 6–2.
Cable Network	A network having a $1/\sqrt{F}$ loss characteristic, and a loss of 18.5 dB at 1/2 the serial clock frequency (71.5 MHz NTSC).	250 meters (820 ft) of Belden 8281 low loss 75 $\Omega$ cable.

Table 6–2: Auxiliary Equipment (Cont.)

		For Example:
D Wiring Converter	<p>Two 25-pin subminiature D-type connectors wired together to convert the 1730D Digital Parallel In to accept the 1900 Digital Parallel-type signals. The wiring converter may be constructed in the following manner:</p> <ol style="list-style-type: none"> <li>1. Choose a male connector (Tektronix Part No. 131-0813-00) for the generator end of the connector. Choose a female connector (Tektronix Part No. 131-0971-00) for the 1730D side if male-to-male cables are used, or a male connector if male-to-female cables are used.</li> <li>2. Position the connectors so that the numbered sides are facing each other, and fasten them together using two posts (Tektronix Part No. 129-0427-00) and four screws (211-0008-00).</li> <li>3. Solder wires to the connectors as shown in Table 6–3, twisting the data wires together to reduce interference. (Ground wires need not be twisted.)</li> </ol>	
Bit Parallel Cable	25-pin cable meeting SMPTE 125M or 244M specifications (25-pin sub-miniature D males on both ends, 10 twisted-pair data lines, and one twisted-pair clock line).	Tektronix cable Part No. 175-3671-00 and adapter Part No. 131-4923-00.

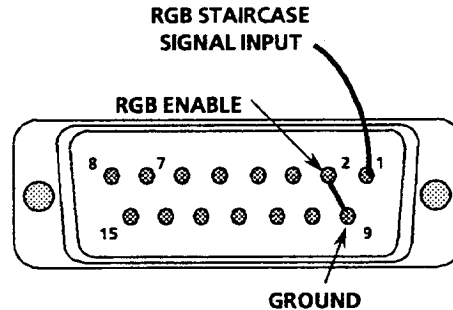


Figure 6–1: Remote connector modified for RGB input

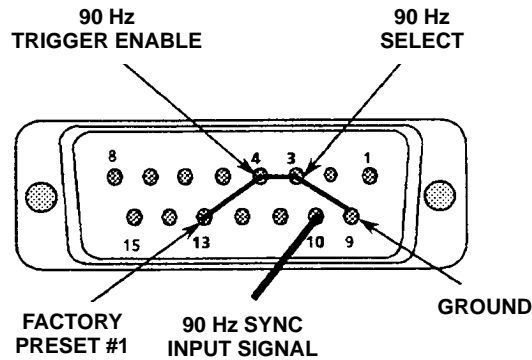


Figure 6-2: Remote connector modified for 90 Hz triggering

Table 6-3: D Wiring Converter

Signal	Digital Sweep Generator <sup>1</sup> Pin # (Male Connector)	1730D Pin # (Male or Female Connector)	Signal	Digital Sweep Generator <sup>1</sup> Pin # (Male Connector)	1730D Pin # (Male or Female Connector)
(MSB) D9	1	3	D3	7	9
/D9	14	16	/D3	20	22
D8	2	4	D2	8	10
/D8	15	17	/D2	21	23
D7	3	5	D1	9	11
/D7	16	18	/D1	22	24
D6	4	6	D0	10	12
/D6	17	19	/D 0	23	25
D5	5	7	CLK	25	1
/D5	18	20	/CLK	12	14
D4	6	8	GND	13	13, 2, 15
/D4	19	21			

<sup>1</sup> 1900 Parallel Digital type

Table 6-4: Clock Cable Wiring

Television Generator Pin # (Male Connector)	Digital Sweep Generator Pin # (Female Connector)
1	25
14	12



## Performance Checks

The Short-Form Procedure is intended for those who are familiar with the complete Performance Check procedure. Step numbers and sub-step designations correlate directly to the steps in the Performance Check Procedure, making it possible to use the Short-Form Procedure as a table of contents for the longer form.

### Short Form Procedure

1. Preliminary Setup
  - a. Connect autotransformer.
  - b. Connect Composite Color Bar signal.
2. Check Power Supply Operation
  - c. Check for stable operation over the prescribed voltage range.
3. Check Calibrator Frequency
  - c. Check Calibrator frequency.
  - d. Check that Calibrator is synchronized in 1LINE and 2LINE Sweeps.
  - e. Check that Calibrator signal free runs in 2FLD Sweep.
4. Check Sync Separation
  - b. Check instrument synchronization according to Table 6–6.
5. Check Sweep Operation
  - b. Check sweep modes (1LINE, 2LINE, 2FLD).
  - d. Check for 1LINE and 2LINE Sweep rates.
  - e. Check for 2FLD Sweep rate.
  - g. Check that some portion of field blanking is displayed (2FLD MAG).
  - i. Check that some portion of horizontal blanking is displayed (2LINE MAG).
  - j. Check that both lines of the 2LINE MAG Sweep can be positioned onto the screen.
6. Check Sweep Calibration
  - c. Check 10  $\mu$ s (2LINE) Sweep accuracy.
  - d. Check 10  $\mu$ s (2LINE) linearity.
  - g. Check 5  $\mu$ s (1LINE) Sweep accuracy.

- i.** Check 1  $\mu\text{s}$  (2LINE MAG) Sweep accuracy.
  - p.** Check 0.2  $\mu\text{s}$  (1LINE MAG) Sweep accuracy.
- 7.** Check RGB/YRGB Parade Display
  - d.** Check shortened sweep length.
  - e.** Check shortened sweep rate and magnification.
  - f.** Check range of HORIZONTAL Position control.
  - i.** Check added deflection.
- 8.** Check 90/100 Hz Triggering
  - f.** Check for a stable display while varying generator frequency.
- 9.** Check Vertical Gain and X5 GAIN Registration
  - f.** Check X5 GAIN accuracy.
  - i.** Check maximum VAR GAIN.
  - j.** Check minimum VAR GAIN.
  - o.** Check X5 GAIN registration.
  - s.** Check CH-2 vertical amplifier gain.
- 10.** Check Calibrator Amplitude
  - b.** Check Calibrator amplitude.
- 11.** Check PIX MON OUT Operation
  - c.** Check PIX MON OUT DC level.
  - g.** Check DC level shift for intensified line.
- 12.** Check DC Restorer Operation
  - c.** Check that DC Restorer operates.
  - d.** Check that DC Restorer turns off.
  - j.** Check SLW DC REST.
  - l.** Check FAST DC REST.
  - p.** Check DC REST with APL change.
  - s.** Check DC REST with loss of burst.

**13. Check Flat Response**

- c. Check CH-2 X1 GAIN flat response.
- e. Check CH-2 X5 GAIN flat response.
- h. Check CH-1 X5 GAIN flat response.
- i. Check CH-1 X1 GAIN flat response.

**14. Check PIX MON OUT Frequency Response**

- c. Check frequency response.

**15. Check PIX MON OUT Gain**

- i. Check gain.

**16. Check Transient Response**

- c. Check preshoot, overshoot, and ringing.
- d. Check pulse-to-bar ratio.
- e. Check bar tilt.
- g. Check field tilt.
- k. Check chrominance-to-luminance gain and delay error.

**17. Check X5 Transient Response**

- c. Check preshoot, overshoot, and ringing.
- d. Check pulse-to-bar ratio.

**18. Check Low Pass Filter Response**

- d. Check amplitude difference from FLAT to LPASS FILTER.

**19. Check Chroma Filter Response**

- c. Check CHRM FILTER gain.
- h. Check CHRM FILTER cutoff.

**20. Check Return Loss**

- d. Check CH-1 ANALOG INPUT loop-through return loss.
- e. Check CH-2 ANALOG and EXT REF INPUTs loop-through return loss.
- h. Check PIX MON OUT return loss.
- k. Check DAC OUT return loss.

- 21. Check SER/PRL Gain**
  - d.** Check SER/PRL gain.
- 22. Check SER/PRL Response**
  - c.** Check SER/PRL response.
- 23. Check DAC OUT Transient Response**
  - d.** Check pulse and bar preshoot.
  - e.** Check pulse ringing.
  - f.** Check bar overshoot.
  - g.** Check bar tilt.
  - h.** Check pulse and bar height match.
  - j.** Check peak-to-peak tilt at blanking level.
- 24. Check Luminance Amplitude Accuracy**
  - b.** Check luminance amplitude.
- 25. Check DAC OUT DC Level**
  - d.** Check blanking level.
- 26. Check Luminance Non-Linearity**
  - c.** Check the spike amplitude.
  - e.** Check for equal amplitude spikes.
- 27. Check Chrominance-to-Luminance Gain and Delay Error**
  - c.** Check gain error and delay error.
- 28. Check DAC OUT Frequency Response**
  - j.** Check flat response.
- 29. Check DAC OUT Differential Phase and Gain**
  - h.** Check differential phase.
  - l.** Check differential gain.
- 30. Check DAC OUT SCH Phase**
  - e.** Check SCH Phase.

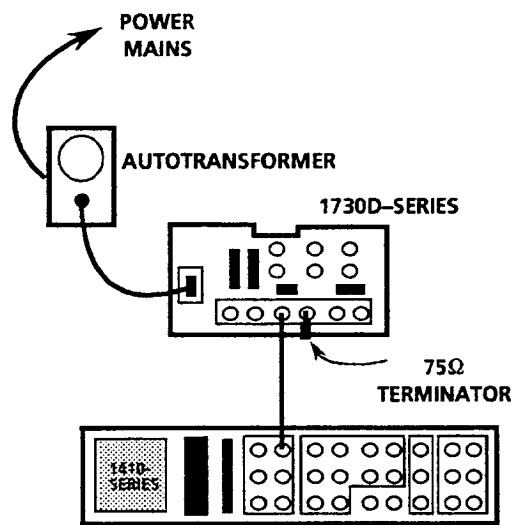
Performance Checks Steps 31 and on are the Serial board checks.

- 31. Check Digital Signal Generator Serial Gain**
  - f.** Note VAC amplitude readout.
- 32. Check Eye Sample Efficiency and Gain**
  - d.** Check that the Eye pattern is overlaid.
  - e.** Check Eye gain.
- 33. Check CH-2 SERIAL INPUT Gain**
  - c.** Check gain.
- 34. Check CH-2 SERIAL INPUT Transient Response**
  - c.** Check transient response.
- 35. Check CH-1 SERIAL INPUT Transient Response**
  - c.** Check transient response.
- 36. Check Eye Timing**
  - b.** Check timing.
- 37. Check Eye Bandwidth**
  - e.** Check CH-1 SERIAL INPUT bandwidth response.
  - h.** Check CH-2 SERIAL INPUT bandwidth response.
- 38. Check Serial Dynamic Range**
  - i.** Check CH-1 SERIAL INPUT errored seconds readout is zero for both displays.
  - m.** Check CH-2 SERIAL INPUT errored seconds readout is zero for both displays.

**Standard Performance  
Check Procedure**

**1. Preliminary Setup**

- a. Connect the 1730D AC power cord to the variable autotransformer. Set the autotransformer for the voltage shown by the rear-panel line voltage indication.
- b. Connect a Composite Color Bar signal with 100% peak white bar and 75% amplitude color bars to the CH-2 ANALOG INPUT and terminate the opposite side of the loop-through with a 75 Ω termination. See Figure 6-3.



**Figure 6-3: Initial equipment hook-up for the Performance Checks**

- c. Turn the 1730D power on and set the front panel controls as shown in Table 6-5.

**Table 6-5: Initial Control Settings for Performance Checks**

Control	Setting
POWER	ON
INTENS	As desired
FOCUS	As desired
SCALE	As desired
VERTICAL Position	On screen
HORIZONTAL Position	On screen
FILTER	FLAT

**Table 6-5: Initial Control Settings for Performance Checks (Cont.)**

Control	Setting
REF	INT
INPUT Channel	CH2
INPUT Format	ANLG
GAIN (switch)	off
DC REST	OFF
MAG	off
Sweep	2LINE
LINE SEL	off

**2. Check Power Supply Operation**

Requirement: Operation over any mains voltage of 90 – 250 V.

- a. Turn on the 1730D and adjust the controls for a usable display.
- b. Vary the autotransformer from low-line to high-line voltage (90 – 132 V for 110 V, or 180 – 250 V for 220 V operation).
- c. Check for stable operation over the prescribed voltage range.

**3. Check Calibrator Frequency**

Requirement: Frequency 100 kHz  $\pm$ 100 Hz, Synchronizes in 1LINE and 2LINE Sweep (free runs in 2FLD).

- a. Connect a X10 probe from the frequency counter to A3J19 (the blue CRT lead on the 1730D Main circuit board).
- b. Display the CAL signal at the 2LINE Sweep rate.
- c. Check that the frequency of the Calibrator is 99.9 to 100.1 kHz.
- d. Check that the Calibrator is synchronized in both 1LINE and 2LINE Sweeps.
- e. Check that sweep free runs in 2FLD Sweep.
- f. Remove the probe from A3J19.

**4. Check Sync Separation**

Requirement: Check for stable sweep synchronization; internally 40 IRE (300 mV)  $\pm$ 6 dB, and externally 143 mV to 4 V.

- a. Connect the Black Burst signal from the 1410-Series to the 1730D EXT REF INPUT and terminate the loop-through in  $75 \Omega$ .
- b. Check that the 1730D instrument can be synchronized to the amplitudes shown in Table 6–6, using the 1410-Series Option AA Test Signal Generator. Check both 2LINE and 2FLD Sweeps for stable triggering.

**Table 6–6: Sync Amplitudes**

REF Source	Signal	Amplitude of SYNC
Internal	Composite Video	NTSC = 143 mV to 572 mV
EXT REF	Composite Sync or Video	NTSC = 143 mV to 4 V

**NOTE.** Use the 1410-Series Option AA Variable Sync Amplitude control to change composite video sync amplitude. If the 1410-Series Option AA is not available, use the step attenuator with a non-terminated input. The step attenuator, set to 0 dB and 12 dB attenuation, yields 0.5 and 2X sync amplitude.

- c. Remove the Black Burst signal and terminator from the EXT REF INPUT.

## 5. Check Sweep Operation

Requirement: Check that the sweep will occur in all Horizontal settings with or without synchronization. Check that some part of the blanking interval is displayed when magnifying the centered 2LINE and 2FLD Sweeps.

- a. Display CH1 INPUT with nothing connected.
- b. Check that a sweep occurs at each Sweep rate (2LINE, 2FLD, and 1LINE).
- c. Select CH2 INPUT.
- d. Check that the 1LINE and 2LINE Sweep modes display one line and two lines of the Color Bar signal, respectively.
- e. Check for a 2FLD Sweep display of the Color Bar signal.
- f. Select and center the 2FLD Sweep, then push the MAG button.
- g. Check that some portion of the vertical (field) blanking interval is displayed.
- h. Select and center the 2LINE Sweep, then push the MAG button.
- i. Check that some portion of the horizontal (line) blanking interval is displayed.



j. Check that both lines of the 2LINE MAG Sweep can be positioned onto the display with the HORIZONTAL Position control.

k. Turn off the MAG Sweep.

## 6. Check Sweep Calibration

Requirement: Timing Accuracy: For 10  $\mu\text{s}/\text{div}$  (2LINE), 5  $\mu\text{s}/\text{div}$  (1LINE), and 1  $\mu\text{s}/\text{div}$  (2LINE+MAG),  $\pm 2\%$ . For 0.2  $\mu\text{s}/\text{div}$  (1LINE +MAG),  $\pm 3\%$ .  
Linearity:  $\pm 1\%$ .

a. Hold the 1730D REF button in until the calibrator signal is displayed.

### 10 $\mu\text{s}/\text{div}$ Check

b. Use the HORIZONTAL Position control to place the first falling calibrator transition on the 10  $\mu\text{s}$  graticule mark (the timing mark on the left side of the graticule that goes completely through the blanking line). See Figure 6-4.

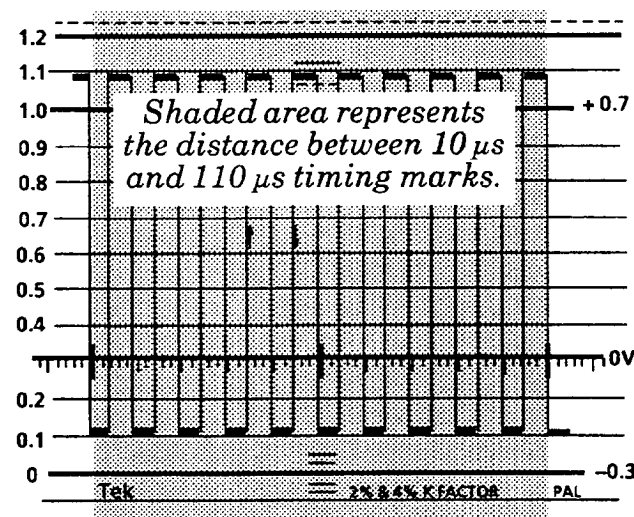


Figure 6-4: Ten full cycles of calibrator signal between timing marks

c. Check for 10 full cycles of calibrator signal in the 10 center major graticule divisions,  $\pm 2\%$  (1 minor division). Adjust the front-panel HCAL to place the 11th falling transition exactly on the 110  $\mu\text{s}$  graticule mark (the timing mark on the right side of the graticule).

d. Check that no falling transition between the 10  $\mu\text{s}$  and the 110  $\mu\text{s}$  graticule marks is more than 1% (0.5 minor division) from a major graticule mark.

**5  $\mu\text{s}/\text{div}$  Check**

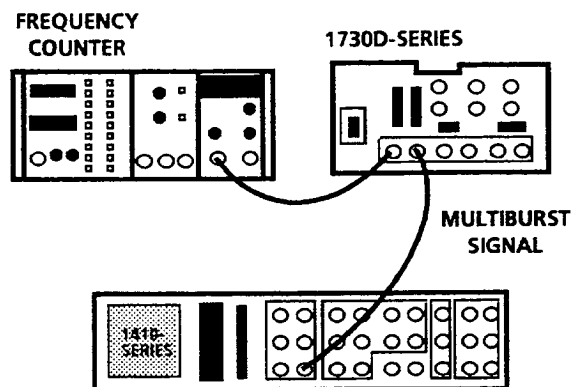
- e. Select 1LINE Sweep.
- f. Use the HORIZONTAL Position control to place the first calibrator transition on the 5  $\mu\text{s}$  graticule mark (left side graticule timing mark).
- g. Check for five full cycles of calibrator signal in the center 10 major graticule divisions,  $\pm 2\%$  (1 minor division).

**1  $\mu\text{s}/\text{div}$  Check**

- h. Select 2LINE Sweep and turn on the HORIZONTAL MAG.
- i. Check for 1 full cycle of calibrator signal in the center 10 divisions of the graticule,  $\pm 2\%$  (1 minor division).

**0.2  $\mu\text{s}/\text{div}$  Check**

- j. Connect the Multiburst output from the television signal generator to the 1730D CH-1 ANALOG INPUT, and loop-through connect the signal to the frequency counter. See Figure 6-5.

Figure 6-5: Checking 0.2  $\mu\text{s}$  timing

- k. Set the multiburst generator to Low, Continuous, and Manual. Turn Markers off.
- l. Adjust the multiburst Frequency for a 5 MHz sine wave as measured on the frequency counter.
- m. Select the 1730D CH1 INPUT, INT REF, and 1LINE Sweep. Turn on the MAG and VAR GAIN. Adjust the VAR GAIN control for approximately six vertical divisions of display.
- n. Set the multiburst generator to Composite.

- o.** Use the 1730D HORIZONTAL Position control to display all but the first and last 10% of the sweep.
- p.** Check for 10 cycles over 10 graticule divisions,  $\pm 1.5$  minor divisions.
- q.** Switch the multiburst generator to Continuous and check that its frequency, as measured on the frequency counter, remains set at 5 MHz. Return the generator to Composite.
- r.** Repeat parts p. and q. several times to ensure an accurate check.
- s.** Remove the cable to the frequency counter, turn off VAR GAIN and MAG.

#### 7. Check RGB/YRGB Parade Display

Requirement: Attenuated sweep: 3.4 to 4.1 divisions for 3-step or 2.5 to 3.1 divisions for 4-step. Staircase input gain: 10 V = 9 horizontal divisions  $\pm 1.4$  division. Attenuated sweep responds to sweep rate and magnification controls.

- a.** Connect the Color Bar signal to the CH-2 ANALOG INPUT and terminate with 75  $\Omega$ .
- b.** Display the Color Bar in 1LINE Sweep. Center the display. Note the position of the plug on A3J10 that selects the 3- or 4-step Parade display. The 2–3 position selects attenuation for a 3-step display.
- c.** Connect the Parade Display Test Connector to the 1730D REMOTE connector.
- d.** Check that the sweep has shortened to 3.4 to 4.1 divisions if A3P10 is set to a 3-step display, or 2.5 to 3.1 divisions if the plug on A3J10 (1–2) is set for a 4-step display.
- e.** Check that the shortened sweep is 1LINE or 2FLD, according to the Sweep controls, and that the sweep can be magnified.
- f.** Check that the display can be moved to the sides of the screen with the HORIZONTAL Position control. It may be necessary to adjust A3R170, RGB OFFSET, to increase range of positioning. (See Figure 6–13 for location.)
- g.** Select CH1 INPUT and position the display to the right side of the screen. It may be necessary to adjust A3R170, RGB OFFSET, to increase range of positioning.
- h.** Connect a 0 to +10 V, 2 kHz square wave to the BNC connector of the Parade Display Test Connector, as shown in the equipment list.

- i. Check that 7.6 to 10.4 divisions of deflection have been added by the square wave.
- j. Remove the REMOTE connector.

**8. Check 90/100 Hz Triggering**

Requirement: 90 Hz,  $\pm 15\%$  (100 Hz,  $\pm 15\%$ ).

- a. Connect the function generator output, through a dual-input coupler and an in-line 75  $\Omega$  terminator, to the 1730D CH-1 ANALOG INPUT.
- b. Install a BNC-to-alligator clip adapter on the remaining side of the dual-input coupler.
- c. Install the 90 – 100 Hz Test Connector (see Figure 6–2) on the 1730D REMOTE connector. Pins 3 and 4 are grounded to select and enable 90–100 Hz triggering, and pin 13 is grounded to provide the front-panel configuration necessary for this step.
- d. Connect the red lead of the alligator clip to pin 10 of the 90 – 100 Hz Test Connector.
- e. Set the function generator for a 1 V p-p square wave, 90 Hz output .
- f. Check that the display remains stable (although sweep length varies) while varying the generator from 76 to 104 Hz.
- g. Remove the test connector from the 1730D rear-panel REMOTE connector.

**9. Check Vertical Gain and X5 Gain Registration**

Requirement: Gains within 1% for both CH-1 ANALOG and CH-2 ANALOG INPUTs. X5 GAIN within 5%. Input signals between 0.8 and 2 V can be adjusted to full-scale video amplitude with the VAR GAIN. Less than 1 major division of vertical shift from baseline between unmagnified and magnified signal.

- a. Connect the Video Amplitude Calibrator (VAC) to the CH-1 ANALOG INPUT. Connect the television test signal generator Linearity signal to CH-2 ANALOG INPUT. Do not terminate either loop-through. See Figure 6–6.
- b. Set the VAC to 999.9 mV.
- c. Select CH1 INPUT and ANLG Format.

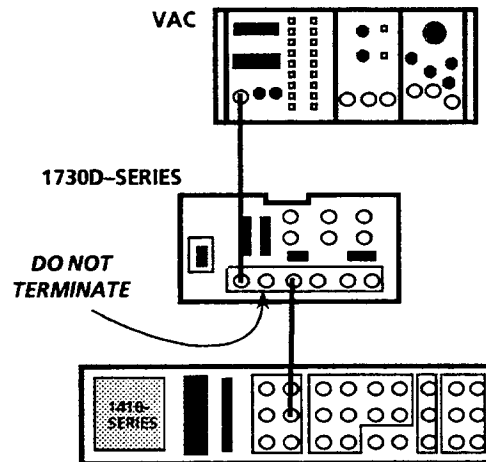


Figure 6-6: Test equipment hook-up for checking the vertical gain

- d. Adjust VCAL for exactly 140 IRE (1.00 V).
- e. Set the VAC to 0.200 V and change the 1730D to X5 GAIN.
- f. Check that the display is 133 to 147 IRE (0.950 V to 1.05 V).
- g. Select CH2 INPUT.
- h. Turn on the 1730D VAR GAIN (X5 GAIN off).
- i. Check that the VAR GAIN control can be adjusted for a sync pulse amplitude greater than 100 IRE (720 mV).
- j. Check that the 1730D VAR GAIN control can be adjusted for a display amplitude of 140 IRE (1.0 V) or less.
- k. Turn off the 1730D VAR GAIN.
- l. Terminate the CH-2 ANALOG INPUT loop-through in 75  $\Omega$ .
- m. Use the VERTICAL Position control to place the signal blanking level on the baseline.
- n. Select X5 GAIN.
- o. Check for less than 1 major division of baseline shift when switching between X1 (Gain off) and X5 GAIN.
- p. Turn off X5 GAIN.
- q. Connect the VAC to the CH-2 ANALOG INPUT. Do not terminate the loop-through.

- r. Set the VAC for a 999.9 mV square wave.
- s. Check that the vertical amplitude of the 1730D display is 138.6 to 141.4 IRE (0.990 V to 1.010 V).
- t. Disconnect the VAC from the 1730D.

**10. Check Calibrator Amplitude**

Requirement: Amplitude 1 V  $\pm$ 1%.

- a. Push the REF and hold it in until the calibrator signal is displayed.
- b. Check the 1730D for a displayed amplitude of 139.3 to 140.7 IRE (0.995 V to 1.005 V).
- c. Set the 1730D to INT REF.

**11. Check PIX MON OUT Operation**

Requirement: DC level within  $\pm$ 0.5 V of 0 V. Selected line DC offset by approximately 180 mV.

- a. Install a 75  $\Omega$  terminator on the CH-1 ANALOG INPUT. Display CH1 INPUT and use 2LINE Sweep rate.
- b. Connect a coaxial cable from the PIX MON OUT to the test oscilloscope. Use an in-line terminator at the test oscilloscope. Connect the Composite Sync from the television test signal generator to the 1730D EXT REF. See Figure 6-7.

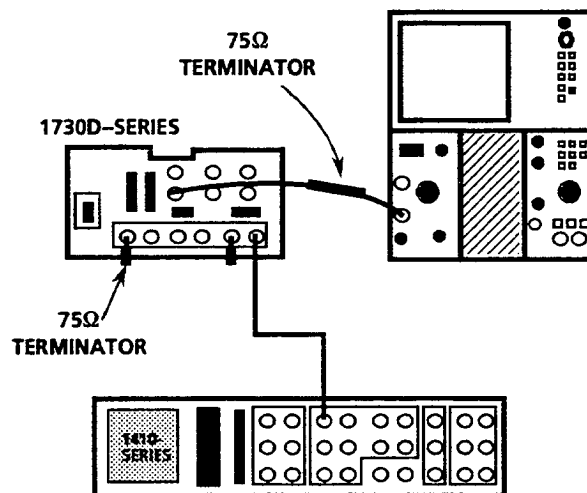


Figure 6-7: Using the test oscilloscope to check the 1730D PIX MON OUT

- c. Check that the level at the PIX MON OUT is  $0\text{ V} \pm 0.5\text{ V}$ .
- d. Set the 1730D to EXT REF.
- e. Turn on the 1730D LINE SEL and set the test oscilloscope sweep rate to display at least one field.
- f. Using the test oscilloscope Magnifier and HORIZONTAL Position control, display the DC level (intensified) shifted line.
- g. Check that the DC level shift for the intensified line is approximately 180 mV.
- h. Turn off LINE SEL and disconnect the cable from PIX MON OUT.

## 12. Check DC Restorer Operation

Requirement: Attenuation of 60 Hz input signal 20% or less. Blanking level shift with APL change, less than 1 IRE (7 mV). Blanking level shift with presence or absence of burst, less than 1 IRE (7 mV).

- a. Connect a Modulated 5-Step Linearity signal (with AC Bounce on) to the CH-2 ANALOG INPUT and terminate the loop-through in  $75\ \Omega$ .
- b. Select 2LINE Sweep and turn on VAR GAIN and FAST DC REST. Position the blanking level of the signal to the 0 IRE (0 V) line.
- c. Check that the blanking level does not move when the VAR GAIN is rotated.
- d. Check that the blanking level moves when the DC REST is turned off.
- e. Turn off the 1730D VAR GAIN and the 1410-Series AC Bounce.
- f. Connect the Black Burst signal to the EXT REF and terminate the remaining side of the loop-through input in  $75\ \Omega$ .
- g. Replace the Linearity signal on the CH-2 ANALOG INPUT with the function generator output. (Leave the remaining side of the loop-through input terminated.)
- h. Set the function generator for a sine wave with a Frequency of 60 Hz . Set the Amplitude for a 100 IRE display.
- i. Turn on SLW DC REST and select EXT REF on the 1730D.
- j. Check that the display amplitude is 80 IRE or greater.
- k. Turn on FAST DC REST.
- l. Check that the display amplitude is 10 IRE or less.

- m.** Replace the function generator output on the CH-2 ANALOG INPUT with the Linearity signal. (Leave the remaining side of the loop-through input terminated.)
- n.** Select 2LINE Sweep and turn on SLW DC REST.
- o.** Switch the Linearity signal APL between 50% and 10% and between 50% and 90%.
- p.** Check that the signal blanking level moves less than 1 IRE (7 mV).
- q.** Replace the Linearity signal on the CH-2 ANALOG INPUT with the Multiburst signal. (Leave the remaining side of the loop-through input terminated.)
- r.** Switch the multiburst generator Burst off and on.
- s.** Check that the blanking level changes less than 1 IRE (7 mV).
- t.** Turn OFF DC REST and remove the signal cables and terminators from the 1730D.

### 13. Check Flat Response

Requirement: Flat response with 50 kHz as a reference; 250 kHz to 6 MHz within 2%. X5 Flat response with 50 kHz as a reference; 250 kHz to 6 MHz within 5%.

- a.** Connect the sine-wave generator signal output to the CH-2 ANALOG INPUT and terminate the loop-through in 75  $\Omega$ . See Figure 6–8.
- b.** Set flat response on the sine-wave generator to 50 kHz and adjust the output amplitude for 100 IRE on the 1730D.
- c.** Check the flat response using the 50 kHz response as a reference. Check that the response is within  $\pm 2\%$  from 250 kHz to 6 MHz.

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**NOTE.** Other checks in this procedure assure that flat response is within specification; however, the low frequency flat response can be checked using an LF sine-wave generator (see sine-wave generator in the Equipment Required List) and changing 250 kHz to 50 kHz in the preceding part c.

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- d.** Select X5 GAIN on the 1730D and repeat part b. of this step.
- e.** Check the flat response using the 50 kHz response as a reference. Check that the response is within  $\pm 5\%$  from 250 kHz to 6 MHz.
- f.** Move the sine-wave generator output to the CH-1 ANALOG INPUT and terminate the remaining side of the loop-through in 75  $\Omega$ .



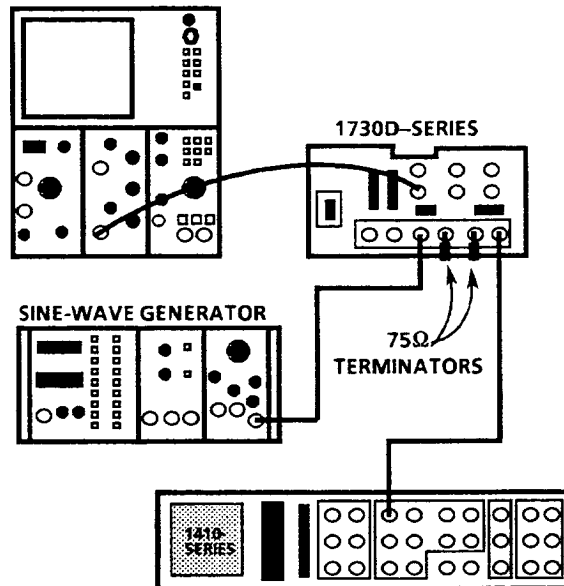


Figure 6–8: Equipment connections for checking flatness and PIX MON OUT frequency response

- g. Select CH1 INPUT.
- h. Check flat response using the 50 kHz response as a reference. Check that the amplitude is 100 IRE (0.7 V)  $\pm 5\%$  from 250 kHz to 6 MHz.
- i. Repeat parts b. and c. with the X5 GAIN turned off.

#### 14. Check PIX MON OUT Frequency Response

Requirement: Frequency Response within 3% of 50 kHz up to 6 MHz.

- a. Connect a coaxial cable from the 1730D PIX MON OUT to the test oscilloscope Vertical Input using an in-line 75  $\Omega$  terminator.
- b. Set the flat response on the sine-wave generator to 50 kHz and adjust the Amplitude on the test oscilloscope for 714 mV.
- c. Check the frequency response on the test oscilloscope display, using the 50 kHz response as a reference. Check that the response is within  $\pm 3\%$  from 250 kHz to 6 MHz.

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**NOTE.** Other checks in this procedure assure that frequency response is within specification; however, the low frequency response can be checked using an LF sine-wave generator (see sine-wave generator in the Equipment Required List) and substituting 50kHz for 250 kHz in the preceding part c.

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#### 15. Check PIX MON OUT Gain

Requirement: Gain from Input 1:1  $\pm$ 2% at 3.58 MHz.

- a. Connect a sine-wave generator to the 1730D CH-1 ANALOG INPUT. Do not terminate the input.
- b. Connect the peak-to-peak detector Head to the CH-1 ANALOG INPUT loop-through.
- c. Set the sine-wave generator Frequency to 3.58 MHz, and the Amplitude to 100 IRE.
- d. Adjust the peak-to-peak detector amplifier for a green light.
- e. Connect the peak-to-peak detector amplifier Output to the oscilloscope CH 1 input.
- f. Set the oscilloscope Amplitude to 5 mV/div and Coupling to DC. Adjust the CH 1 Position control to place the trace on the center line.
- g. Replace the peak-to-peak detector Head on the 1730D CH-1 ANALOG INPUT with a 75  $\Omega$  precision, .025% terminator (011-0102-01).
- h. Connect the peak-to-peak detector Head to the 1730D PIX MON OUT connector.
- i. Check that the DC level on the oscilloscope is  $\pm$ 14 mV from the center line.
- j. Remove the peak-to-peak detector Head from the 1730D PIX MON OUT, and remove the cable and terminator from the CH-1 ANALOG INPUT.

#### 16. Check Transient Response

Requirement: Transient response for the 2T pulse and 2T bar: preshoot 1% or less. Pulse-to-bar ratio: 1:1 within 1%. Overshoot: 2% or less. Ringing: 2% or less. Tilt: 1% or less for field-rate square wave or 25  $\mu$ s bar. Variation of the 12.5T modulated pulse baseline (Overscan), less than 2% as the display is positioned over the middle 80% of the display (with AC-coupled inputs).

- a. Connect the Pulse and Bar signal to the CH-2 ANALOG INPUT and terminate the other side of the loop-through in 75  $\Omega$ . Select the

full-amplitude 2T Pulse and Bar signal from the television test signal generator.

- b. Select CH2 INPUT, INT REF, and 1LINE Sweep.
- c. Check for less than 1% preshoot and less than 2% overshoot and ringing for the pulse and bar transitions.
- d. Check for a pulse-to-bar ratio within 1% of unity.
- e. Check for less than 1% tilt across the bar.
- f. Select the Field Square Wave signal. Display the signal with the 2FLD Sweep.
- g. Check for less than 1% tilt across the high APL portion of the display.
- h. Turn off the Field Square Wave signal.
- i. Set the 1730D to X5 GAIN and select 1LINE Sweep.
- j. Display the 12.5T modulated pulse. Position the baseline over the center 140 IRE.
- k. Check that the baseline of the modulated pulse varies less than 2%.

#### 17. Check X5 Transient Response

Requirement: Transient response for the 2T pulse and 2T bar: preshoot 1% or less. Pulse-to-bar ratio: 1:1 within 2%. Overshoot: 4% or less. Ringing: 4% or less.

- a. Install the step attenuator and insert 14 dB of attenuation in the input signal path.
- b. Connect Black Burst to the EXT REF INPUT and terminate the other side of the loop-through in 75  $\Omega$ . Set the 1730D to EXT REF.
- c. Check for 1% or less preshoot and 4% or less overshoot and ringing for the pulse and bar transitions.
- d. Check for a pulse-to-bar ratio within 2% of unity.
- e. Disconnect the signal from the CH-2 ANALOG INPUT (leave terminated), and disconnect the cable and terminator from the EXT REF INPUT.

#### 18. Check Low Pass Filter Response

Requirement: Response at 15 kHz does not vary between FLAT and LPASS FILTER by more than 1%.

- a. Connect the Modulated 5-step Linearity signal to the CH-2 ANALOG INPUT. Select the 100-IRE (100%) Flat Field/Alt Linearity setting of the generator.
- b. Set the 1730D to LPASS FILTER, INT REF, and 2LINE Sweep. Turn the X5 GAIN off.
- c. Switch back and forth between LPASS and FLAT FILTER.
- d. Check that the amplitude of the Linearity signal, in LPASS FILTER, is within 1% of the amplitude of the display in the FLAT FILTER mode.

#### 19. Check Chroma Filter Response

Requirement: Response at 3.58 MHz does not vary between FLAT and CHROMA FILTER by more than 1%. Attenuation at 7.2 MHz: greater than 20 dB.

- a. Connect the Color Bar signal to the CH-2 ANALOG INPUT. Turn the Luminance (Y) portion of the signal off. Unlock the SCH phasing of the generator.
- b. Display the signal in FLAT FILTER with the 1LINE Sweep. Use the 1730D VAR GAIN control to adjust the amplitude of the largest Chroma packet to equal the amplitude from blanking to 100% peak white. Select CHRM FILTER.
- c. Check that the amplitude of the largest chrominance bar is 99 to 101% of the amplitude in part b.
- d. Turn the 1410-Series Luminance (Y) on, and the SCH Phasing off.
- e. Select FLAT FILTER and turn VAR GAIN off.
- f. Replace the Color Bar signal on the CH-2 ANALOG INPUT with the sine-wave generator output and set the Frequency to 50 kHz. Adjust the Amplitude so that the display is 100 IRE.
- g. Set the Frequency of the sine-wave generator to 7.2 MHz. Select CHRM FILTER.
- h. Check that less than 10% of the reference amplitude remains.
- i. Remove all cables and terminators from the 1730D.

#### 20. Check Return Loss

Requirement: Return Loss for INPUT at least 40 dB from 50 kHz to 6 MHz (instrument on or off, any deflection factor setting). Return Loss of the PIX MON OUT at least 30 dB (50 kHz to 6 MHz) with the instrument on. DAC OUT at least 36 dB from 50 kHz to 5 MHz.

- a. Connect the output from the sine-wave generator, through a minimum loss attenuator, to the input of the Return Loss Bridge. Set the sine-wave generator to 50 kHz. Connect the output of the Bridge to the oscilloscope and set the amplitude of the display to 500 mV p-p with the terminator removed from the Unknown arm of the Bridge. Set the oscilloscope Coupling to AC. See Figure 6-9a.
- b. Change the generator Frequency to 6MHz. Reconnect the terminator to the Unknown arm, set the test oscilloscope for 1mV/div, and balance the Bridge. See Figure 6-9b.

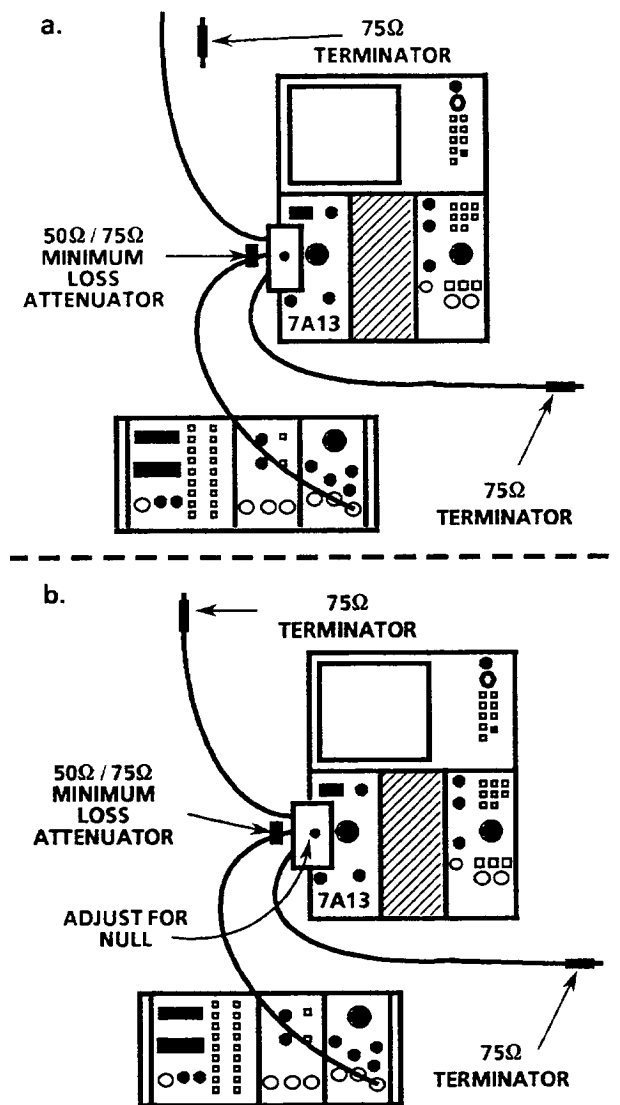


Figure 6-9: Setting up the Return Loss Bridge: a) Set-up 500 mV amplitude. b) Null bridge

- c. Connect the Unknown arm to the CH-1 ANALOG INPUT of the 1730D instrument and the terminator to the opposite side of the loop-through. See Figure 6-10.

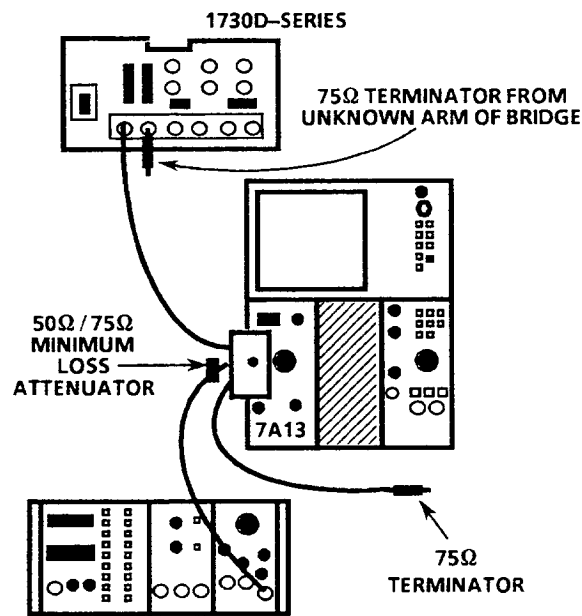


Figure 6-10: Measuring return loss of 1730D CH-1 ANALOG INPUT

- d. Check that the return loss of the CH-1 ANALOG INPUT is better than 40 dB, from 50 kHz to 6 MHz. Make this check (within this frequency range) with the instrument power on and off. Using the Nomograph supplied with the Return Loss Bridge, 40dB converts to 5 mV on the test oscilloscope vertical scale.
- e. Repeat parts c. and d. for the CH-2 ANALOG and EXT REF INPUTs.
- f. Check that the 1730D inputs are not terminated and that there is no signal applied. Connect the Unknown arm of the Return Loss Bridge to the PIX MON OUT connector.
- g. Set the test oscilloscope for 2 mV/div.
- h. Check that the return loss of the PIX MON OUT is better than 30 dB (15.8 mV), from 50 kHz to 6 MHz. Make this measurement with instrument power on and no signal output.
- i. Connect the Unknown Arm of the Return Loss Bridge to the 1730D DAC OUT.
- j. Move the plug on A4J3 (DAC board) to the 2-3 position.

- k. Check that the return loss of the DAC OUT is less than 8 mV on the test oscilloscope scale.
- l. Return the plug on A4J3 (DAC board) to the 1–2 position and disconnect the return loss bridge.

## 21. Check SER/PRL Gain

Requirement:  $\pm 1\%$  of a 140 IRE signal.

- a. Connect the digital signal generator output to the 1730D DIGITAL PARALLEL IN connector.
- b. Select the digital signal generator Pulse and Bar signal.
- c. Select PRL FORMAT and INT REF on the 1730D.
- d. Check for a displayed amplitude of 140 IRE,  $\pm 1\%$ .

## 22. Check SER/PRL Response

Requirement: Flat from 50 kHz to 4.2 MHz  $\pm 3\%$ .

- a. Select Line sweep on the digital signal generator.
- b. Select 1LINE Sweep on the 1730D.
- c. Check that the displayed response is within  $\pm 3\%$  on the 1730D, checking from 50 kHz to 4.2 MHz.

## 23. Check DAC OUT Transient Response

Requirement: Transient response for the 2T pulse and 2T bar: preshoot 1% or less. Pulse-to-bar ratio: 1:1 within 1%. Overshoot: 1% or less. Ringing: 2% or less. Tilt: 1% or less for field-rate square wave or 25  $\mu$ s bar.

- a. Connect a 75  $\Omega$  cable from the 1730D DAC OUT to the 1480 MOD W5F CH A INPUT. Terminate the CH A loop-through in 75  $\Omega$ .
- b. Select the Pulse and Bar signal on the digital signal generator.
- c. Select the following on the 1480: CH A INPUT, DC Coupled, FLAT Filter, One Line, and 0.2 VFS.
- d. Check the leading edge of the 2T pulse and the leading edge of the 25  $\mu$ s bar for less than 1% preshoot.
- e. Check the trailing edge of the 2T pulse for less than 2% ringing peak-to-peak.
- f. Check the leading edge of the bar for less than 1% overshoot.
- g. Check that the bar tilt is less than 1%.

- h.** Check that the pulse top is within 1% of Bar height.
- i.** Select Two Field on the 1480.
- j.** Check for less than 1% peak-to-peak tilt at the blanking level.

**24.** Check Luminance Amplitude Accuracy

Requirement: Luminance Amplitude Accuracy  $\pm 1\%$ .

- a.** Select 100 IRE, CAL +OPER, 0.2 VFS, and One Line on the 1480.
- b.** Check that the bar top and blanking of the chopped display overlay to within 1 IRE.

**25.** Check DAC OUT DC Level

Requirement: Blanking level = 0 VDC,  $\pm 5$  IRE.

- a.** Change the 1480 input setting to A, DC CPL'D, 0.2 V/div.
- b.** Remove the connection from the 1480 CH A loop-through connector and replace it with a 75  $\Omega$  terminator, so that the CH A Input is double-terminated.
- c.** Vertically position the trace to the 0 V graticule line. Remove one of the terminators and reconnect the 1730D output to the 1480 CH A Input.
- d.** Check that the blanking level is within 5 IRE of the 0 V graticule line.

**26.** Check Luminance Non-Linearity

Requirement: Equal amplitude transitions  $\pm 1\%$ .

- a.** Select the following on the 1480: X1 GAIN, FLAT FILTER, and One Line. Select the 5-Step Luminance Staircase on the digital signal generator.
- b.** Select DIFF FILTER on the 1480.
- c.** Check that the five spikes are 100 IRE. If they are not, use the Variable Gain control to adjust the amplitude to 100 IRE.
- d.** Select 0.2 VFS on the 1480. Position the display so that the tops of the spikes are visible.
- e.** Check that the spikes are all the same height, within 1%.

**27.** Check Chrominance-to-Luminance Gain and Delay Error

Requirement: Chrominance-to-Luminance Gain Error  $\pm 1\%$ ; Delay Error  $\leq 10$  ns ( $\leq 1\%$  peak-to-peak).

- a.** Select the Pulse and Bar signal from the digital signal generator.



- b. Set the 1480 MOD W5F to 0.2 Volts Full Scale. Select FLAT Filter.
- c. Check the 12T pulse baseline for less than  $\pm 1\%$  gain error and less than 1% peak-to-peak delay error. See Figure 6–11.

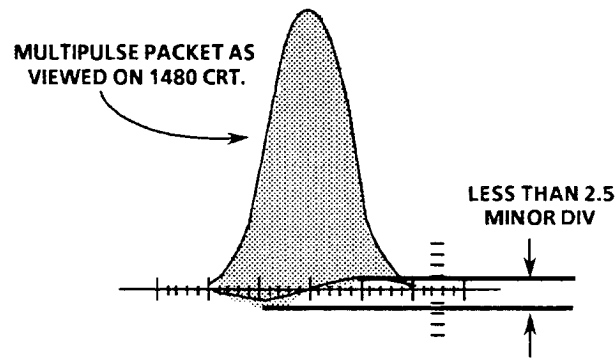


Figure 6–11: Delay error within 1%

## 28. Check DAC OUT Frequency Response

Requirement: Flat from 50 kHz to 4.2 MHz,  $\pm 1\%$ .

- a. Connect the digital sweep generator, via a wiring converter, to the rear-panel DIGITAL PARALLEL IN. Instructions for building the converter are given in the Required Equipment List at the beginning of the Performance Check procedure. Table 6–3 shows the wiring diagram.
- b. Connect the peak-to-peak detector to the DAC OUT on the 1730D. Connect the DC side of the detector Head to the + input on the peak-to-peak detector Head. Connect the output of the peak-to-peak detector to the CH 1 Input of the test oscilloscope.
- c. Connect the Marker Output of the digital sweep generator to the CH 2 Input on the test oscilloscope. Connect the Black Burst Output of the digital sweep generator to the Ext Trigger Input of the test oscilloscope.

- d.** Set the test equipment as follows:

Sweep Generator		
Clock		Int
Sine Wave H Reset		Out
Freq Knob		In
Peak-to-Peak Detector		
+ Input		In
Input		Out
Test Oscilloscope		
Vertical		
Ch 1 Volts/Div		5 mV
Ch 2 Volts/Div		1 V
Coupling		DC
Display Mode		Add
Trigger Source		Ext
Time Base		
Slope		+
Coupling		AC LF REJ
Time/Div		2 ms
Ref		EXT

- e.** Adjust the + Input on the peak-to-peak detector until the green LED lights. Position the CH 1 oscilloscope display to the CRT center for reference.
- f.** Pull out the Frequency knob on the Sweep and turn it fully counterclockwise. The sweep generator is now putting out a 55 kHz sine wave.
- g.** Adjust the peak-to-peak detector level until the green LED lights. Vertically position the trace to center screen on the test oscilloscope.
- h.** The horizontal trace (with vertical markers) should resemble that shown in Figure 6–12. The height of the horizontal trace represents the DC value, corresponding to the peak-to-peak value of the 55 kHz sine wave. The markers indicate frequency points.
- i.** Push in the Frequency knob on the sweep generator to put it in the Sweep mode.
- j.** Check that the flat response is within 1% of the 50 kHz response, from 50 kHz to 4.2 MHz.

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**NOTE.** 1% is equal to 7 mV.

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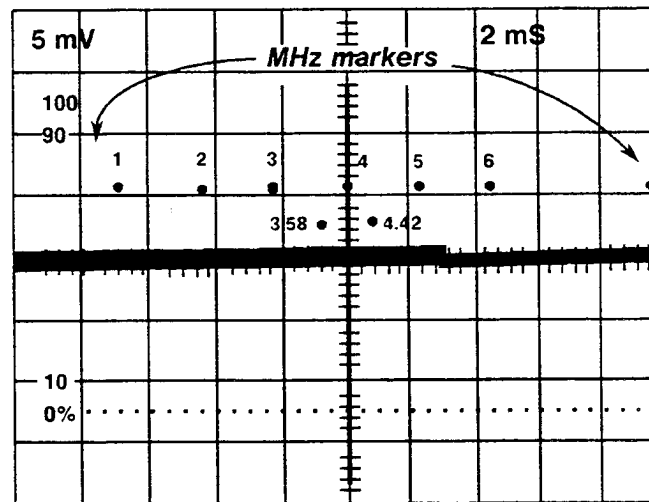


Figure 6-12: 55 kHz Reference signal, showing markers at 1, 2, 3, 3.58, 4, 4.42, 5, and 6 MHz

- k. Remove the digital sweep generator output and peak-to-peak detector Head.

## 29. Check DAC OUT Differential Phase and Gain

Requirement:  $<0.5^\circ$  differential phase.  $<0.6\%$  differential gain.

- a. Connect the digital signal generator output to the 1730D DIGITAL PARALLEL IN connector.
- b. Connect a  $75 \Omega$  cable from the 1730D DAC OUT to the CHA INPUT on the 1780R. Terminate the loop-through in  $75 \Omega$ .
- c. Select the following on the 1780R: X1 Waveform Gain, CHA Input, Flat Filter, and One Line. Select the Modulated Ramp on the digital signal generator.
- d. Select the 1780R Measure menu. Select DIFF PHASE on the menu screen.
- e. Use the Vector Variable Gain to place the Chroma Vector to the compass rose.
- f. Select Double and Noise Reduction Off on the 1780R.
- g. Use the 1780R phase shift control (large knob) to bring one end of the double display together. Press the Reference Set to zero the readout, then use the phase shift control to bring the other end of the display together. Select X5 Waveform Gain if desired for increased resolution.

- h.** Check that the differential phase is less than 0.5%.
- i.** Select Diff Gain on the 1780R menu screen.
- j.** Adjust the VERTICAL Position control to set the signal to center screen.
- k.** Use the 1780R phase shift control (large knob) to bring one end of the double display together. Press the Reference Set to zero the readout, then use the phase shift control to bring the other end of the display together. Select X5 Waveform Gain if desired for increased resolution.
- l.** Check that the differential gain is less than 0.6%.
- m.** Exit the 1780R Measure menu. Turn off the X5 Waveform Gain.

**30.** Check DAC OUT SCH Phase

Requirement:  $<10^\circ$ .

- a.** Select the Pulse and Bar signal on the digital signal generator.
- b.** Turn the 1780R SCH Phase On and Phase Shift On.
- c.** Set the large knob function to PHASE and select Vector operation on the 1780R. Use the HORIZONTAL and VERTICAL Position controls to place the center dot to the cross mark on the 1780R.
- d.** Use the phase shift control (large knob) to place the burst on the  $0^\circ$  line. Press the Reference Set. Use the phase shift control to align the SCH dot to the  $0^\circ$  line.
- e.** Check for an SCH Phase reading of  $\pm 10^\circ$  on the 1780R.
- f.** Turn the 1780R SCH Phase On and Phase Shift Off.

Performance Checks Steps 31 and on are the Serial board checks for the 1730D.

**31.** Check Digital Signal Generator Serial Gain

- a.** Connect the digital signal generator CH1 Serial Output to the + Input on the 7A13 with a  $75\ \Omega$  in-line terminator.
- b.** Connect the VAC to the Input on the 7A13 and set the VAC for an 800 mV output.
- c.** Set the 7A13 + and– Inputs to DC coupling. Set the Volts/Div to 100 mV with Full Bandwidth. Set the oscilloscope Sweep to 500  $\mu$ s.
- d.** Position the display to view the chopped signal.
- e.** Adjust the Amplitude control on the VAC so that the two chopped signals just touch.

- f. Note the VAC Amplitude readout as it will be used in the following steps.

### 32. Check Eye Sample Efficiency and Gain

Requirement:  $\pm 5\%$  Gain Accuracy for a nominal 800 mV signal.

- a. Connect the CH-1 Serial cable from the digital signal generator to the 1730D CH-1 SERIAL INPUT, terminating the input with the  $75\ \Omega$  in-line terminator used in Step 31a.
- b. Set the 1730D to FLAT FILTER, CH1 INPUT, SER Format, INT REF, GAIN off, and 1LINE Sweep.
- c. Set the 1730D to Eye CH-1.
- d. Check that the Eye pattern is overlaid. See Figure 6–13.
- e. Check for a displayed amplitude matching the noted VAC readout  $\pm 2$  minor divisions on the 1730D.

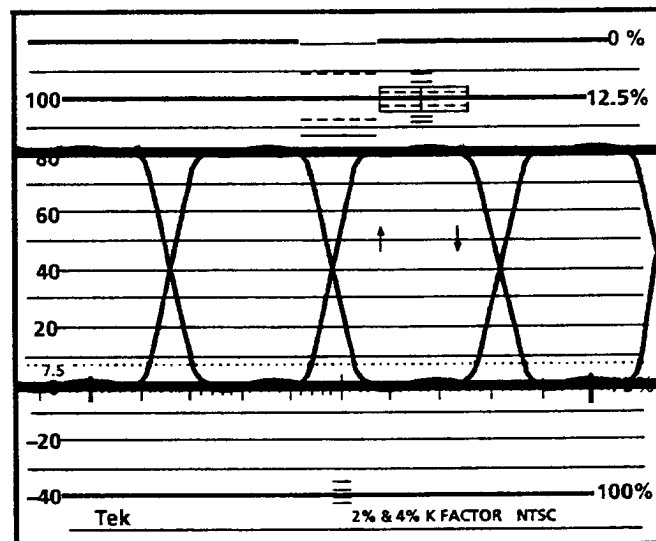


Figure 6–13: Normal Eye pattern display

### 33. Check CH-2 SERIAL INPUT Gain

Requirement:  $\pm 5\%$  Gain Accuracy for a nominal 800 mV signal.

- a. Move the serial input cable and terminator to the CH-2 SERIAL INPUT.
- b. Select CH2 INPUT.

- c. Check for a displayed amplitude matching the noted VAC readout  $\pm 2$  minor divisions on the 1730D.

**34. Check CH-2 SERIAL INPUT Transient Response**

Requirement: <10% aberrations for an 800 mV step.

- a. Replace the 75  $\Omega$  in-line terminator with a precision high frequency terminator.
- b. Set the 1730D to VAR GAIN and adjust the control for 10 major divisions of Eye pattern display.
- c. Check the leading edge of the Eye pattern for <1 major division of any aberration.

**35. Check CH-1 SERIAL INPUT Transient Response**

Requirement: <10% aberrations for an 800 mV step.

- a. Move the serial input cable and high frequency terminator to the 1730D CH-1 SERIAL INPUT and select CH1 INPUT.
- b. Adjust the VAR GAIN control for a display of 10 major divisions on the 1730D.
- c. Check the leading edge of the Eye pattern for <1 major division of any aberration.

**36. Check Eye Timing**

Requirement: 2 ns/div  $\pm 3\%$ , measured over at least 7 divisions.

- a. Select X5 GAIN on the 1730D then use the VERTICAL Position to place the first Eye crossing on the first major division mark.
- b. Check that the 3rd Eye crossing is on the 7th major division mark  $\pm 1$  minor division.
- c. Remove the serial input cable and high frequency terminator from the 1730D. Turn off the X5 GAIN.

**37. Check Eye Bandwidth**

Requirement: 50 kHz–225 MHz +1 dB, –3 dB.

- a. Connect a precision 50 cable and 50/75  $\Omega$  minimum loss attenuator and high frequency terminator to the CH-1 SERIAL INPUT on the 1730D.
- b. Set the SG503 Frequency to 1 MHz.
- c. Adjust the SG503 Amplitude for an 8 division display on the 1730D.

- d. Select VAR GAIN on the 1730D and adjust the control for a 10 division display.
- e. Check while varying the SG503 Frequency range and Variable Frequency range controls between 1 MHz and 225 MHz, that the response amplitude does not vary by more than +1 and 3 major divisions. (Pay special attention to the response between 100 – 225 MHz.)
- f. Move the 50  $\Omega$  cable, 50 to 75  $\Omega$  min-loss attenuator, and high frequency terminator to the CH-2 SERIAL INPUT on the 1730D.
- g. Select CH2 INPUT and GAIN off.
- h. Repeat parts b. through e. for the CH-2 SERIAL INPUT.
- i. Remove all cables and terminators from the 1730D.

### 38. Check Serial Dynamic Range

Requirement: Proper operation with up to 18.5 dB loss at 71.5 MHz , using coaxial cable having a  $1/\sqrt{F}$  loss characteristic (Belden 8281 cable is suggested).

- a. Connect 250 meters (820 ft) of Belden 8281 coaxial cable from the digital signal generator Serial Output to the 1730D CH-1 SERIAL INPUT. Terminate the remaining side of the loop-through with a high frequency terminator.
- b. Select SER Format and CH1 INPUT.
- c. Check that a video waveform appears.
- d. Press the EDH READOUT button.
- e. Check that the EDH screen readout appears.
- f. Press the CH INPUT button to zero the various counters.
- g. Allow the instrument to run for at least 2.5 minutes.
- h. Press the Fld button to toggle between the active picture and full field error display.
- i. Check that the errored seconds is zero for both displays.
- j. Press the EDH READOUT button to return to waveform display.
- k. Move the Belden cable and terminator to the 1730D CH-2 SERIAL INPUT.
- l. Select SER Format and CH2 INPUT.
- m. Repeat steps c. through j. for the CH-2 SERIAL INPUT.

This completes the Performance Checks Procedure.





# Adjustment Procedure



# Adjustment Procedures

The Adjustment Procedure covers only adjustments. Checks, other than those that must be made to ensure a step is completed, are in the Performance Check Procedure. There are actually two Adjustment Procedures: the Short-Form Procedure, for those familiar with the adjustments, followed by the longer, more detailed, Standard Procedure.

Allow 20 minutes of warm-up time at normal room temperature (approximately 25°C) before making any adjustments to the instrument.

## Short Form Procedure

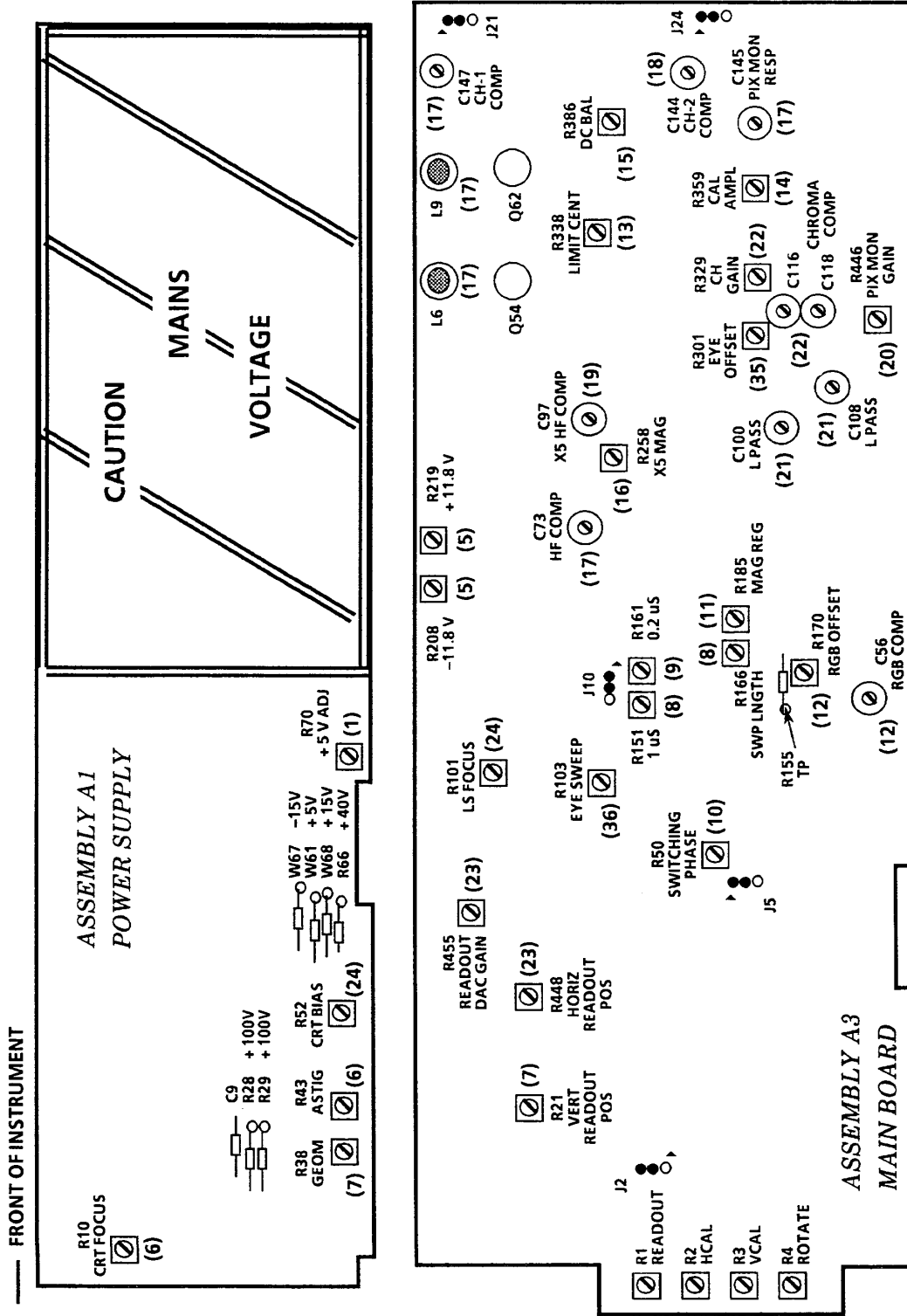
The Short-Form Adjustment Procedure steps are in the same order as the longer form of the procedure, so that the short form can be used as an index for the long form. The components to be adjusted are shown in Figures 7-1 and 7-2, with corresponding step numbers shown in parentheses near each component. The circuit numbers of these components are also included in the step titles.

### Power Supply Adjustments

1. Adjust +5 Volts Supply (A1R70)
2. Adjust CRT Bias (A1R52)
3. Adjust -5.2 Volts Supply (A4R91)
4. Check A5 Serial Board Power Supplies (5.2 V, +12 V, 12 V)
5. Adjust A3 Main Board Power Supplies (A3R208, A3R219)
6. Adjust Focus and Astigmatism (A1R10, A1R43)
7. Adjust Trace Rotation and Geometry (A3R448, A3R21, A3R455, A1R38)

### A3 Main Board Adjustments

8. Adjust 2LINE and 1 S Sweep Calibration (A3R166, A3R151)
9. Adjust 0.2  $\mu$ s Sweep Calibration (A3R161)
10. Adjust Dual Filter Switching Phase (A3R50)
11. Adjust Magnifier Registration (A3R185)
12. Adjust RGB Offset and Compensation (A3R170, A3C56)
13. Adjust Output Bias (A3R338)
14. Adjust Calibration Signal Amplitude (A3R359)



Variable resistors are shown as rectangles with slotted adjustments, variable capacitors are shown as circles with slotted adjustments, and variable inductors are shown as circles with solid centers. Numbers enclosed by brackets are adjustment step numbers. Some test points and all plug jumpers are shown.

Figure 7-1: Adjustment locations for the Power Supply and Main circuit board assemblies

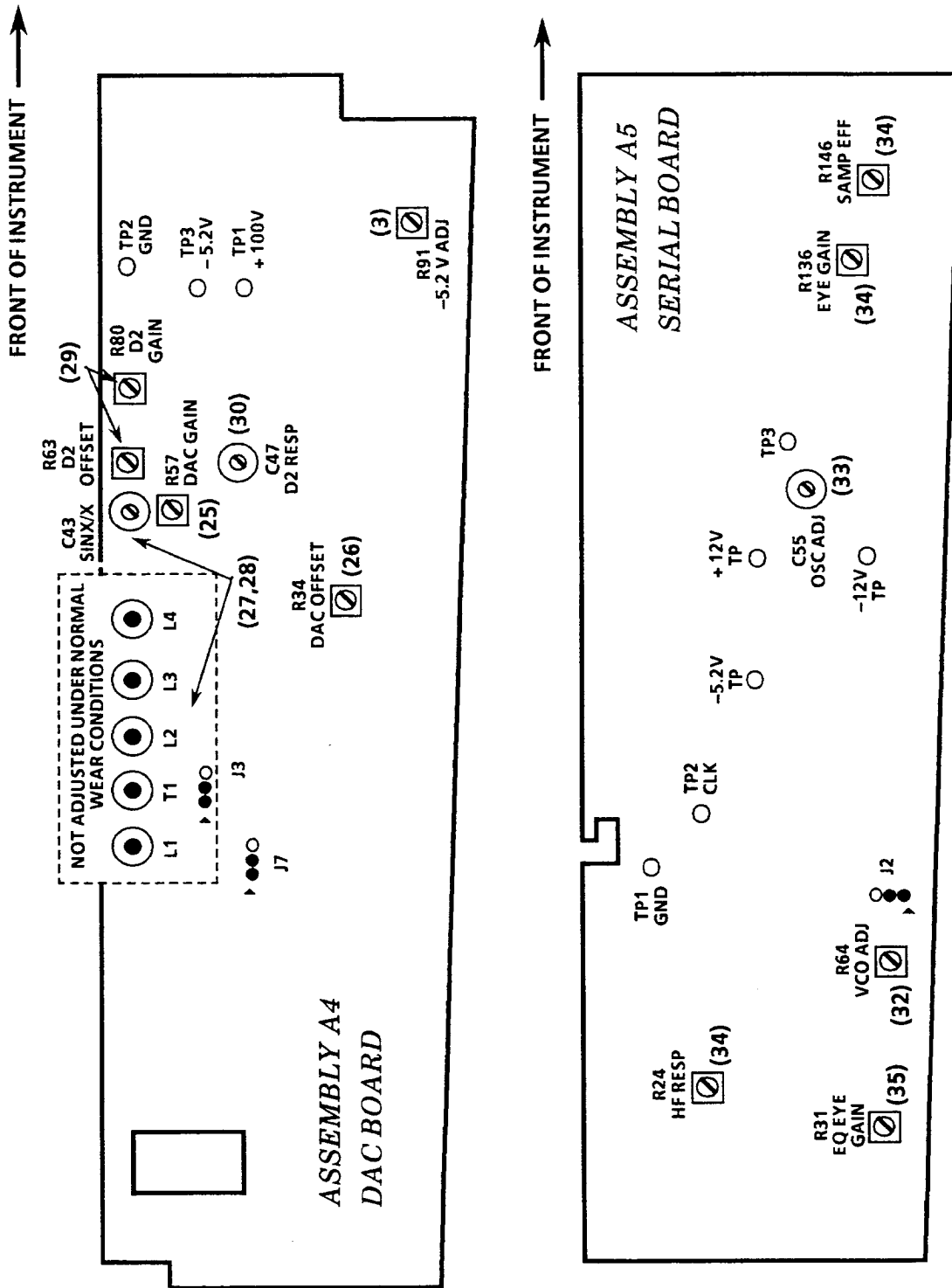


Figure 7-2: Adjustment locations for the DAC and Serial circuit board assemblies

15. Adjust Dual Input DC Level (A3R386)
16. Adjust X5 Magnifier Registration (A3R258)
17. Adjust CH-1 INPUT Compensation and Flat Response, and PIX MON OUT Response (A3L6, A3L9, A3C147, A3C73, A3C145)
18. Adjust CH-2 INPUT Compensation (A3C144)
19. Adjust X5 GAIN HF Response (A3C97)
20. Adjust VIDEO OUT Gain (A3R446)
21. Adjust Low Pass Filter (A3C108, A3C100)
22. Adjust Chroma Filter (A3R329, A3C116, A3C118)
23. Adjust Readout Position (A3R448, A3R21)
24. Adjust CRT Bias and Line Select Focus (A1R52, A3R101)

**A4 DAC Board  
Adjustments**

25. Adjust DAC Gain (A4R57)
26. Adjust DAC DC Level (A4R34)
27. Adjust Frequency Response and Group Delay (A4C43, A4L1, A4L2, A4L3, A4L4, A4T1)
28. Adjust SER/PRL INPUT Offset and Gain (A4R63, A4R80)
29. Adjust SER/PRL Response (A4C47)

**A5 Serial Board  
Adjustments**

30. Check Digital Signal Generator Serial Gain
31. Adjust VCO Frequency (A5R64)
32. Adjust VCO Oscillator (A5C55)
33. Adjust Sample Efficiency and Gain (A5R136, A5R146, A5R24)
34. Adjust EQ/EYE Gain (A5R31, A3R301)
35. Adjust Eye Pattern Timing (A3R103)

## Standard Adjustment Procedure

**Preliminary Setup** Connect the 1730D AC power cord to the variable autotransformer. Turn power on and set the autotransformer for a voltage between 90 – 250 V.

Connect the Multiburst signal to the CH-2 ANALOG INPUT and terminate the opposite side of the loop-through with a 75  $\Omega$  terminator. See Figure 7-3.

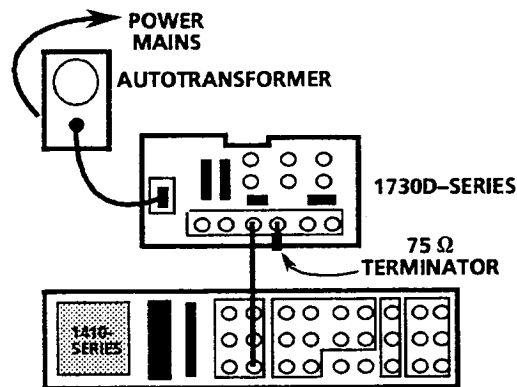


Figure 7-3: Initial equipment hook-up for the Adjustment Procedure

Turn ON the 1730D and set the front-panel controls as shown in Table 7-1.

Table 7-1: 1730D Initial Control Settings

Control	Setting
POWER	ON
INTENSity	As desired
FOCUS	As desired
SCALE	As desired
VERTICAL Position	On screen
HORIZONTAL Position	On screen
FILTER	FLAT
REF	INT
INPUT	CH 2
Format	ANLG
GAIN (switch)	off
DC REST	OFF

**Table 7-1: 1730D Initial Control Settings (Cont.)**

Control	Setting
MAG	off
Sweep	2LINE
LINE SElect	off
Field	FLD1

**Power Supply  
Adjustments**

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**NOTE.** *A1R70 should only be adjusted when full instrument recalibration is performed. (After completing the Performance Checks procedure, if only a few adjustments are indicated, and the supply is very close to +5 V, do not adjust R70.)*

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1. Adjust +5 Volts Supply (A1 Power Supply Board)
  - a. Connect the voltmeter to the +5 V test point (A1W61). See Figure 7-1 for location.
  - b. Adjust A1R70 (+5ADJ) for +5 volts.
  - c. Remove the voltmeter from A1W61.
2. Adjust CRT Bias
  - a. Turn the INTENS control fully counterclockwise.
  - b. Adjust A1R52 (CRT BIAS) so that the display is just extinguished.
  - c. Set INTENS control to desired level.
3. Adjust 5.2 Volts Supply (A4 DAC Board)
  - a. Connect the voltmeter to A4TP3. See Figure 7-2 for location.
  - b. Adjust A4R91 (5.2VADJ) for -5.22 volts.
4. Check A5 Serial Board Power Supplies
  - a. Connect the voltmeter to the -5.2V test point on the A5 Serial board. See Figure 7-2 for location.
  - b. Check for -5.15 to -5.20 volts.
  - c. Connect the voltmeter to the +12 V test point on the A5 Serial board. See Figure 7-2 for location.

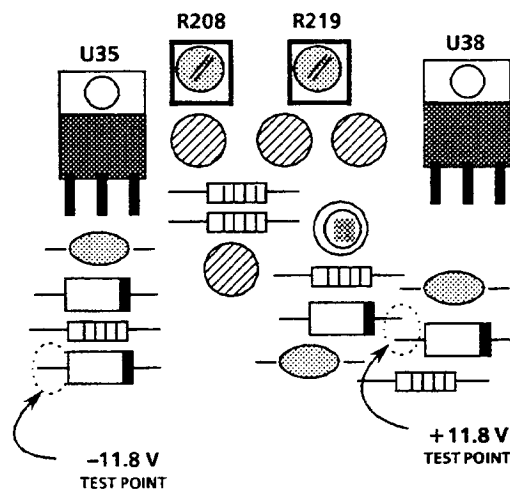


- d. Check for +11.76 to +12.24 volts.
- e. Connect the voltmeter to the -12 V test point on the A5 Serial board. See Figure 7-2 for location.
- f. Check for -11.76 to -12.24 volts.
- g. Remove the voltmeter from the -12 V test point.

#### 5. Adjust A3 Main Board Power Supplies

**NOTE.** The power supply should not be adjusted unless the entire Adjustment Procedure will be performed. If supplies are within tolerances listed below, individual adjustments should be possible without performing a complete readjustment.

- a. Connect the voltmeter to the -11.8 V test point on the A3 Main board. See Figure 7-4 for location.



**PORTION OF A3 MAIN CIRCUIT BOARD**

Figure 7-4: The + and- 11.8 V supply test points

- b. Adjust A3R208 for -11.78 to -11.82 volts.
- c. Connect the voltmeter to the +11.8 V test point on the A3 Main board. See Figure 7-4 for location.
- d. Adjust A3R219 for +11.78 to +11.82 volts.
- e. Remove the voltmeter from the +11.8 V test point.

6. Adjust Focus and Astigmatism
  - a. Set the FOCUS control on the front panel so that it is approximately at the center of its rotation.
  - b. Adjust A1R10 (CRT FOCUS) and A1R43 (ASTIG) for the most clearly-defined Multiburst display.
7. Adjust Trace Rotation and Geometry
  - a. Select CH1 INPUT on the 1730D.
  - b. Adjust the front-panel TRACE ROT potentiometer for a level trace across the 0 IRE line.
  - c. Press and hold the 1730D Field button to bring up the MENU.
  - d. Select DIAGNOSTICS by using the UP and DN LINE SEL buttons and then press the Field button.
  - e. Select READOUT DAC by using the UP and DN LINE SEL buttons and then press the Field button.
  - f. Check that there is a DAC display. See Figure 7-5.

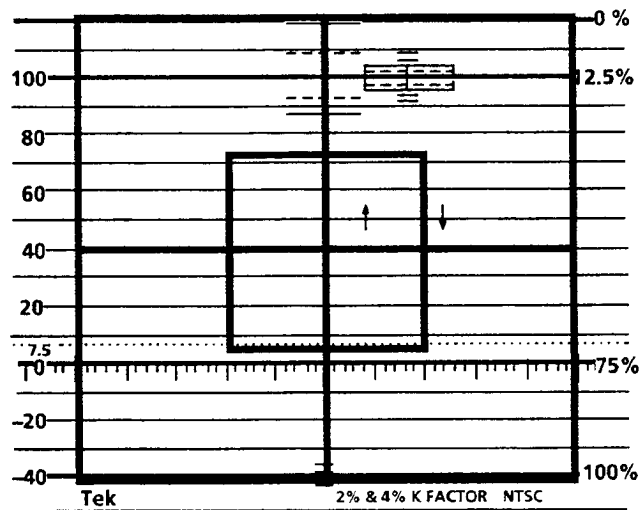


Figure 7-5: DAC test pattern superimposed on the 1730D graticule

- g. Adjust A3R448 (HORIZ READOUT POS) to horizontally center the DAC display.
- h. Adjust A3R21 (VERT READOUT POS) to vertically center the DAC display.

- i. Adjust A3R455 (VERT DAC GAIN) to set the top of the DAC display on the 120 IRE line, and the bottom of the display on the 40 IRE line.
  - j. Repeat parts f. and g. until no adjustment is necessary.
  - k. Adjust A1R38 (GEOM) for the squarest looking DAC display.
  - l. Adjust A3R448 and A3R21 (HORIZ and VERT READOUT POS) to position the DAC display in the center of the CRT. See Figure 7-5.
  - m. Check for less than one minor division of tilt across the top of the DAC display.
  - n. Exit the MENU (FLD1 should be lit).
- A3 Main Board Adjustments**
- 8. Adjust 2LINE and 1  $\mu$ s Sweep Calibration
    - a. Press and hold the REF button to display the CAL signal on the 1730D. Select 2LINE Sweep.
    - b. If necessary, center the display using the front-panel HCAL.
    - c. Adjust A3R166 (SWEEP LENGTH) for one cycle of the CAL signal per major division over the center 10 divisions.
    - d. Turn on the MAG (1  $\mu$ s should be lit).
    - e. Adjust A3R151 (1  $\mu$ s CAL) for one full cycle over the 10 major divisions.
    - f. Turn off the MAG and return to INT REF.
  - 9. Adjust 0.2  $\mu$ s Sweep Calibration
    - a. Select CH2 INPUT and remove the terminator from the CH-2 ANALOG INPUT.
    - b. Loop-through connect the Multiburst signal to the CH-2 ANALOG INPUT of the 1730D and the frequency counter. See Figure 7-6.

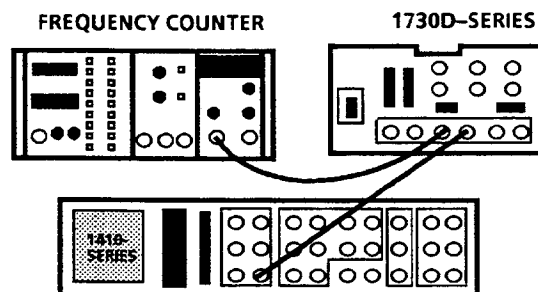


Figure 7-6: Equipment hook-up to adjust 0.2 s timing

- c. Set the multiburst generator to Low, Continuous, and Manual. Turn Markers off.
- d. Adjust the multiburst Frequency for a 5.0 MHz sine wave as measured on the frequency counter.
- e. Change the multiburst generator to Composite.
- f. Select 1LINE Sweep and turn on the MAG.
- g. Adjust A3R161 for 10 cycles of the 5 MHz sine wave over 10 divisions  $\pm 1$  minor division. Recheck the generator frequency of 5 MHz by switching it to Continuous. (Return the generator to Composite after check.)
- h. Disconnect the frequency counter from the 1730D and terminate the remaining side of the CH-2 ANALOG INPUT loop-through in 75  $\Omega$ .
- i. Turn off MAG and select 2LINE Sweep.

**10. Adjust Dual Filter Switching Phase**

- a. Hold the FILTER button in until both the FLAT and LPASS indicators are lit.
- b. Identify the sync pulse that occurs between the two lines. Position the tip of the pulse so that the switching transition is visible.
- c. Adjust A3R50 (SWITCHING PHASE) so that the switching transition occurs at the center of the sync tip.
- d. Select FLAT FILTER.

**11. Adjust Magnifier Registration**

- a. Set the multiburst generator for High Range Multiburst.
- b. Turn on the 1730D MAG.
- c. Use the HORIZONTAL Position control to position the center of the sync pulse to the center major graticule division.
- d. Turn Off the MAG.
- e. Adjust A3R185 (MAG REG) so that the center of the sync pulse is at the center major graticule division. It may be necessary to repeat parts b. through e. of this step several times to achieve best magnifier registration.
- f. Check with the MAG off, that both ends of the trace can be positioned to at least the center of the screen.

**12. Adjust RGB Offset and Compensation**

- a. Replace the Multiburst signal on the CH-2 ANALOG INPUT with the Color Bar signal.
- b. Select 1LINE Sweep and use the HORIZONTAL Position control to center the display.
- c. Connect pin 2 of the rear-panel REMOTE socket to ground.
- d. Adjust A3R170 (RGB OFFSET) to place the display's right edge on the 10th (far right) graticule mark.
- e. Note that the Color Bar display compresses to 1/4 or 1/3 of its previous length (depending on the setting of jumper A3J10).
- f. Remove the Color Bar signal from the CH-2 ANALOG INPUT.
- g. Input a 10 V, 2 kHz Square Wave signal, from the function generator to pin 1 of the 1730D rear-panel REMOTE connector. (Pin 2 grounded.)
- h. Connect a probe from the test oscilloscope to the junction of A3R155 and A3R157. See Figure 7-1 for location (shown as circle on end of A3R155).
- i. Adjust A3C56 (RGB COMP) for best transient response.
- j. Remove all connections and terminators from the 1730D.

### 13. Adjust Output Bias

- a. Adjust the VERTICAL Position control fully clockwise.
- b. Connect the voltmeter lead to the collector of A3Q54 (transistor case). See Figure 7-1 for location.
- c. Adjust A3R338 (LIMIT CENTER) for +0.8V if going through this step for the first time, or for a voltage halfway between the reading noted in part f. if repeating this step.
- d. Set the VERTICAL Position control fully counterclockwise.
- e. Connect the voltmeter lead to the collector (transistor case) of A3Q62. See Figure 7-1 for location.
- f. Check that the voltage matches the reading on the collector of A3Q54 from part c. If it does not, adjust A3R338 for a voltage halfway between the voltages noted.
- g. Repeat steps a. through f. until the collectors of A3Q54 and A3Q62 are balanced at the same DC level.

---

**NOTE.** The balanced voltage may not be +0.8 V.

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#### 14. Adjust Calibration Signal Amplitude

- a. Connect the VAC signal to the 1730D CH-1 ANALOG INPUT; do not terminate. See Figure 7-7.

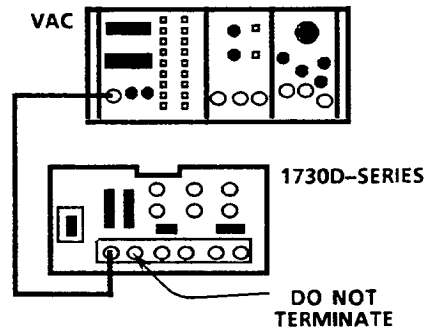


Figure 7-7: Test equipment hook-up for setting calibrator signal amplitude

- b. Set the VAC for 999.9 mV.
- c. Select the 1730D CH1 INPUT and adjust the front-panel VCAL so that the VAC signal is exactly 140 IRE p-to-p as displayed on the 1730D.
- d. Display the 1730D CAL signal.
- e. Adjust A3R359 (CAL AMPTD) so that the Calibrator amplitude is 140 IRE p-to-p as displayed on the 1730D.
- f. Remove the VAC signal from the 1730D.
- g. Select INT REF.

#### 15. Adjust Dual Input DC Level

- a. Connect the Color Bar signal through a 75  $\Omega$  in-line terminator and a Dual Input Coupler to the CH-1 and CH-2 ANALOG INPUTS. Do not terminate the loop-through inputs.
- b. Connect the Black Burst signal to the 1730D EXT REF INPUT and terminate the remaining side of the loop-through input in 75  $\Omega$ .
- c. Set the 1730D INPUT to BOTH (CH1 and CH2 INPUTS, ANLG Format, and SLW DC REST indicators lit), select 1LINE Sweep, and turn On X5 GAIN.
- d. Adjust A3R386 (DC BAL) for overlaid displays.

- e. Select 2LINE Sweep, CH1 INPUT, and turn Off X5 GAIN.
16. Adjust X5 Magnifier Registration
    - a. Use the VERTICAL Position control to position the signal blanking level on the graticule baseline.
    - b. Select X5 GAIN.
    - c. Adjust A3R258 (X5 MAG) to reposition blanking level to the baseline.
    - d. Select X1 GAIN (GAIN Off). Repeat this step as necessary until there is no change between X1 and X5 GAIN.
  17. Adjust CH-1 INPUT Compensation and Flat Response, and PIX MON OUT Response
    - a. Connect the Multiburst signal, through an in-line  $75\ \Omega$  termination, to the CH-1 ANALOG INPUT. Connect the Black Burst signal to the EXT REF INPUT and terminate in  $75\ \Omega$ . Connect a  $75\ \Omega$  cable from the 1730D PIX MON OUT to the test oscilloscope vertical input using a  $75\ \Omega$  in-line terminator. See Figure 7-8.

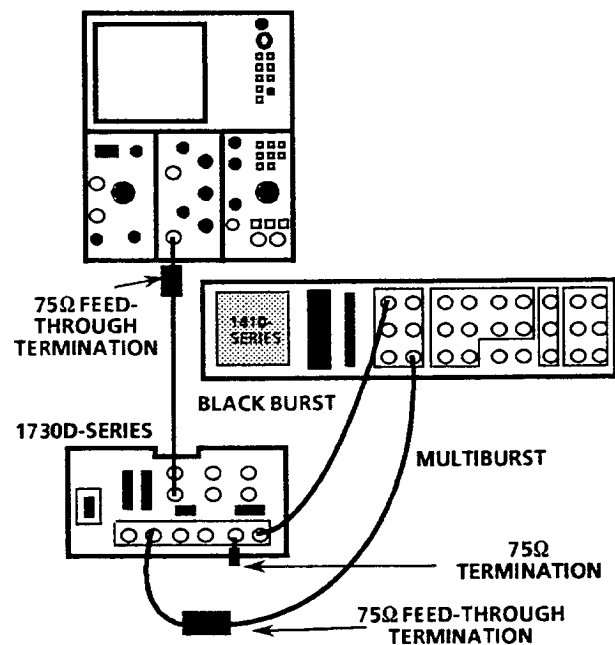


Figure 7-8: Test equipment connections for adjusting high-frequency compensation

- b. Set the multiburst generator to Sweep, High Range, Composite, Markers, and Full Amplitude.
- c. Set the 1730D to 2FLD Sweep and EXT REF.
- d. Set the test oscilloscope Vertical Volts/Div to 100 mV, and Horizontal Sec/Div to 2 ms.
- e. If calibrating a new board, preset A3C145 to midrange, and A3L6 and A3L9 to five turns down from the top of the coils. (The cores should be adjusted together.)
- f. Adjust A3C147 (CH1 Input Comp) for flat response at 6 MHz on the 1730D. See Figure 7-9.

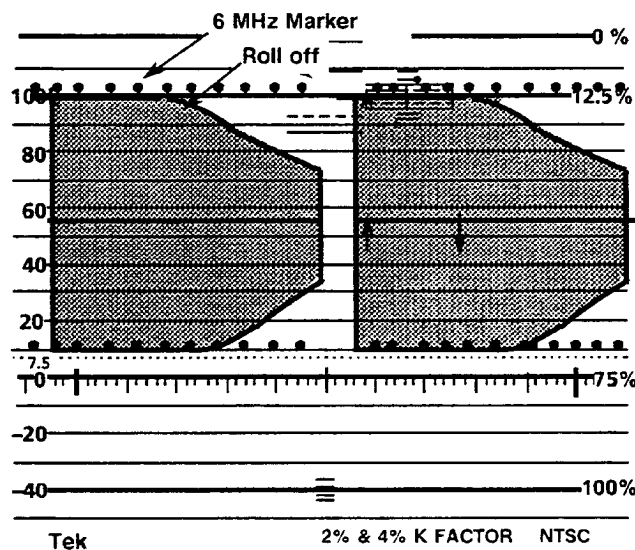


Figure 7-9: Adjusting for best flat response

- g. Check the response in the 2 – 4 MHz region.

If it is bumped up:

Adjust A3L6 and A3L9 in a small amount. (The cores should be adjusted together.)

If it is dipped:

Adjust A3L6 and A3L9 out a small amount. (The cores should be adjusted together.)



- h. Repeat parts f. and g. until the best response to 6 MHz is achieved. A3C73 (HF COMP) may need to be adjusted slightly. (It affects response in the 6 – 8 MHz region.)
- i. Adjust A3C145 (PIX MON FREQ RESP) for a flat display on the test oscilloscope. See Figure 7-10.

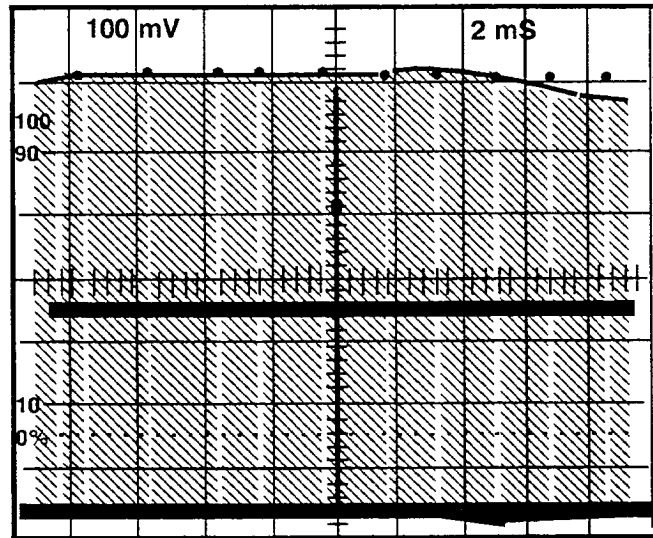


Figure 7-10: Using high range swept signal to set flatness

- j. Disconnect the Multiburst signal from the CH-1 ANALOG INPUT, and remove the 75  $\Omega$  termination from the remaining side of the loop-through connector.
- k. Connect the output of the leveled sine-wave generator, through a 50/75  $\Omega$  minimum loss terminator, and a 75  $\Omega$  feed-through terminator and the Dual Input connector, to the CH-1 and CH-2 ANALOG INPUTs.
- l. Set the leveled sine-wave generator Frequency to 50 kHz and adjust its Amplitude for a 100 IRE output as displayed on the 1730D.
- m. Set the leveled sine-wave generator Frequency to 6 MHz.
- n. Adjust A3C147 (CH-1 COMP) for 100 IRE.
- o. Set the leveled sine-wave generator Frequency to 3.58 MHz and check for 100 IRE  $\pm 2$  IRE (2%).

---

**NOTE.** *The dashed lines in the graticule Line Tilt Box, located at the 100 IRE marker, are 2% for 100 IRE signals.*

---

- p. If not in specification at 3.58 or 4.43MHz, repeat parts f. through h. of this step (as set up by parts a. and b.).

**18. Adjust CH-2 INPUT Compensation**

- a. Set the 1730D INPUT to A1/A2 mode (CH1 and CH2 INPUT, and ANLG Format indicators lit), and select 2LINE Sweep.
- b. Set the leveled sine-wave generator Frequency to 6 MHz.
- c. Adjust A3C144 (CH-2 COMP) to overlay the CH-1 and CH-2 ANALOG INPUT displays.
- d. Set the leveled sine-wave generator Frequency to 3.58 MHz and check for 100 IRE  $\pm 2\%$  (2 IRE).

**19. Adjust X5 GAIN HF Response**

- a. Select CH1 INPUT, X5 GAIN, and 1LINE Sweep.
- b. Set the sine-wave generator Frequency to 50 kHz and adjust the sine-wave generator for a displayed amplitude of 100 IRE.
- c. Set the sine-wave generator Frequency to 3.58 MHz.
- d. Adjust A3C97 (X5 COMP) for an amplitude of 100 IRE.
- e. Set the sine-wave generator Frequency to 6 MHz and check that the displayed amplitude is still 100 IRE  $\pm 5$  IRE.
- f. Turn off X5 GAIN.

**20. Adjust VIDEO OUT Gain**

- a. Connect the leveled sine-wave generator through a 50/75  $\Omega$  minimum loss attenuator to the 1730D CH-1 ANALOG INPUT.
- b. Connect the peak-to-peak detector Head to the other side of the CH-1 ANALOG INPUT loop-through.
- c. Set the leveled sine-wave generator Frequency to 3.58MHz, and adjust the Amplitude for a 100 IRE display on the 1730D.
- d. Adjust the peak-to-peak detector amplifier for a green light, and then connect the amplifier output to the test oscilloscope CH1 input.
- e. Set the test oscilloscope CH1 input for 5 mV per division and DC coupling.

- f. Adjust the test oscilloscope CH1 position control to place the trace on the center graticule line.
- g. Remove the peak-to-peak detector Head from the 1730D CH-1 ANALOG INPUT loop-through and replace it with a .025% precision 75  $\Omega$  terminator.
- h. Connect the peak-to-peak detector Head to the PIX MON OUT connector.
- i. Adjust A3R446 (PIX MON GAIN) so that the trace is on the test oscilloscope center graticule line.
- j. Remove all cables and terminators from the 1730D.

## 21. Adjust Low Pass Filter

- a. Connect the Color Bar signal to the CH-1 ANALOG INPUT and terminate the loop-through in 75  $\Omega$ .
- b. Select 2LINE Sweep, LPASS FILTER, INT REF, and CH1 INPUT. Turn on the MAG and X5 GAIN.
- c. Adjust A3C108 (LPASS Filter) for minimum chrominance (minimum trace width on the backporch, following color burst).
- d. Position the sync pulse to the baseline (0 IRE) at center screen.
- e. Adjust A3C100 (LPASS Filter) for the best corner on the leading edge of the sync pulse.
- f. Turn off the MAG and X5 GAIN, and select FLAT FILTER.

## 22. Adjust Chroma Filter

- a. Set the Color Bar generator for Full Field and turn off Luminance (Y) and Setup. Set color bar Amplitude to 75%.
- b. Select 1LINE Sweep.
- c. Use the 1730D VAR GAIN to set the displayed amplitude of the largest Color Bar packet to be from blanking level to peak white (100 IRE).
- d. Select CHRM FILTER.
- e. Adjust A3R329 (CHROMA GAIN) so that the amplitude of the largest color packet is again 100 IRE.
- f. Adjust A3C116 (CHROMA COMP) for the squarest envelope (minimum burst envelope decay time). It may be necessary to readjust A3C118 (CHROMA COMP) for maximum amplitude.

- g.** It may be necessary to perform parts e. and f. of this step several times before reaching the optimum setting for both Chroma Gain and Chroma Filter Compensation.
- h.** Select FLAT FILTER, 2LINE Sweep, and turn off the VAR GAIN.
- i.** Set the television test signal generator for a standard Color Bar signal (turn on Luminance (Y) and Setup).

**23.** Adjust Readout Position

- a.** Press and hold the 1730D Field button to bring up the MENU.
- b.** Select DIAGNOSTICS by using the UP and DOWN LINE SEL buttons and then press the Field button.
- c.** Select READOUT DAC by using the UP and DOWN LINE SEL buttons and then press the Field button.
- d.** Check that there is a DAC display.
- e.** Adjust A3R448 (HORIZ READOUT POS) to horizontally center the DAC display.
- f.** Adjust A3R21 (VERT READOUT POS) to position the top of the DAC display on the 120 IRE line.

---

**NOTE.** *The bottom of the display should be on the 40 IRE line.*

---

- g.** Press any key on the 1730D to exit the MENU.

**24.** Adjust CRT Bias and Line Select Focus

- a.** Turn LINE SEL ON and select Line 19.
- b.** Set the front-panel READOUT screwdriver adjustment for minimum intensity.
- c.** Turn the INTENS control fully clockwise.
- d.** Adjust A1R52 (CRT BIAS) so that the readout display is almost extinguished.
- e.** Adjust A3R101 (LS FOCUS) for optimum display definition.
- f.** Adjust the READOUT control to match the readout intensity to the display intensity.
- g.** Turn LINE SEL Off, and adjust the INTENS control for a usable display.
- h.** Turn LINE SEL ON and select Line 19.

- i. Check that the display is visible.
- j. Turn LINE SEL Off.
- k. Check by adjusting INTENS fully counterclockwise, that the display is not visible.
- l. Check that by adjusting the FOCUS control, that the display can be defocused at both ends of the control range.

### A4 DAC Board Adjustments

#### 25. Adjust DAC Gain

- a. Connect the digital signal generator Digital Output to the 1730D rear-panel DIGITAL PARALLEL IN using the bit parallel cable. Select the Pulse and Bar test signal.
- b. Select PRL Format on the 1730D.
- c. Connect a 75  $\Omega$  cable from the 1730D DAC OUT to the CH A input on the 1480-Series MOD W5F. Terminate the loop-through in 75  $\Omega$ . Connect the VAC to the CH B INPUT. Do not terminate the loop-through. See Figure 7-11.

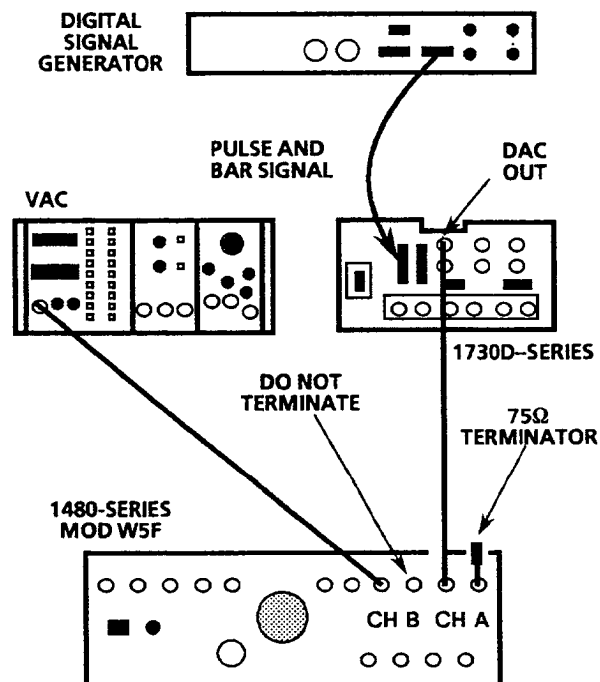


Figure 7-11: Equipment connections for Adjusting DAC Gain

- d. Select the 1480-Series MOD W5F CH A INPUT. Check that the video signal is present.
- e. Set the VAC to 714 mV.
- f. Set the 1480-Series as follows:

Volts Full Scale	0.2 V/Div
Display	5 $\mu$ s
Input	A-B
- g. Position the display so that the top of the Pulse and Bar signal and blanking level are visible.
- h. Adjust A4R57 (DAC GAIN) until the bar top and blanking of the chopped display overlay.

**26. Adjust DAC DC Level**

- a. Change the 1480-Series Input setting to A, DC CPL'D.
- b. Remove the connection from the 1480-Series CH A Input loop-through and replace it with a 75  $\Omega$  terminator, so that the CH A Input is double-terminated.
- c. Vertically position the trace to the 0 IRE graticule line. Remove one of the terminators and reconnect the 1730D DAC OUT to the 1480-Series CH A Input.
- d. Adjust A4R34 (DAC OFFSET) to align the displayed blanking level with the 0 IRE graticule line.
- e. Remove the VAC from the 1480-Series CHB Input and remove the terminator from the CH A INPUT.

**27. Adjust Frequency Response and Group Delay**

---

**NOTE. DO NOT ADJUST COILS OR TRANSFORMERS UNDER NORMAL CONDITIONS.**

*The DAC board coils and transformers have been sealed after factory adjustment, and should not be readjusted under normal instrument wear. Simply skip these parts when performing this procedure. If a problem occurs, making adjustment of these parts necessary, first remove the seal, then perform the adjustment as described here.*

*The sealed parts are: A4L1, A4L2, A4L3, A4L4, and A4T1.*

---

- a. Connect the digital sweep generator, via a wiring converter, to the rear-panel DIGITAL PARALLEL IN connector. Instructions for building

the converter are given in the Required Equipment List at the beginning of the Performance Check procedure. Table 6–3 shows the wiring diagram.

- b. Connect the peak-to-peak detector Head to the rear-panel DAC OUT on the 1730D. Connect the DC side of the detector Head to the + Input on the peak-to-peak detector Head. Connect the Output of the peak-to-peak detector to the CH1 Input of the test oscilloscope.
- c. Connect the Marker Output of the digital sweep generator to the CH2 Input on the test oscilloscope. Connect the Black Burst Output of the digital sweep generator to the Ext Trigger Input of the test oscilloscope.
- d. Set the test equipment as follows:

Sweep Generator	
Clock	Int
Sine Wave H Reset	Out
Freq Knob	In
Peak-to-Peak Detector	
+ Input	In
– Input	Out
Test Oscilloscope	
Vertical	
Ch 1 Volts/Div	5 mV
Ch 2 Volts/Div	1 V
Coupling	DC
Display Mode	Add
Trigger Source	Ext
Time Base	
Slope	+
Coupling	AC LF REJ
Time/Div	2 ms
Ref	EXT

- e. Adjust the + Input on the peak-to-peak detector until the green LED lights. Position the test oscilloscope display with the CH1 Position control.
- f. Pull out the Frequency knob on the Sweep and turn it fully counterclockwise. The sweep generator is now putting out a 55 kHz sine wave.
- g. Adjust the peak-to-peak detector level until the green LED lights. Vertically position the trace to center screen on the test oscilloscope. This is the 55 kHz reference level.
- h. The horizontal trace (with vertical markers) should resemble that shown in Figure 7–12. The height of the horizontal trace represents the DC

value, corresponding to the peak-to-peak value of the 55 kHz sine wave. The markers indicate frequency points.

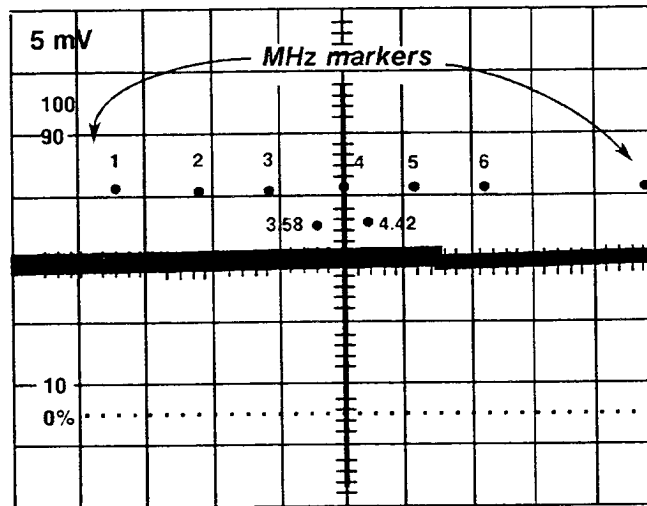


Figure 7-12: 55 kHz Reference signal, showing markers at 1, 2, 3, 3.58, 4, 4.42, 5, and 6 MHz

---

**NOTE.** Perform parts f. through i. periodically throughout the remainder of the Calibration procedure.

---

- i. Push in the Frequency knob on the sweep generator to put it in the Sweep mode.
- j. Adjust A4C43 (SINX/X CORRECTION) for flattest response. See Figure 7-13.



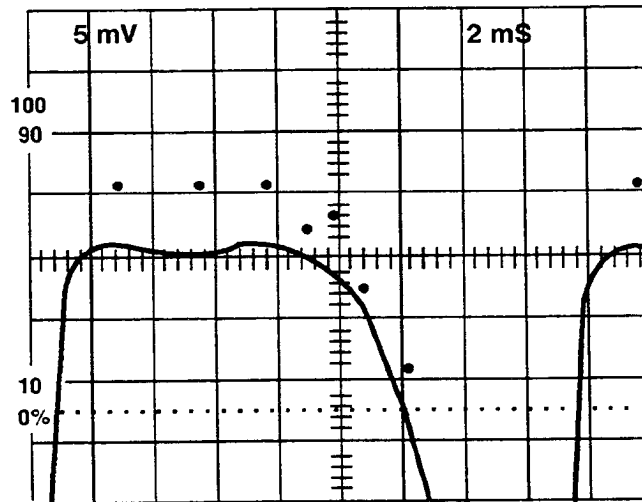


Figure 7-13: Adjusting for flattest response

Before proceeding, refer to the NOTE at the beginning of this step.

- k. Adjust A4T1, and then A4L1, in succession, for the best response from 1 – 3 MHz.
- l. Adjust A4C43 (SINX/X CORRECTION) to reset the overall flatness of the display back to the 55 kHz reference level.
- m. Adjust A4L3 so that the filter rolls off smoothly, beginning at 5 MHz. Typically, the roll off is 5 – 10 mV. See Figure 7-14.

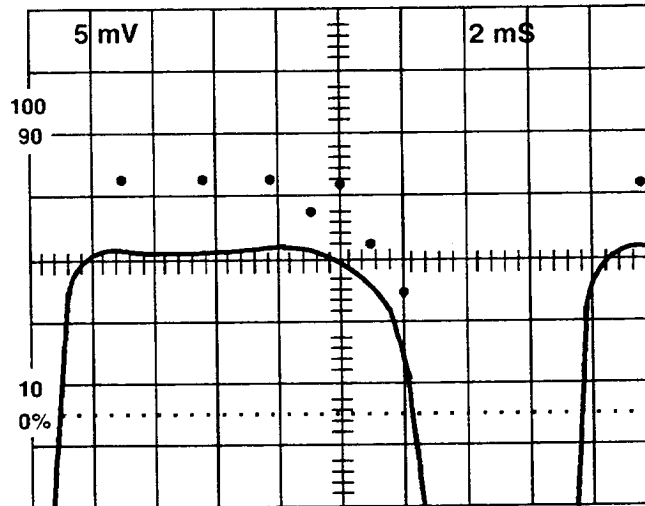


Figure 7-14: Adjusting for rolloff

- n. Adjust A4L4, A4L3, and A4L2, in succession, to flatten the response between 55 kHz and 5 MHz.
- o. Adjust A4T1 and A4L1 as needed to flatten the 1 – 3 MHz response.
- p. Adjust A4C43 (SINX/X CORRECTION) to flatten the response as much as possible.
- q. Repeat all adjustments (parts k. through p. of this step) as necessary for best response. Typically a response of  $\pm 3$  mV (0.4%) from the 55 kHz reference is achievable. (Each minor division on the test oscilloscope is 1 mV.) See Figure 7-15.

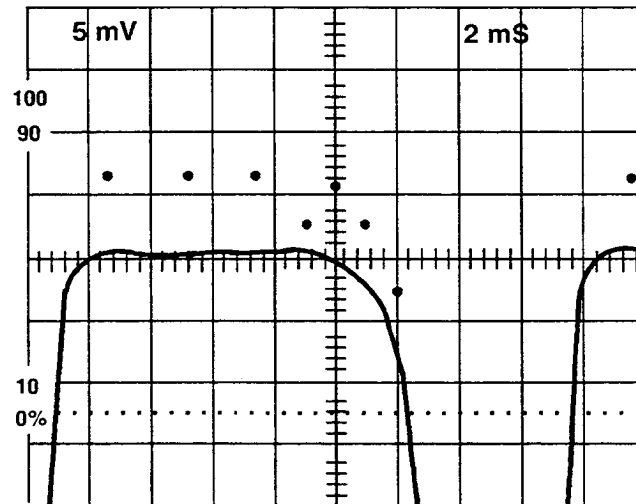


Figure 7-15: Typical response

- r. Disconnect the sweep generator and peak-to-peak detector from the 1730D.
- s. Connect the digital signal generator to the 1730D DIGITAL PARALLEL IN. Select the Multipulse test signal. The five multipulses are: 1, 2, 3, 3.58, and 4.2 MHz.
- t. Connect the 1480 MOD W5F to the DAC OUT on the 1730D. Terminate the 1480 MOD W5F with a .025% 75  $\Omega$  precision terminator.
- u. Set the 1480 as follows:
 

Magnifier	X1 (5 $\mu$ s/Div)
Volts Full Scale	0.2 V/Div
- v. Check each pulse to see that there is less than 1% (2.5 minor divisions) peak-to-peak sinusoidal term (delay error). Figure 17-16 illustrates delay error within 1%. Figure 7-17 illustrates delay error greater than 1%.

---

**NOTE.** A3C43 can be used to remove the gain error so that each pulse can be examined closely for delay error. A3C43 will be readjusted in a later step.

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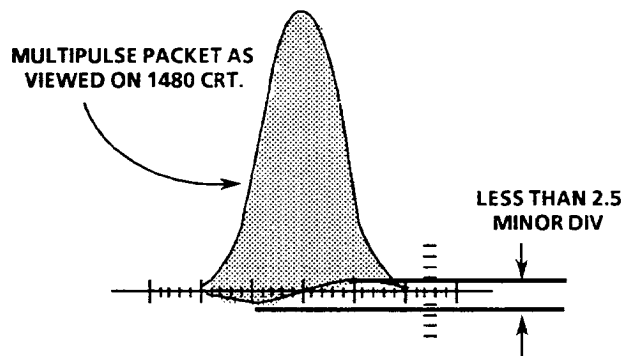


Figure 7-16: Delay error within 1%

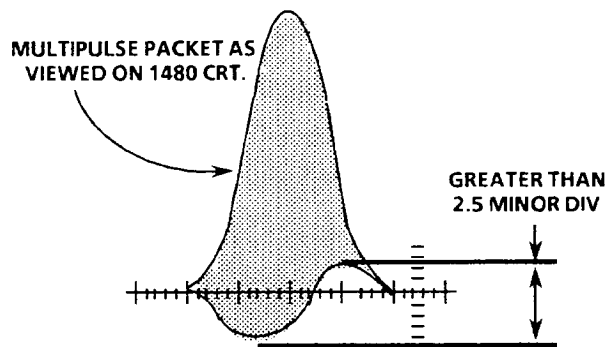


Figure 7-17: FDelay error more than 1%

- w. Adjust A4T1 (only if necessary) for the flattest 2 – 3 MHz multipulses, and A4L3 for the flattest 4.2 MHz multipulse.
- x. Disconnect the digital signal generator and the 1480 MOD W5F from the 1730D.
- y. Connect the sweep generator to the 1730D DIGITAL PARALLEL IN. Connect the peak-to-peak detector Head to the 1730D DAC OUT connector.
- z. Pull out the Frequency knob on the Sweep and turn it fully counterclockwise. The sweep generator is now putting out a 55 kHz sine wave.
- aa. Adjust the peak-to-peak detector level until the green LED lights. Vertically position the trace to center screen on the test oscilloscope.
- ab. Push in the Frequency knob on the sweep generator to put it in the Sweep mode.

- ac.** Adjust A4C43, A4L4, and A4L2 for the flattest response.
- ad.** Disconnect the sweep generator and peak-to-peak detector Head from the 1730D.
- ae.** Connect the digital signal generator to the 1730D DIGITAL PARALLEL IN. Connect the 1480 MOD W5F to the 1730D DAC OUT connector.
- af.** Check each pulse to see that there is less than 1% (2.5 minor divisions) peak-to-peak sinusoidal term (delay error).
- ag.** Select the Pulse and Bar signal on the digital signal generator.
- ah.** Check for less than 2.5 minor divisions (1%) preshoot, and 1 major division (2%) peak-to-peak ringing on the 2T pulse.
- ai.** Check that the 2T pulse amplitude is within 2.5 minor divisions of the top of the Bar.
- aj.** Disconnect the digital signal generator and the 1480 MOD W5F from the 1730D.

---

**NOTE.** *If the DAC board has sealed coils and transformers (A4L1, A4L2, A4L3, A4L4, and A4T1) that have been unsealed or replaced in the previous steps, they need to be resealed after completing readjustment. The following steps detail how to reseal the components.*

---

- ak.** Connect the sweep generator to the 1730D DIGITAL PARALLEL IN. Connect the peak-to-peak detector Head to the 1730D DAC OUT connector.
- al.** Pull out the Frequency knob on the Sweep and turn it fully counterclockwise. The sweep generator is now putting out a 55 kHz sine wave.
- am.** Adjust the peak-to-peak detector level until the green LED lights. Vertically position the trace to center screen on the test oscilloscope.
- an.** Push in the Frequency knob on the sweep generator to put it in the Sweep mode.
- ao.** Check that while applying the RTV sealant in the following step, the signal response does not change.
- ap.** Apply RTV sealant to the following component cores as needed: A4L1, A4L2, A4L3, A4L4, and A4T1.

---

**NOTE.** Sealant needs only to be applied to those parts that you unsealed or replaced.

---

**aq.** Disconnect the sweep generator and peak-to-peak detector Head from the 1730D.

**28.** Adjust SER/PRL Input Offset and Gain

**a.** Connect the digital signal generator to the 1730D DIGITAL PARALLEL IN and select the Pulse and Bar signal.

**b.** Connect a 75  $\Omega$  cable from the DAC OUT connector to the CH-1 ANALOG INPUT on the 1730D. Connect a second cable from the CH-1 ANALOG INPUT loop-through to the EXT REF INPUT and terminate in 75  $\Omega$ .

**c.** Set the 1730D as follows:

SWEEP	1 LINE
MAG	OFF
INPUT	A1/P
DC REST	ON
GAIN	X5

**d.** Adjust A4R63 (D2 OFFSET) so that the blanking levels of the two waveforms are overlaid on the 1730D.

**e.** Position the display so that the bar tops are visible.

**f.** Adjust A4R80 (D2 GAIN) so that the bar tops of the two waveforms are overlaid.

**g.** Parts d., e., and f. of this step are interactive. Repeat them until the bar tops and blanking levels of the two signals are overlaid.

**29.** Adjust SER/PRL Response



---

**CAUTION.** Be sure to properly identify A4C47 before adjusting. It is not far from A4C43 (SINX/X CORRECTION), which you already adjusted. Altering the A4C43 adjustment would require the DAC Frequency Response be rechecked.

---

**a.** Select Line Sweep on the digital signal generator.

**b.** Adjust A4C47 (D2 RESPONSE) for best overlay of the two signals. Use X5 GAIN to view the top of the sweep.

**c.** Remove all cables, except the parallel cable, from the 1730D.

**A5 Serial Board  
Adjustments****30. Check Digital Signal Generator Serial Gain**

- a. Connect the digital signal generator CH1 Serial Output to the + Input on the 7A13 with a 75  $\Omega$  in-line terminator.
- b. Connect the VAC to the Input on the 7A13 and set the VAC for an 800 mV output.
- c. Set the 7A13 + and – Inputs to DC coupling. Set the Volts/Div to 100 mV with Full Bandwidth. Set the oscilloscope Sweep to 500  $\mu$ s.
- d. Position the display to view the chopped signal.
- e. Adjust the Amplitude control on the VAC until the edges of the two chopped signals just touch.
- f. Note the VAC Amplitude readout as it will be used in the following steps.

**31. Adjust VCO Frequency**

- a. Connect the CH-1 Serial cable from the digital signal generator to the 1730D CH-1 SERIAL INPUT. Terminate the loop-through with a high frequency precision terminator.
- b. Set the 1730D Format to SER.
- c. Connect a X1 probe from the frequency counter to A5TP2, and the probe ground to A5TP1.
- d. Set the frequency counter for X1 Attenuation, AC Coupling, and 0.1 sec Gate.
- e. Adjust the frequency counter trigger for a stable readout.
- f. Check that the counter readout is 14.318 MHz.
- g. Move the jumper on A5J2 to the 2 – 3 position.
- h. Adjust A5R64 (VCO ADJ) for a frequency readout of 14.320 MHz  $\pm$ 0.2 MHz.
- i. Move the jumper on A5J2 to the 1 – 2 position.
- j. Check that the counter readout is a stable 14.318 MHz.
- k. Remove the test probe and ground clip from A5TP1 and A5TP2.

**32. Adjust VCO Oscillator**

- a. Connect the voltmeter to A5TP3.
- b. Adjust A5C55 (OSC ADJ) for 4.0 V  $\pm$ 0.5 V.

- c. Remove the voltmeter from A5TP3.

**33. Adjust Sample Efficiency and Gain**

- a. Set the 1730D Format to EYE.
- b. Adjust A5R136 (EYE GAIN) fully clockwise.
- c. Adjust A5R146 (SAMPLE EFFICIENCY) for the best overlay of the display.
- d. Adjust A5R24 (HF RESP) for the best looking corner on the leading edge (transient response).
- e. Select CAL on the 1730D.
- f. Adjust the front-panel VCAL, if necessary, for a 140 IRE display.
- g. Select INT on the 1730D.
- h. Replace the high frequency precision terminator on the CH-1 SERIAL INPUT with the 75  $\Omega$  in-line terminator used in Step 31a.
- i. Adjust A5R136 (EYE GAIN) to match the display amplitude to the amplitude noted on the VAC readout in Step 31,  $\pm 1$  minor division.

**34. Adjust EQ/EYE Gain**

- a. Select EQ/EYE Format on the 1730D.
- b. Adjust A5R31 (EQ EYE GAIN) for an 80 IRE display on the 1730D.
- c. Select SER Format on the 1730D and turn DC REST ON.
- d. Position the baseline to the 0 IRE graticule line.
- e. Select EYE Format on the 1730D.
- f. Adjust A3R301 (EYE OFFSET) to position the bottom of the Eye display to the 0 IRE graticule line.

**35. Adjust Eye Pattern Timing**

- a. Use the Position controls to place the first Eye crossing on the first major division mark. Select X5 GAIN if needed for better resolution.
- b. Adjust A3R103 (EYE SWEEP CAL) so that the second Eye crossing (3rd transition) is at the 7th major division mark  $\pm$ one minor division. See Figure 7-18.



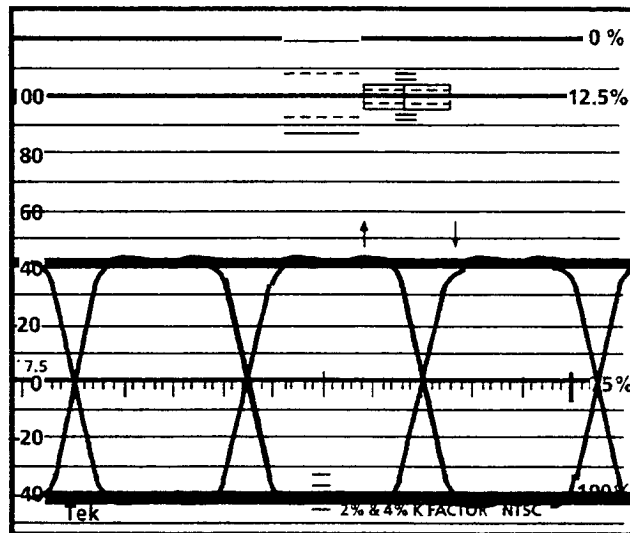


Figure 7-18: Adjusting Eye Pattern Timing

This completes the Adjustment Procedure.





# Maintenance



# Maintenance

This section contains instructions for preventive maintenance, general troubleshooting, Auxiliary Port and LED Driver diagnostics, and corrective maintenance. If the instrument does not function properly, troubleshooting and corrective measures should be undertaken immediately to circumvent additional problems.

## Preventive Maintenance

Preventive maintenance consists of cleaning, visual inspection, performance checks, and (if needed) readjustment. The preventive maintenance schedule established for the instrument should be based on the amount of use it receives and the environment in which it is operated. Under average conditions, scheduled preventive maintenance should be performed every 2000 hours of operation.

### Performance Checks and Readjustments

Instrument performance should be checked after each 2000 hours of operation, or every 12 months if used intermittently. This will help ensure maximum performance and assist in locating defects that may not be apparent during regular operation. The *Performance Check Procedure* and the *Adjustment Procedure* are in Section 7.

**Cleaning/ Replacing the Air Filter.** The 1730D has a fan to circulate filtered, cooling air. To ensure that the instrument continues to operate within its stated tolerance the fan filter must be cleaned periodically. The length of time between filter cleanings depends on the amount of dust buildup on the filter. Three replacement filters are included as standard accessories, allowing the choice of cleaning the filter or installing a new filter. See accessory list for filter part number.

To remove the filter, simply pinch the center of the filter and pull out.

### Cleaning

The instrument should be cleaned often enough to prevent dust and dirt from accumulating. Dirt acts as a thermal insulator, preventing effective heat dissipation, and can also provide high-resistance electrical leakage paths between conductors or components in a humid environment.



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**CAUTION.** Do not allow water to get inside any enclosed assembly or component. Do not clean any plastic materials with benzene, toluene, xylene, acetone, or similar compounds, because they may damage the plastic.

---

**Exterior.** Clean the dust from the outside of the instrument with a soft cloth or small brush. A brush is especially useful for removing dust from around the selector buttons, knobs, and connectors. Remove hardened dirt using a cloth dampened with a mild detergent and water solution. Do not use abrasive cleaners.

**CRT.** Clean the face of the CRT with a soft, lint-free cloth dampened in isopropyl alcohol or glass cleaner solution. Do not use abrasive cleaners.

**Interior.** Loosen dust with a soft, dry brush and remove it with low-pressure air (high-velocity air can damage some parts). Hardened dirt or grease can be removed with a cotton-tipped applicator dampened with a mild detergent and water solution. Do not use abrasive cleaners.

If the circuit board assemblies must be removed for cleaning, follow the instructions for removal/ replacement under the heading of Corrective Maintenance.

After cleaning, allow the interior to dry thoroughly before applying power to the instrument.

### **Visual Inspection**

After cleaning, check the instrument carefully for improperly seated transistors or integrated circuits, defective connections, and damaged parts. To prevent additional damage in the case of heat-damaged parts, determine the cause of overheating before replacing the damaged part.

Periodic checks of the transistors and integrated circuits are not recommended. The best measure of performance is the actual operation of the component in the circuit.

## Static-Sensitive Components

This instrument contains electrical components that are susceptible to damage from static discharge. Static voltages from 1 kV to 30 kV are common in unprotected environments. Table 8–1 shows the relative static discharge susceptibility of various semiconductor classes.

**Table 8–1: Static Susceptibility**

Relative Susceptibility Levels		Voltage <sup>1</sup>
1	MOS and CMOS	100 to 500 V
2	ECL	200 to 500 V
3	SCHOTTKY SIGNAL DIODES	250 V
4	SCHOTTKY TTL	500 V
5	HF BIPOLAR TRANSISTORS	400 to 600 V
6	JFETS	600 to 800 V
7	LINEAR CIRCUITS	400 to 1000 V est.
8	LOW POWER SCHOTTKY TTL	900 V
9	TTL	1200 V

<sup>1</sup> Voltage equivalent for levels (voltage discharged from a 100-pF capacitor through a resistance of 100).

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive components or assemblies.
3. Discharge the static voltage from your body by wearing a grounding wrist strap while handling these components. Static-sensitive assemblies or components should be serviced only at a static-free work station by qualified personnel.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Keep component leads shorted together whenever possible.
6. Handle components by the body, never by the leads.
7. Do not slide components over any surface.

8. Avoid handling components in areas that have a floor or work surface covering capable of generating a static charge.
9. Use a soldering iron that is connected to earth ground.
10. Use only wick-type or special antistatic suction desoldering tools.

## Repackaging

### Identification Tag

If the instrument is to be shipped to a Tektronix Service Center, attach a tag to the instrument showing:

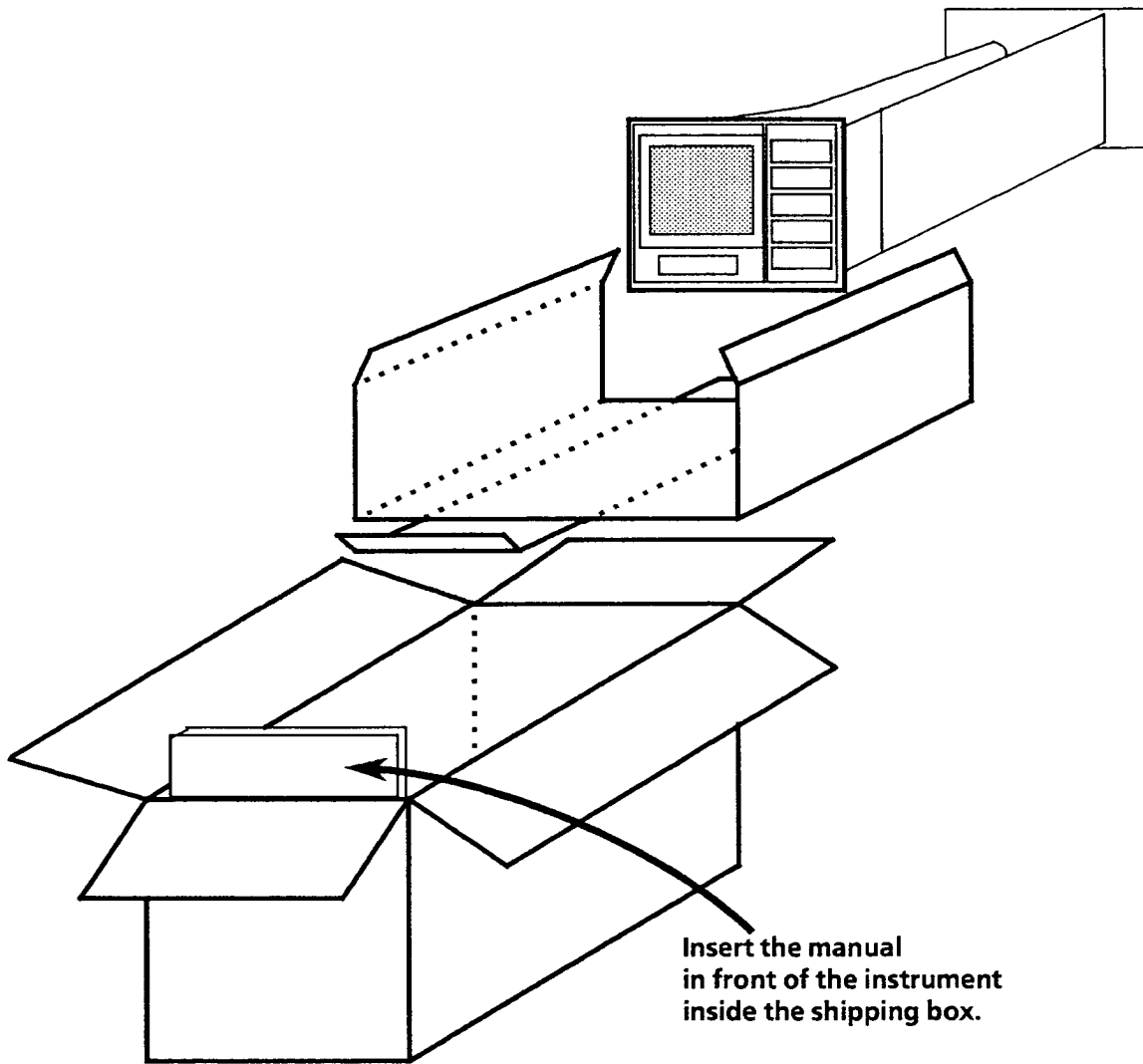
1. Owner (with complete address) and the name of the person at your firm who can be contacted.
2. Instrument serial number and a description of the service required.

### Repackaging for Shipment

Repackage the instrument in the original manner to provide adequate protection (see Figure 8-1). If the original packaging is not available or is unfit for use, repackage the instrument as follows:

1. Obtain a corrugated cardboard carton whose inside dimensions are at least six inches greater than the dimensions of the instrument, for cushioning. The shipping carton should have a test strength of at least 275 pounds.
2. Surround the instrument with polyethylene sheeting to protect the finish.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument.
4. Seal the carton with shipping tape or industrial stapler.





**Insert the manual  
in front of the instrument  
inside the shipping box.**

Figure 8-1: Repackaging



# Installation

## Packaging

The shipping carton and pads provide protection for the instrument during transit. They should be retained in case subsequent shipment becomes necessary. Repackaging instructions can be found in the previous section, *Maintenance*.

## Electrical Installation

<b>Power Source</b>	This instrument is designed to operate from a single-phase power source having one of its current-carrying conductors at or near earth-ground (the neutral conductor). Only the Line conductor is fused for over-current protection. Systems that have both current-carrying conductors live with respect to ground (such as phase-to-phase in multiphase systems) are not recommended as power sources.
<b>Mains Frequency and Voltage Ranges</b>	The 1730D operates over a frequency range of 48 to 66 Hz, at nominal mains voltage of 90 VAC to 250 VAC.
<b>Operating Options</b>	The 1730D provides operating flexibility through internal jumper selections, which are shown in Table 8–2. For example, it is possible to select either the 3-step or 4-step parade to accommodate RGB or YRGB displays. With the exception of the 50–60 Hz jumper (which may not be present in all instruments), the factory preset position is indicated by a box printed on the etched circuit board. If any of these jumpers are placed in the optional position, be sure that all personnel are aware of the changes.
<b>RGB OFFSET and COMPENSATION</b>	RGB OFFSET (A3R170) is provided to compensate for the variation in output DC level of television cameras. R170 may have to be readjusted each time the camera input to the 1730D is changed. A3C56 is the compensation adjustment. See Figure 8–2 for their locations.

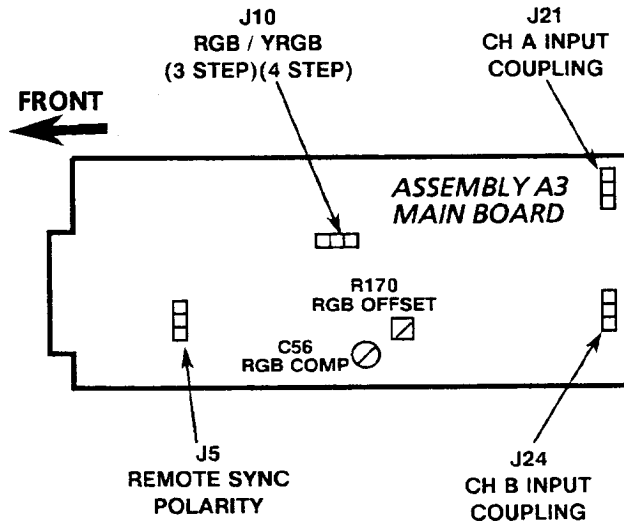


Figure 8-2: Plug jumpers and RGB adjustments

Table 8-2: Internal Jumper Selection

Jumper	Name	Position	Function
A3J21	Analog CH-1 Input Coupling	1-2 2-3	AC coupled (factory set) DC coupled
A3J24	Analog CH-2 Input Coupling	1-2 2-3	AC coupled (factory set) DC coupled
A3J10	RGB/YRGB	2-3 1-2	RGB, 3-step parade display (factory set) YRGB, 4-step parade display
A3J5	Remote Sync Polarity	1-2 2-3	Positive sync polarity (factory set) Negative sync polarity
A3A1 J100	Light Enable	1-2 2-3	Graticule Lights enabled (factory set) Graticule Lights disabled
A4J7	Serial / Parallel	1-2 2-3	Multiplexer is switched by the Serial board. (factory set) Multiplexer is always connected to Parallel input
A4J4	Troubleshooting Aid	1-2 2-3	Normal operation. (factory set) DAC disconnected from low-pass filter for troubleshooting

### Procedure for setting RGB Offset (R170) and RGB Compensation

1. Display any standard television waveform (do not have the rear-panel RGB Enable set low).
2. Set the 1730D HORIZONTAL Position control to align the display with the graticule.
3. Activate the RGB Enable, apply the camera staircase output to the RGB Staircase input, and apply the camera's video output to the 1730D INPUT (CHA or CHB).
4. ADJUST R170 to center the RGB or YRGB signal on the 1730D graticule. See Figure 8–2 for the location of R170.
5. ADJUST C56 for the best display on the 1730D. See Figure 8–2 for the location.

### Serial Digital Inputs

The 1730D Digital Waveform Monitor is equipped with two 75  $\Omega$  passive bridging loop-through inputs. See Figure 8–3.

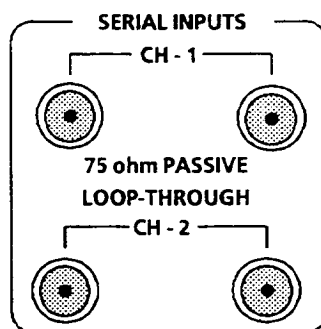


Figure 8–3: 1730D rear-panel serial digital loop-through inputs

If the 1730D is at the end of a signal path, termination will be required. Standard 75  $\Omega$  terminators will usually work; however, the high frequency characteristics may be marginal. In these cases, terminators with better high frequency characteristics will be required to maximize return loss at the higher frequencies. See page 3–3, *Line Termination*.

There are high frequency terminations available from several vendors. It is also possible to construct a high frequency termination by cascading a 50–75  $\Omega$  min-loss attenuator and a high frequency 50  $\Omega$  terminator.

**DIGITAL PARALLEL IN / OUT Connectors**

The Digital Parallel Input is resistor terminated differential ECL, requiring a minimum of 185 mV differential signal. No external termination is required. The Parallel Digital Output is reconstructed differential ECL levels that are latched out with a new clock. The connectors are 25-pin D-type with female contacts. See Figure 8–4 for pin assignments.

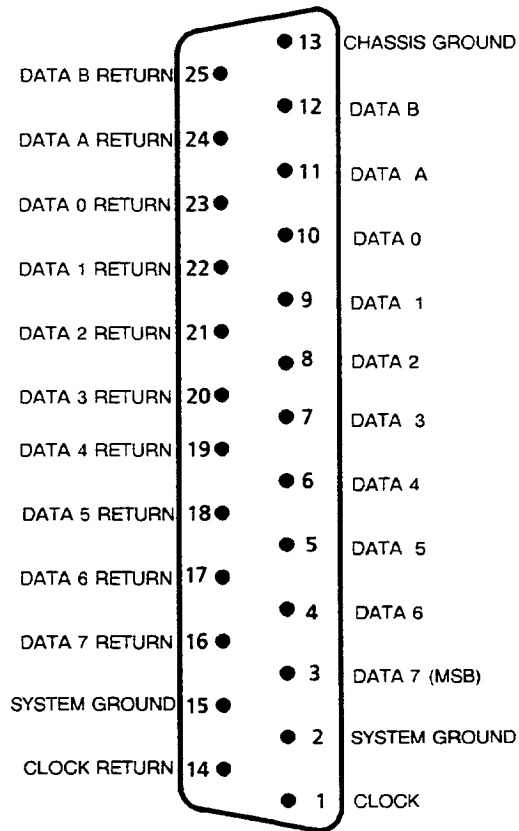


Figure 8–4: Parallel Digital rear-panel connector

**DAC OUT Connector**

The 1730D internal DAC is driven by the digital signal selected by the front-panel INPUT selection. The primary purpose of the DAC is to convert the digital signal to analog to drive the analog waveform monitor circuitry; however its output is also output through the rear-panel 75 Ω BNC connector. The DAC OUT can be used to drive the 75 Ω video input of other equipment.

**REMOTE Connector**

The rear-panel REMOTE connector (Figure 8–5 and Table 8–3) is a 15-pin, D-type connector. It provides the Remote Control Interface, the input connector for RGB signals, and the input for Remote Sync.

Remote functions, which provide switching and storing of front-panel setups at a remote location, are enabled by ground closures (TTL lows). Four Recall setups can be stored and recalled through the front-panel controls or rear-panel Remote. In addition, there are up to four factory-programmed Presets which can only be called up remotely. As factory shipped, pin 8 outputs an Error Flag from the EDH circuitry. If it is not needed, Remote Recall 4 can be enabled. (See *Enabling Recall 4* on page 8–13.)

The RGB input provides a stable, nine-division parade display of RGB or YRGB with an approximate 10 volt input. Remote sync requires an approximate 2 to 5 V input signal of 25–30 Hz or 50–60 Hz to synchronize the 1730D. Polarity is selected by an internal jumper selected (see Table 8–2).

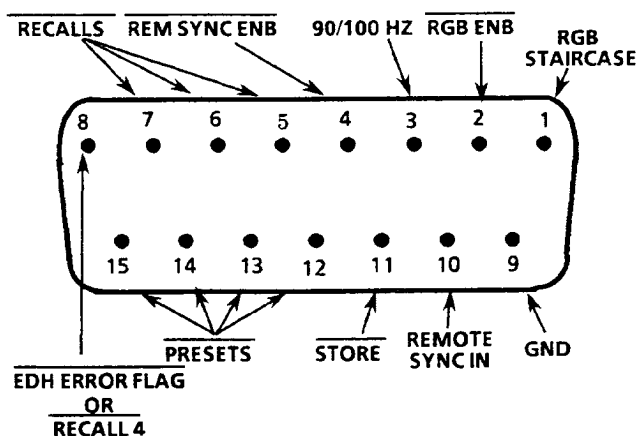


Figure 8–5: View of 1730D rear-panel showing REMOTE connector pins

Table 8–3: REMOTE Connector Pin Assignments and Functions

Pin	Name	Function / Description <sup>1</sup>
1	RGB STAIRCASE	The RGB Staircase input signal (usually a 3- or 4-step negative-going staircase) is added to the internal ramp signal to offset the Horizontal in time with the RGB Parade signal applied to the VIDEO input.
2	/RGB ENABLE	Low = RGB Enable. Level sensitive, allowing instrument to recognize the RGB staircase signal input (pin 1).
3	90 Hz	90 Hz Triggering if front-panel field-rate sweep is selected.
4	/REMOTE SYNC EN /90 HZ TRIG EN	Low = Enable Remote Sync. Allows the instrument to recognize the Remote Sync input signal or 90 Hz Sync input signal on pin 10.

Table 8–3: REMOTE Connector Pin Assignments and Functions (Cont.)

Pin	Name	Function / Description <sup>1</sup>
5	/RECALL 2	When pin 5 is low, and pins 6, 7, and 8 are high, Recall #2 is enabled. If pin 6, 7, or 8 is also low, the first pin to go low is enabled.  Remotely recalls user defined front-panel settings from non-volatile memory location #2.
6	/RECALL 3	When pin 6 is low, and pins 5, 7, and 8 are high, Recall #3 is enabled. If pin 5, 7, or 8 is also low, the first pin to go low is enabled.  Remotely recalls user defined front-panel settings from non-volatile memory location #3.
7	/RECALL 1	When pin 7 is low, and pins 5, 6, and 8 are high, Recall #1 is enabled. If pin 5, 6, or 8 is also low, the first pin to go low is enabled.  Remotely recalls user defined front-panel settings from non-volatile memory location #1.
8	/EDH ERROR FLAG	Factory enabled. Pin 8 is momentarily low when a defined error condition occurs . Defined errors are selected in the EDH Configure Menu. Stays low when Freeze on Error is enabled and a defined error occurs.
8	/RECALL 4	Optional: Requires changing an internal strap.  When pin 8 is low, and pins 5, 6, and 7 are high, Recall #4 is enabled. If pin 5, 6, or 7 is also low, the first pin to go low is enabled.  Remotely recalls user defined front-panel settings from non-volatile memory location #4.
9	GROUND	Instrument ground for remote control.
10	REMOTE SYNC INPUT	Pin 10 the input for Remote Sync. Remote Sync input signal is usually a field-rate square wave. It bypasses the Sync Stripper and directly to the Sweep Gating circuitry.
	90 Hz INPUT	The 90 Hz Sync input signal is a TTL level square wave.
11	/STORE	Low = Store disabled.  When this line is low, the front-panel STORE button is disabled. This is to prevent unauthorized changes to the user-defined recalls.
12	/FRONT PANEL  PRESET 4	When pin 12 is low, and pins 13, 14, and 15 are high, Preset #4 is enabled. If pin 13, 14, or 15 is low, the first pin to go low is enabled.  Selects factory preset front-panel settings from location #4. Settings are defined in Section 2, Preset Front-Panel Measurements.
13	/FRONT PANEL  PRESET 1	When pin 13 is low, and pins 12, 14, and 15 are high, Preset #1 is enabled. If pin 12, 14, or 15 is low, the first pin to go low is enabled.  Selects factory preset front-panel settings from location #1. Settings are defined in Section 2, Preset Front-Panel Measurements.
14	/FRONT PANEL  PRESET 2	When pin 14 is low, and pins 12, 13, and 15 are high, Preset #2 is enabled. If pin 12, 13, or 15 is low, the first pin to go low is enabled.  Selects factory preset front-panel settings from location #2. Settings are defined in Section 2, Preset Front-Panel Measurements.



Table 8-3: REMOTE Connector Pin Assignments and Functions (Cont.)

Pin	Name	Function / Description <sup>1</sup>
15	/FRONT PANEL PRESET 3	When pin 15 is low, and pins 12, 13, and 14 are high, Preset #3 is enabled. If pin 12, 13, or 14 is low, the first pin to go low is enabled.  Selects factory preset front-panel settings from location #3. Settings are defined in Section 2, Preset Front-Panel Measurements.

<sup>1</sup> All 1730D remote functions are level sensitive and are enabled by ground closures (TTL lows).

/ A slanted line before a signal name indicates an active low.

### EDH Error Flag

The EDH Error Flag (pin 8) allows remote reporting of serial errors detected by the 1730D. Pin 8 goes momentarily low when a defined error condition occurs, as selected in the EDH Configure menu. The pulse will occur approximately 25 lines into the video field, and its duration is 8  $\mu$ s. Multiple errors within one field are counted as one. Output is from an LS-TTL Gate capable of sinking 2 mA while assuring a valid TTL low. Pin 8 will be latched low when Freeze on Error is enabled and a defined error condition occurs (see Section 2, EDH Configure).

### Enabling Recall 4

When the 1730D-Series Digital Waveform Monitor is shipped, it is wired to output the EDH Error Flag on pin 8 of the rear-panel REMOTE connector. If the Error Flag is not desired and the front-panel configuration, stored in location #4, is to be remotely selected, the strap on A3W2 (Main circuit board) will need to be removed and a strap installed on A3W3. See Figure 8-6.

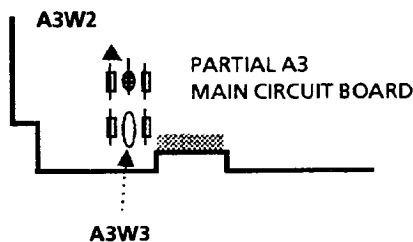


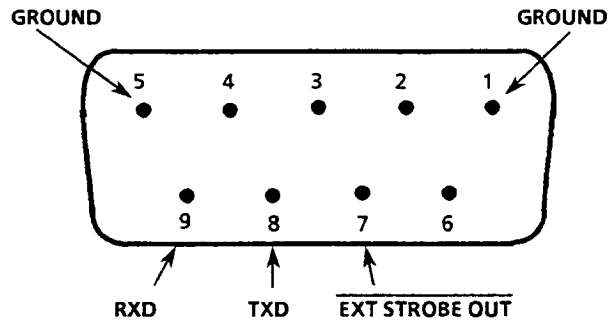
Figure 8-6: Location of W2 and W3 on the Main circuit board

**AUXILIARY Connector**

The rear-panel AUXILIARY connector is a 9-pin, D-type connector. It is used to operate a companion 1720-Series Vectorscope. Line and Field selection information is provided to the Vectorscope over the bus that is contained in this interface. Table 8-4 and Figure 8-7 show the AUXILIARY connector pin assignments.

**Table 8-4: Auxiliary Connector Pin Assignments**

Pin #	Use
2-4-4-6	No Connection
1-5	Ground
7	External Strobe Out for line select blanking output.
8	TXD (Transmit Data) 1730-Series to 1720-Series communication line.
9	RXD (Receive Data) 1720-Series to 1730-Series communication line.



**Figure 8-7: View of the 1730D rear-panel showing AUXILIARY connector pins**

## Mechanical Installation

### Cabinet Options

**NOTE.** Cabinet drawings are provided for installation information only, and are not to scale. All dimensions are in inches.

All qualification testing for the 1730D was performed with a 1700F00 cabinet installed. To guarantee compliance with specifications, the instrument should be operated in a cabinet. The plain cabinet, 1700F00, is shown in Figure 8–8. The portable cabinet, 1700F02, is shown in Figure 8–9. The 1700F02 has a handle, four feet, a flipstand, and has different hole sizes and spacing than the 1700F00.

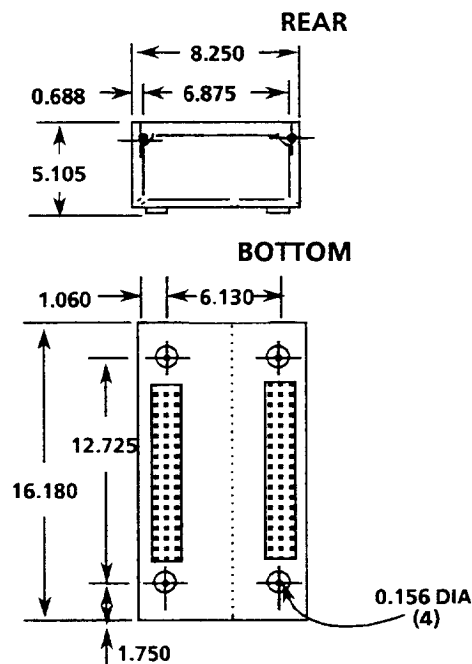


Figure 8–8: 1700F00 plain cabinet

All of the 1700-Series metal cabinets available from Tektronix as Optional Accessories provide the proper electrical environment for the instrument, supply adequate shielding, minimize handling damage, and reduce dust collection within the instrument.

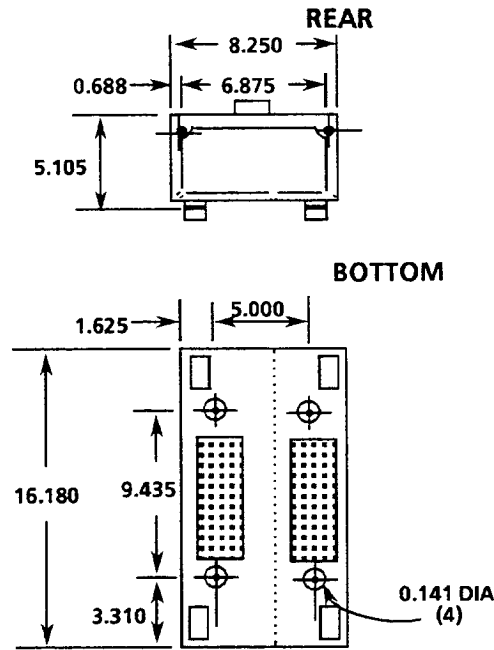


Figure 8-9: 1700F02 portable cabinet

### Installing the Cabinet

Cable dress should be carefully checked prior to attempting to slide the instrument into its cabinet. Cables can be damaged by pinching them between cabinet and chassis.

The instrument is secured to the cabinet by two 6-32 Pozidrive® screws, located in the upper corners of the rear panel. See Figure 8-10.

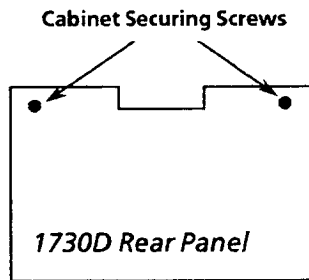


Figure 8-10: Cabinet securing screws



**WARNING.** Do not attempt to carry an instrument in a cabinet without installing the mounting screws. There is nothing to hold the instrument in the cabinet if it is tipped forward.

### Rack Mounting

The optional 1700F05 Side-by-Side Rack Adapter shown in Figure 8–11 includes two attached cabinets, and can be used to mount the 1730D in a standard 19-inch rack with another half-rack-sized instrument.

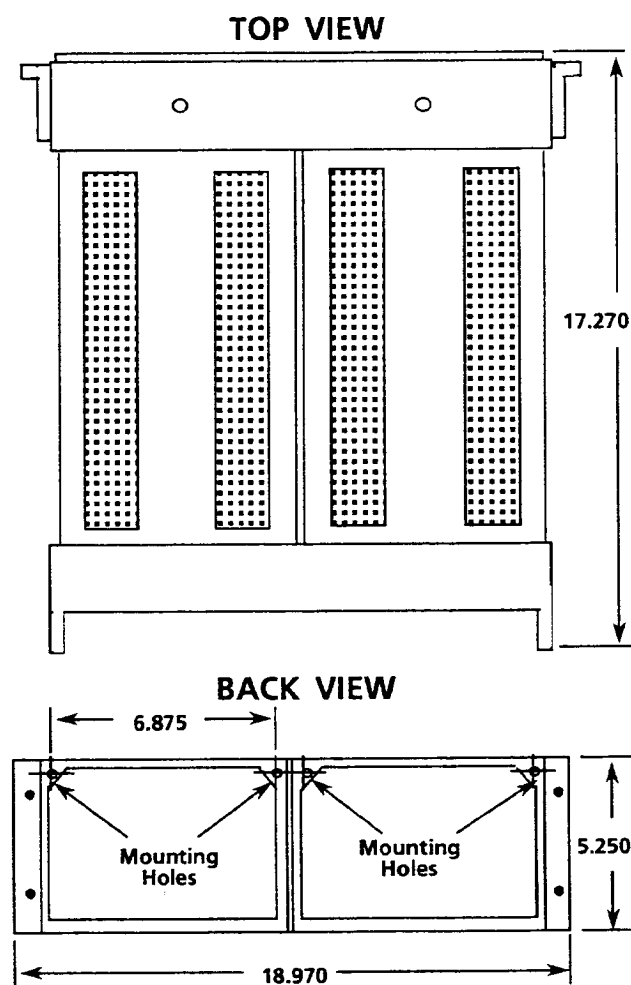


Figure 8–11: 1700F05 Rack Adapter

The rack adapter is adjustable, so the 1730D can be more closely aligned with other equipment in the rack. See Figure 8–12.

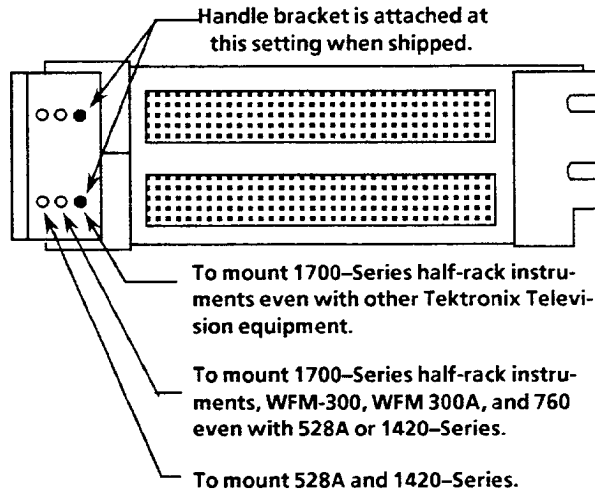


Figure 8–12: 1700F05 Rack Adapter adjustment

**NOTE.** The 1730D is designed to work in a 1700F05 cabinet with no vertical clearance. However, internal operating temperature is reduced by providing a slight amount (1/4 inch) of vertical clearance. This can prolong the life of components such as electrolytic capacitors.

If only one section of the rack adapter is used, a 1700F07 utility drawer or a 1700F06 Blank Panel can be inserted in the unused section. Figure 8–13 shows the blank panel, 1700F06 and Figure 8–14 shows the 1700F07. The rack adapter, utility drawer, and blank panel are available through your local Tektronix field office or representative.

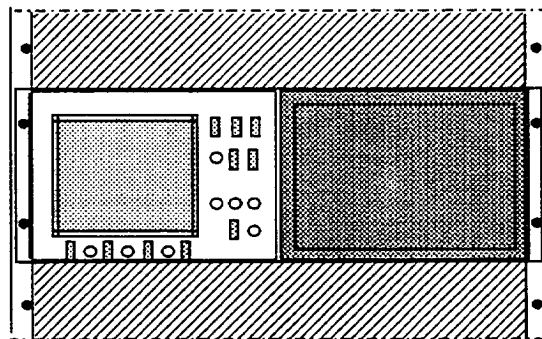


Figure 8–13: 1730D and 1700F06 blank panel

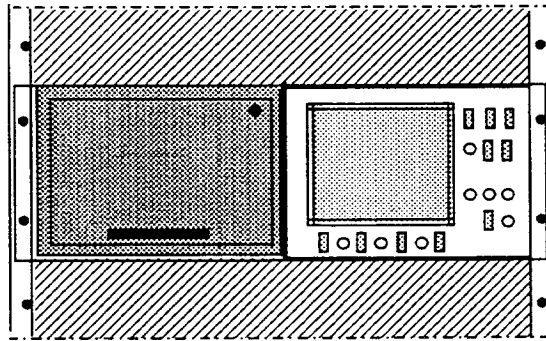


Figure 8-14: 1730D and 1700F07 utility drawer

### Custom Installation

For applications such as consoles, shown in Figure 8-15, the instrument can be mounted with front molding flush or protruding from the console. In both cases, allow approximately 3 inches of rear clearance for BNC and power-cord connections.

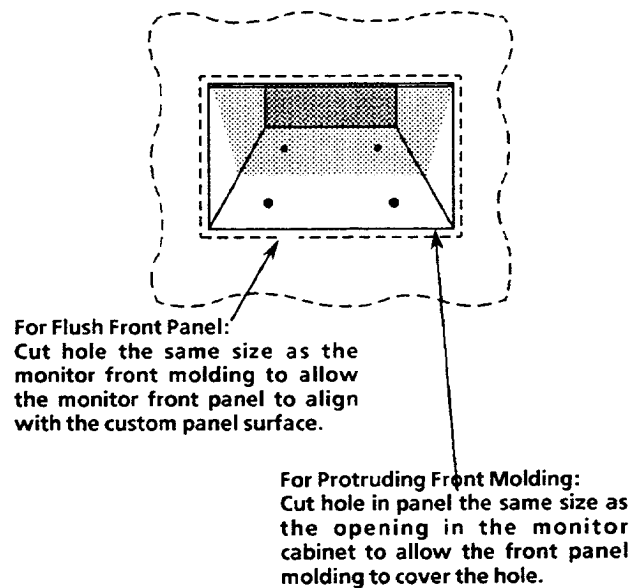


Figure 8-15: Typical custom installation front view of console

To mount the 1730D safely, attach it to a shelf strong enough to hold its weight, using the four 0.156-inch diameter holes in the bottom of the 1700F00 cabinet. See Figure 8-16.

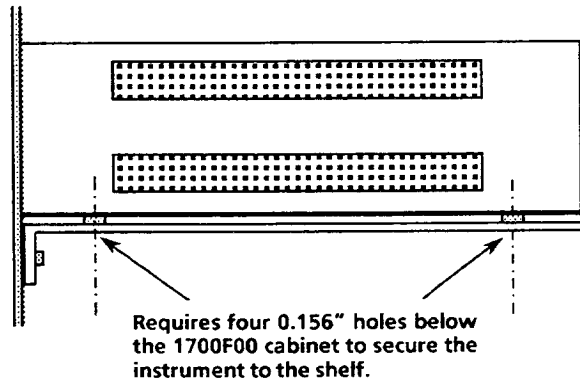


Figure 8-16: Typical custom installation inside view of console



# Removal and Replacement Procedures

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*NOTE. No repair should be attempted during the warranty period.*

---

## Obtaining Replacement Parts

Replacement parts are available through the local Tektronix, Inc., field office or representative. However, many common electronic parts are available through local sources. Using a local source, where possible, will eliminate shipping delays.

Changes to Tektronix instruments are sometimes made to accommodate improved components, as they become available, and to improve circuit performance. Therefore, it is important to include the following information when ordering parts:

1. Part Number
2. Instrument Type or Number
3. Serial Number
4. Modification or Option Number (if applicable)

If an ordered part has been replaced with a new or improved part that is a direct replacement, the new part will be shipped. If the part does not directly replace the old one, the local Tektronix field office or representative will contact the customer. After any repair or modification of the instrument, circuit readjustment may be required.

## Mechanical Disassembly/Assembly

Use these instructions for disassembly and reverse them for reassembly, unless otherwise noted.



---

**WARNING.** *Before attempting any disassembly/ assembly of the instrument, be sure to disconnect the power cord.*

---



---

**CAUTION.** Do not re-insert screws in the rear panel when the instrument is removed from the cabinet.

---

---

**NOTE.** Two types of screws are used in this instrument; TORX that can be removed with a T15 screwdriver tip (Tektronix part number 003-0967-00), and #1 Pozidrive screws which can be removed with a #1 Pozidrive tip (Tektronix part number 003-0443-00).

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### Bezel Removal

1. Remove the two bezel screws. See Figure 8-17.

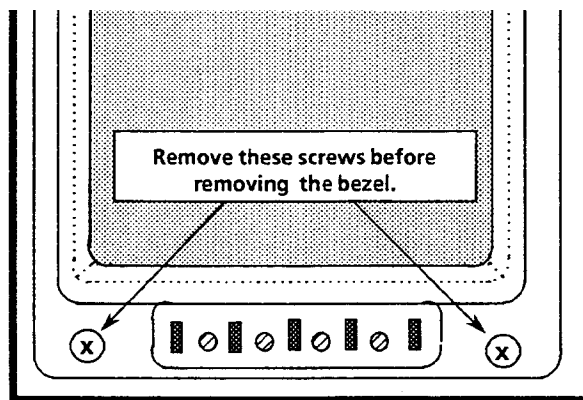


Figure 8-17: Bezel screws

2. Grasping the bottom of the bezel, pull straight out and upward. There are two hinges at the top of the bezel that hold it in place; once the bezel is at an approximate 45° angle with the front panel they will disengage.
3. To replace, reverse the procedure.

### Graticule Light Removal and Replacement

For graticule light removal and replacement, tweezers with curved, serrated tips are recommended. For example: Miltex PL312, 7-100 (equivalent to PL312), or PL317 (longer than PL312).



---

**CAUTION.** Needle-nosed pliers are not recommended.

---

Replacement bulbs are supplied with this instrument as Standard Accessories. Additional bulbs can be purchased from Tektronix (see Replaceable Electrical Parts List) or from local electronics distribution sources.

1. Remove the bezel according to the preceding instructions.
2. To remove a bulb, position the tweezer tips on the thin, flat portion of the bulb (close to the plastic socket). Carefully pull the bulb straight out.
3. To install a bulb, hold it with the tweezers as described in step 2, position it in front of the socket and push the bulb with your finger until it snaps into place.
4. Replace the bezel.

### CRT Removal

1. Remove the bezel.



---

**WARNING.** *The CRT may retain a dangerous charge. Ground the conductor of the anode to discharge the CRT. Do not allow the conductor to touch your body or any circuitry.*

---

2. Disconnect the anode by separating the connector. Do not touch the exposed tip of the connector. Discharge the connector tip to the chassis.
3. Disconnect J3 (trace rotation connector) on the Main board and push the connector through the hole in the board.



---

**WARNING.** *The CRT is a high vacuum device and must be handled with care. Safety glasses, gloves, and protective clothing should always be worn when handling CRTs.*

---

4. Hold one hand in front of the CRT. Grasp the CRT just behind the anode cap and push the CRT straight out (some pressure is needed).

### Replacement of the CRT

1. Reposition the metal CRT shield on the CRT base mounting.
2. Remove the clear plastic cover from the back of the CRT holder. This will make it easier to line up the connections on the CRT holder.
3. Slip the CRT part way back into position, so that the wires (and plug) from the trace rotation coil can be fed back through the hole in the Main board.
4. Slide the CRT back into the rear CRT socket. Align the socket and CRT base. The screws holding the rear mount down may be loosened slightly, if necessary. The CRT should fit securely in place.
5. Press the CRT the rest of the way in by pressing straight back on the corners of the faceplate.

6. Replace the clear rear cover on the CRT holder and screw the holder screws back down (if they were loosened).
7. Wipe off the faceplate of the CRT to remove fingerprints.
8. Reconnect the anode connector and the trace rotation (J3 Main board) plug. (To ensure the correct orientation of J3, the red lead is toward the front of the instrument.)
9. Replace the bezel.

### Removing the Front Panel and the Front-Panel Circuit Board

1. Unplug J1 and J3 on the Main circuit board.
2. Remove the two screws holding the board in place. See Figure 8–18 for location.

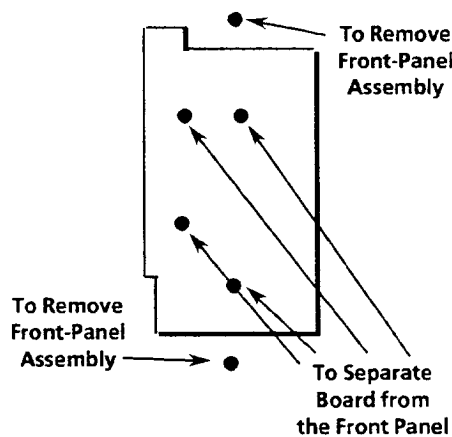


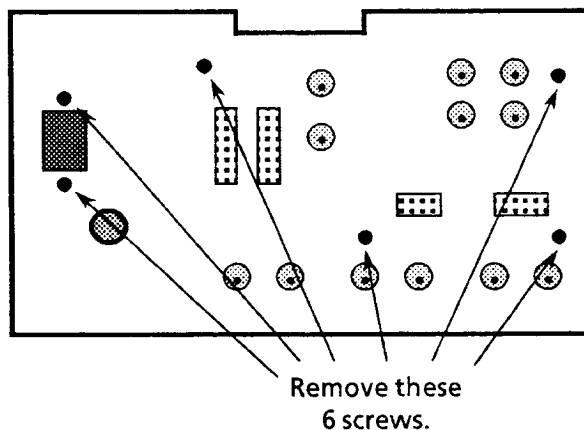
Figure 8–18: Screws that hold the Front Panel board (A2) in place

3. Remove the board by slipping it through the front-panel opening.
4. To access the Front Panel board components:
  - a. Remove the knobs from the front.
  - b. Remove the four screws from the rear.
  - c. The board should now separate from the front panel making the components accessible.
5. To re-assemble, reverse the procedure.

### Removing the Rear Panel

1. Remove the six screws connecting the rear panel to the instrument chassis. If the rear panel will be kept close to the instrument, remove the nuts from the

DIGITAL PARALLEL IN connector. If the rear panel must be totally separated from the instrument, remove the nuts from the DIGITAL PARALLEL IN and OUT, AUX OUT and REMOTE connectors. See Figure 8-19.



**Figure 8-19: Screws and nuts to remove before disconnecting Rear Panel from instrument**

2. Unsolder the eight BNC connectors and one ground connection.
3. Pull the rear panel free from the chassis, being careful not to pull the unsoldered wires.
4. To replace, reverse the procedure.

### Removing the Main Board

1. Remove the key caps on the four RECALL switches and the STORE key cap.
2. Remove the plugs from the following connectors: J1 to the Front Panel board, J4 and J9 to the Serial Interface board, J5 to the Power Supply board, J3 to the DAC board, J17 to the Serial Interface board, J20 to the DAC board, and J3 to the Main board (the trace rotation leads to the CRT).
3. Unsolder the 3 leads to the BNC connectors and the rear panel ground, the two horizontal CRT leads (red J11, and green J12), the lead from the PIX MON OUT (J15), and the two vertical CRT leads (brown J18, and blue J19.)
4. Slip the CRT and trace rotation leads through the appropriate holes in the Main board.
5. Remove the eight screws that are holding the board in place. See Figure 8-20 for their locations.

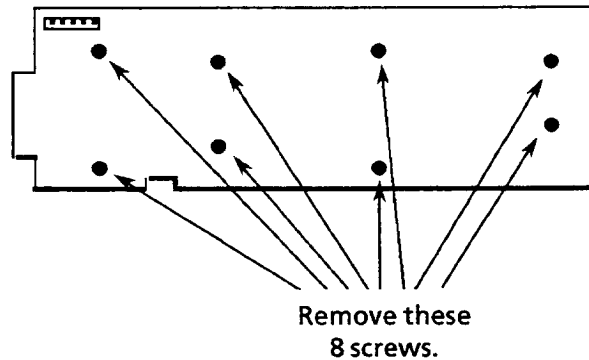


Figure 8-20: Screws holding the Main board (A3) in place

6. Remove the board by sliding it toward the rear panel and to the left until the toe of the board clears the front. Now disconnect J6 and lift out the Main board, pulling the J3 connector through the notch in the chassis.
7. To replace the Main board, lay the board flat and slide in just enough to reconnect J6. Then slide the board back into place.
8. To complete the replacement of the board, reverse the rest of the steps.

### Removing the Power Supply Board

1. Remove the plug from J1, J3, J4, J5 and J501 on the Power Supply board.
2. Disconnect the anode coupling in front of the Power Supply board and discharge the center conductor to ground.



---

**WARNING.** *The CRT may retain a dangerous charge. Ground the conductor of the anode to discharge the CRT. Do not allow the conductor to touch your body or any circuitry.*

---

3. Disconnect the AC line filter by unscrewing its two rear-panel mounting screws.
4. Remove the six screws that are holding the Power Supply board down. See Figure 8-21.
5. Remove the board by sliding it forward and lifting it up.
6. To replace the board, reverse this procedure.

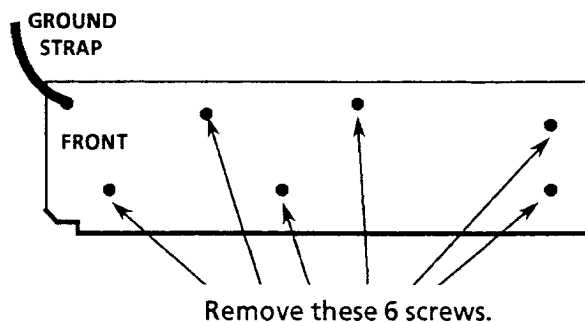


Figure 8-21: Screws holding the Power Supply board (A1) in place

### Removing the DAC Board

1. Remove the four screws holding the DAC board in place. See Figure 8-22.

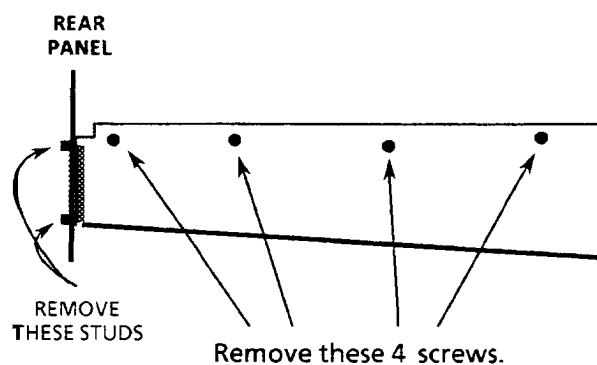
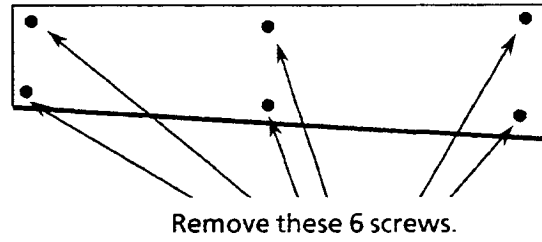


Figure 8-22: Screws securing the DAC board (A4)

2. Unplug J1, J2, J5, and J6 from their plugs on the DAC board.
3. Remove the studs from the rear-panel DIGITAL PARALLEL IN connector.
4. Slide the DAC board toward the front of the instrument until the IN connector clears the rear panel.
5. Unplug J3 at the bottom of the DAC board.
6. Remove the DAC board from the instrument.

### Removing the Serial Interface Board

1. Remove the coaxial cable between J1 and J19.
2. Remove the connectors from J12 and J17.
3. Remove the six screws mounting the circuit board. See Figure 8-23.



**Figure 8-23: Screws securing the Serial Interface board (A5)**

4. Remove the Serial Interface board from the instrument.



# Troubleshooting

Since this manual is a troubleshooting aid, its organization is described here. This material is general, and does not cover specific cases.

## Troubleshooting Aids

**Foldout Pages** The foldout pages at the back of the manual contain block and schematic diagrams, circuit board illustrations, and look-up charts. See Figure 8–24.

**Diagrams.** Schematic diagrams show the circuit number and electrical value of each component. Symbols used on these diagrams are defined on the first page of Section 10. Circuit boards are indicated by a heavy border.

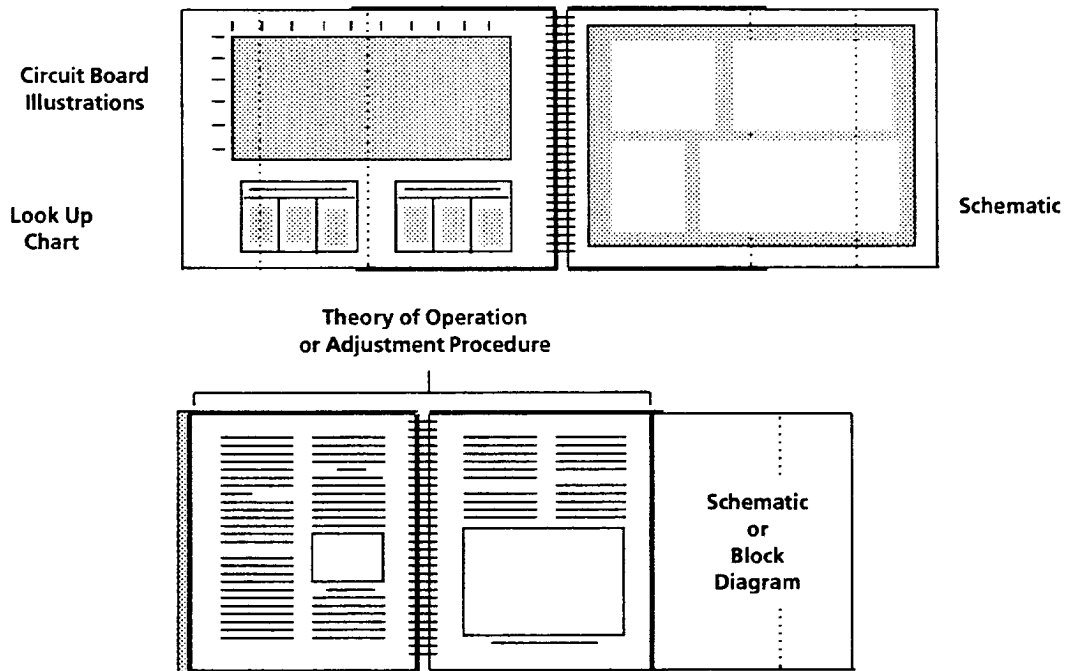


Figure 8–24: Using foldout pages

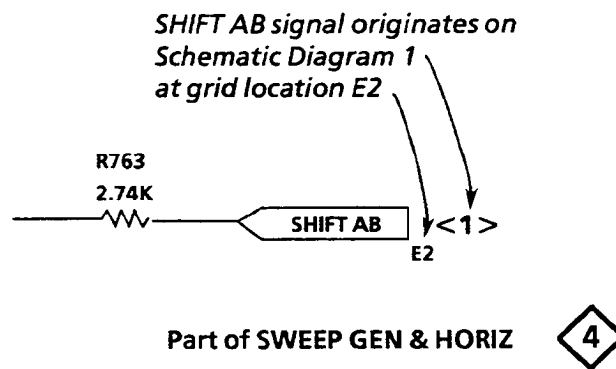
Signals leaving or entering a schematic diagram are cross-referenced with the connecting schematic number in brackets and the schematic grid location in small print. An example is shown in Figure 8–25.

Refer to the Replaceable Electrical Parts List for a complete description of each component.

---

**NOTE.** Check the Change Information section in the rear of the manual for corrections and modifications to the instrument and the manual.

---



**Figure 8–25: Schematic Cross-Referencing**

**Look Up Charts.** Each schematic diagram and circuit board illustration is assigned an alpha-numeric grid and a look-up chart which lists the grid location of components on that schematic or illustration.

**Circuit Board Illustrations.** Electrical components, connectors, and test points are identified on circuit board illustrations, which are located on the back of the schematic diagrams. Circuit boards are grid numbered, with the lowest number in the upper left corner and the highest number in the lower right.

**Assembly and Circuit Numbering.** All circuit board assemblies are assigned assembly or “A” numbers. Figure 8–26 shows the assembly numbers and their locations for this instrument.

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**NOTE.** Always check the parts list for part numbers and descriptions when ordering replacement parts. Some parts may have been replaced or have a different value in an individual instrument.

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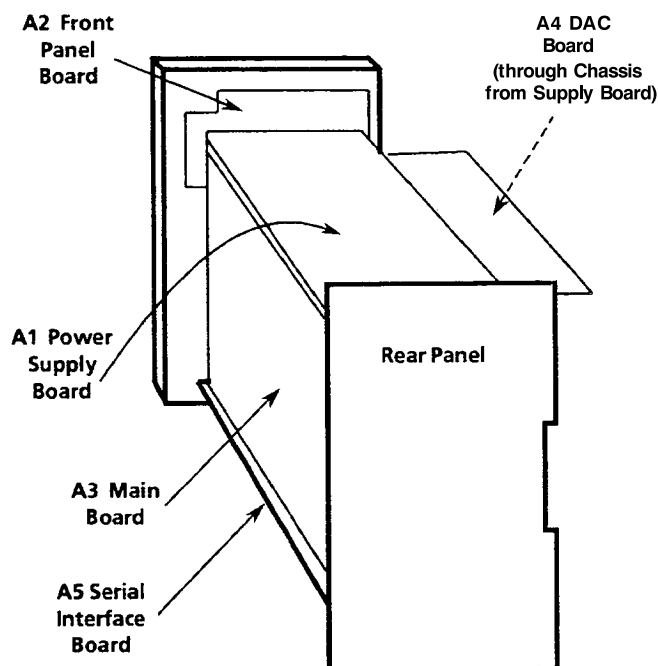


Figure 8–26: Circuit board assembly locations

## Parts Lists

There are two separate parts lists in this manual. The replaceable electrical parts list precedes the schematic diagrams, and the replaceable mechanical parts list follows them.

**Replaceable Electrical Parts.** This list is arranged by assembly (as designated in ANSI standard Y32.16-1975), beginning with the etched circuit board assemblies. These are followed by the individual components, which combine the assembly number with the individual circuit number.

Example: R445 on the power supply board (A1) would be shown in the replaceable electrical parts list as A1R445.

**Replaceable Mechanical Parts List and Exploded View Drawing.** Parts listed in the replaceable mechanical parts list are assigned index numbers which correspond to circled numbers on the exploded view drawing(s).

**Accessories List.** Standard accessories are illustrated in the exploded view drawing. Part numbers of standard and optional accessories are given at the end of the replaceable mechanical parts list.

## Major Assembly Interconnection

Signals and power supply voltages are passed through the instrument using a system of interconnecting cables.

**24 & 32 Pin Connectors.** The male connectors on the cables fit into the connectors that are mounted on the circuit boards. A triangular symbol identifies pin 1 on both connectors, and the remaining pins are numbered. See Figure 8–27.

**Square Pin Connectors.** Pin 1 is marked by a triangular symbol on the circuit board and on the connector.

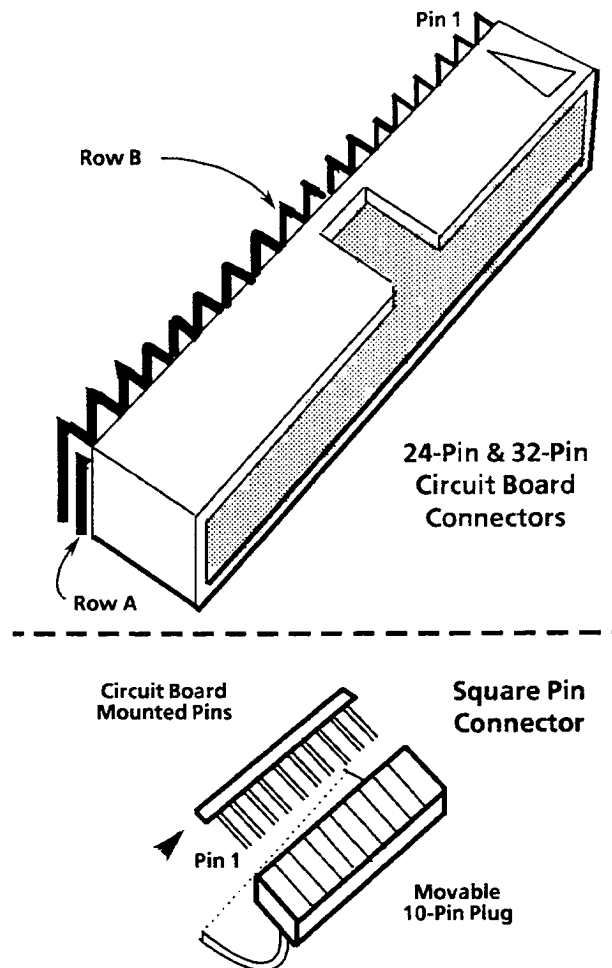


Figure 8–27: Multiple pin connectors

## General Troubleshooting Techniques

1. Be sure the instrument is malfunctioning. See Section 2 to determine whether the instrument is operating properly. Check the operation of front-panel controls, associated equipment, and input signal connections.



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**CAUTION.** Use extreme care when probing with meter leads or probes, because of the high component density and limited access within the instrument. The inadvertent movement of leads or a probe could cause a short circuit or transient voltages capable of destroying components.

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2. Determine the nature of the problem. Determine whether the instrument is out of calibration or there has been a component failure. Once the type of failure has been determined, identify the functional area most likely at fault.
3. Isolate the problem to a circuit or assembly. Use the block diagram as an aid to signal tracing and circuit isolation.



---

**CAUTION.** Always remove the assembly from the instrument before replacing a soldered-in component. See *Corrective Maintenance* for the correct procedure.

---

4. Visually inspect the suspect assembly for obvious defects. Look for chafed insulation, components that are broken, loose, improperly seated, overheated or burned, etc. Repair or replace all obvious defects. In the case of overheated components, determine and correct the cause of overheating before re-applying power.
5. Use successive electrical checks to locate the source of the problem. The primary tool for problem isolation is the oscilloscope. Use the *Performance Check Procedure* in Section 6 to determine if a circuit is operating within specifications. It may be necessary to change a calibration adjustment to determine if a circuit is operational. Use caution, since this can destroy instrument calibration. Note the adjustment position before making changes, so that it can be returned to the same position.
6. Determine the extent of the repair. If the necessary repair is complex, it may be advisable to contact your local Tektronix field office or representative before continuing. If the repair is minor, such as replacing a component, see the parts list for replacement information. Removal and replacement procedures for the assemblies can be found under *Corrective Maintenance*.

## Specific Troubleshooting Techniques

The 1730D Waveform Monitor has two areas where ordinary troubleshooting techniques do not apply; the serial port and front-panel LED circuit, and the Low Voltage Power Supply.

This instrument contains internal diagnostics for the serial port and the front-panel LED indicators. Specific instructions for these diagnostics follow the Power Supply troubleshooting procedure.



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**WARNING.** Do not attempt to troubleshoot the 1730D-Series power supply without reading these instructions.

---

## Power Supply

The most likely components to fail will be those under maximum stress. These include controller IC U4 and switcher transistor Q16. Output filter capacitors C30, C31, C33, C35, and C40 can fail after prolonged high temperature service.

If the power supply fuse blows when line power is applied, Q16 or U4 may be defective. Remove jumper plug P9 to remove power to the switcher. If the fuse still blows, the problem is in the input rectifier/filter circuit. Check this circuit for shorted diodes.

The input rectifier diodes (CR29, CR30, CR31, and CR32) must be replaced with the same type of fast recovery diodes to maintain low conducted EMI.

If the fuse blows with jumper plug P9 in place, but does not blow with jumper plug P9 removed, switcher Q16 or U4 may be shorted. To check Q16 for shorts remove the line power to the power supply. Connect the negative lead of an ohmmeter to TP3 (line side common) and the positive lead to the drain (tab) of Q16. A transistor short will be indicated by a reading of less than 100K ohms.

If Q16 is shorted, replace it and check R96 and R97 for damage.

If the power supply operates but has an output oscillation or poor regulation, the output filter capacitors may have dried out. A dried out filter capacitor will often appear discolored. If any of the output filter capacitors have failed they should all be replaced. Replace C30, C31, C32, C33, C34, C35, C36, C38, and C40. The primary side housekeeping filter capacitors, C42 and C52, should also be replaced. These capacitors are high temperature and high ripple current types and must be replaced with the same type.

If the quick troubleshooting procedure failed to find the cause, the detailed procedure will have to be used.

## Detailed Troubleshooting Procedure

**Primary Circuitry** This procedure is used to check the primary circuitry.

Disconnect the AC line power to the power supply. A variable (4 to 18 volt), 100 mA, DC power supply will be used to power the primary side circuitry. Connect the variable DC power supply negative output to TP3 (line side common). Connect the positive output to the cathode of CR20, the housekeeping rectifier diode. Adjust the variable DC power supply for 18 volts.

**Controller IC Check.** Connect the oscilloscope probe ground to TP3. Use the oscilloscope probe to observe these signals present at U4:

- Pin 1 – Approximately 5 volts.
- Pin 2 – Approximately 1.5 volts.
- Pin 3 – Approximately 5 volts.
- Pin 4 – An 80 kHz sawtooth.
- Pin 6 – 0 volts.
- Pin 7– 18 volts.
- Pin 8 – 5 volts.

Now disable the shutdown logic by shorting the base to emitter of Q19. U4, pin 6 will now output an 80 kHz square wave with a 90% duty cycle.

**Transformer Driver.** Place a jumper on J7. The collector of Q18 should be switching between 0 and 18 volts. Remove the jumper on J7. The anode of CR23 will be switching between approximately –1 and +1 volt.

**Peak Detector.** Place a jumper on J7. The base of Q14 should be at 0 volts. Remove the jumper on J7. The base of Q14 should be at 1 volt.

**Power Switch Receiver.** Place a jumper on J7. The collector of Q15 will be near 2 volts. Remove the jumper on J7. The collector of Q15 will be 4.3 volts.

**Shutdown Logic.** The shutdown logic circuit consists of comparators U5B, U5C, and U5D. U5B shuts down the controller when the housekeeping voltage falls below 13 volts. U5C shuts down the controller when the rectified line voltage falls below 93 volts. U5D shuts down the controller when the controller IC summing junction (pin 2) is less than 2.2 volts.

To test the shutdown logic, U5C and U5D must be biased so their outputs go high. Place a jumper wire across CR27 and one across R115. U5, pin 1 will be 4.3 volts (high). Lower the DC power supply voltage to 11 volts. U5, pin 1 will now be low. Raise the DC power supply voltage to 18 volts and U5, pin 1 will

go high. Remove the jumper wire across CR27 and U5, pin 1 will go low. Replace the jumper wire across CR27 and U5, pin 1 will go high. Remove the jumper wire across R115 and U5, pin 1 will go low. Remove the jumper wire across CR27 to return the shutdown logic circuit to normal.

**Snubber.** A preliminary check of this circuit can be done by checking CR21 and CR24 for shorts, using an ohmmeter.

### Secondary Circuitry

Disconnect the AC line power to the instrument. Disconnect any load from output connector J5. A variable (4 to 6 volts), 100 mA, DC power supply will be used to power the secondary circuitry. Connect the variable DC power supply negative output to TP1 (GND). Connect the positive output to J5, pin 8. A voltmeter or an oscilloscope can be used for voltage measurements. Connect the voltmeter or oscilloscope ground lead to TP1.

**Voltage Reference.** Adjust the variable DC power supply for 5.0 volts. U3, pin 1 will output 2.5 volts.

**Error Amplifier.** Adjust the variable DC power supply for 4.7 volts. U3, pin 6 will output 0 volts. Adjust the variable DC power supply for 5.3 volts. U3, pin 6 will output approximately 5 volts.

**Crowbar.** Raise the power supply towards 6 volts. SCR Q11 should conduct before 6 volts.

**Output Filters.** The output rectifier diodes (CR16, CR17, CR18, and CR19) can be checked for shorts using an ohmmeter.

## Auxiliary Port and LED Driver Diagnostics

A non-destructive diagnostic program is built into the 1730D-Series. All that is required to perform these diagnostics is a male, 9-pin, sub-miniature D-type connector with pins 8 and 9 connected together. The procedure contained here will isolate non-operating front-panel indicators and open or shorted receive and transmit lines in the serial interface.

1. Turn off instrument POWER.
2. Install the male, sub-miniature D-type connector on the rear-panel AUXILIARY connector.
3. Hold in the LINE SELECT and POWER switches until all front-panel indicators light. This step checks:



- a. LEDs and LED Drivers
- b. Interface continuity (RXD in and TXD out)

When all front-panel indicators light, there is continuity from the Microprocessor, out through the TXD Buffer, and back in through the RXD Buffer. If all front-panel indicators do not light, check indicator or Driver. If indicators blink, check RXD Buffer (U809B) or TXD Buffer (U809C).

- 4. Remove the male connector from the rear-panel AUXILIARY connector and check for blinking indicators. This step checks for shorted RXD and TXD lines.

If lights remain on, the RXD and TXD lines are shorted together.

- 5. Turn off POWER. This ends the Diagnostic Procedure. When the 1730D is powered up again it will be operating in the normal waveform monitor configuration.





# **Replaceable Electrical Parts**



# Replaceable Electrical Parts

This section contains a list of the components that are replaceable for the 1730D. Use this list to identify and order replacement parts. There is a separate Replaceable Electrical Parts list for each instrument.

## 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. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument 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.

## Using the Replaceable Electrical Parts List

The tabular information in the Replaceable Electrical Parts list is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replaceable parts.

### **Cross Index–Mfr. Code Number to Manufacturer**

The Mfg. Code Number to Manufacturer Cross Index for the electrical parts list is located immediately after this page. The cross index provides codes, names, and addresses of manufacturers of components listed in the electrical parts list.

### **Abbreviations**

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1.

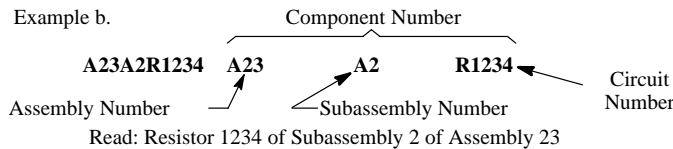
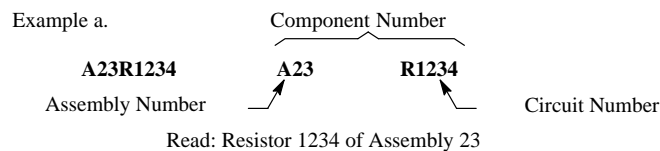
### List of Assemblies

A list of assemblies can be found at the beginning of the electrical parts list. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

## Column Descriptions

### Component No. (Column 1)

The component circuit number appears on the diagrams and circuit board illustrations, located in the diagrams section. Assembly numbers are also marked on each diagram and circuit board illustration, in the Diagram section and on the mechanical exploded views, in the mechanical parts list. The component number is obtained by adding the assembly number prefix to the circuit number.



The electrical parts list is arranged by assemblies in numerical sequence (A1, with its subassemblies and parts, precedes A2, with its subassemblies and parts).

Mechanical subparts to the circuit boards are listed in the electrical parts list. These mechanical subparts are listed with their associated electrical part (for example, fuse holder follows fuse).

Chassis-mounted parts and cable assemblies have no assembly number prefix and are located at the end of the electrical parts list.

### Tektronix Part No. (Column 2)

Indicates part number to be used when ordering replacement part from Tektronix.

### Serial/Assembly No. (Column 3 and 4)

Column three (3) indicates the serial or assembly number at which the part was first used. Column four (4) indicates the serial or assembly number at which the part was removed. No serial or assembly number entered indicates part is good for all serial numbers.

### Name and Description (Column 5)

An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

The mechanical subparts are shown as \*ATTACHED PARTS\* / \*END ATTACHED PARTS\* or \*MOUNTING PARTS\* / \*END MOUNTING PARTS\* in column five (5).

**Mfr. Code (Column 6)** Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

**Mfr. Part No. (Column 7)** Indicates actual manufacturer's part number.

### CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code.	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
01121	ALLEN-BRADLEY CO INDUSTRIAL CONTROL PRODUCTS	1201 S 2ND ST	MILWAUKEE WI 53204-2410
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
02735	RCA CORP SOLID STATE DIVISION		
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
05820	EG AND G WAKEFIELD ENGINEERING	60 AUDUBON RD	WAKEFIELD MA 01880-1203
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
07088	KELVIN ELECTRIC CO	5907 NOBLE AVE	VAN NUYS CA 91411
07263	FAIRCHILD SEMICONDUCTOR CORP		
09023	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO	2652 DALRYMPLE ST	SANFORD NC 27330
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
09969	DALE ELECTRONICS INC	EAST HIGHWAY 50 P O BOX 180	YANKTON SD 57078
11236	CTS CORP BERNE DIV THICK FILM PRODUCTS GROUP	406 PARR ROAD	BERNE IN 46711-9506
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
12969	MICROSEMI CORPORATION WATERTOWN DIVISION	530 PLEASANT STREET	WATERTOWN MA 02172
14193	CAL-R INC	1601 OLYMPIC BLVD PO BOX 1397	SANTA MONICA CA 90406
14301	ANDERSON ELECTRONICS INC	PO BOX 89	HOLLIDAYSBURG PA 16648-0089
14433	ITT SEMICONDUCTORS DIV		WEST PALM BEACH FL
14552	MICROSEMI CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704-5948
15912	THOMAS AND BETTS CORP ELECTRONICS GROUP	76 FAIRBANKS	IRVINE CA 92718
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054-1516
18796	MURATA ERIE NORTH AMERICAN INC STATE COLLEGE OPERATIONS	1900 W COLLEGE AVE	STATE COLLEGE PA 16801-2723
19701	PHILIPS COMPONENTS DISCRETE PRODUCTS DIV RESISTIVE PRODUCTS FACILITY AIRPORT ROAD	PO BOX 760	MINERAL WELLS TX 76067-0760
22229	SOLITRON DEVICES INC SEMICONDUCTOR GROUP SAN DIEGO OPERS	8808 BALBOA AVE	SAN DIEGO CA 92123
22526	BERG ELECTRONICS INC (DUPONT)	857 OLD TRAIL RD	ETTERS PA 17319
24165	SPRAGUE ELECTRIC CO	267 LOWELL ROAD	HUDSON NH 03051



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Mfr. Code.	Manufacturer	Address	City, State, Zip Code
24226	GOWANDA ELECTRONICS CORP	NO 1 INDUSTRIAL PL	GOWANDA NY 14070-1409
26364	COMPONENTS CORP	6 KINSEY PLACE	DENVILLE NJ 07834-2611
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
2M627	ROHM CORPORATION	PO BOX 19515	IRVINE CA 92713
34333	SILICON GENERAL INC	11651 MONARCH ST	GARDEN GROVE CA 92641-1816
34361	OMRON ELECTRONICS INC.		SUNNYVALE CA
37942	NORTH AMERICAN CAPACITOR CO MALLORY DIVISION	INDIANAPOLIS ROAD, HWY 240 PO BOX 240	GREEN CASTLE IN 46135 1
50434	HEWLETT-PACKARD CO OPTOELECTRONICS DIV	370 W TRIMBLE RD	SAN JOSE CA 95131-1008
51406	MURATA ERIE NORTH AMERICA INC HEADQUARTERS AND GEORGIA OPERATIONS	2200 LAKE PARK DR	SMYRNA GA 30080
52769	SPRAGUE-GOODMAN ELECTRONICS INC	134 FULTON AVE	GARDEN CITY PARK NY 11040-5352
53387	MINNESOTA MINING MFG CO	PO BOX 2963	AUSTIN TX 78769-2963
54583	TDK ELECTRONICS CORP	12 HARBOR PARK DR	PORT WASHINGTON NY 11550
54937	DEYOUNG MANUFACTURING INC	12920 NE 125TH WAY	KIRKLAND WA 98034-7716
55112	WESTLAKE CAPACITORS INC	5334 STERLING CENTER DRIVE	WESTLAKE VILLAGE CA 91361
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195-4526
56845	DALE ELECTRONICS INC	2300 RIVERSIDE BLVD PO BOX 74	NORFOLK NE 68701-2242
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
58050	TEKA PRODUCTS INC	45 SALEM ST	PROVIDENCE RI 02907
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
60395	XICOR INC	851 BUCKEYE CT	MILPITAS CA 95035-7408
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
74276	GENERAL INSTRUMENT CORP		
75498	MULTICOMP INC	3005 SW 154TH TERRACE #3	BEAVERTON OR 97006
75915	LITTELFUSE INC SUB TRACOR INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
76493	BELL INDUSTRIES INC JW MILLER DIV	19070 REYES AVE PO BOX 5825	COMPTON CA 90224-5825
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
84411	AMERICAN SHIZUKI CORP OGALLALA OPERATIONS	301 WEST O ST	OGALLALA NE 69153-1844
91275	SIMPLEX PISTON RING MFG CO		CLEVELAND OH
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
S4307	SCHAFFNER ELECTRONIK AG		LUTERBACH SWITZERLAND

### CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code.	Manufacturer	Address	City, State, Zip Code
TK1345	ZMAN & ASSOCIATES		
TK1424	MARCON AMERICA CORP		
TK1450	TOKYO COSMOS ELECTRIC CO LTD	2-268 SOBUDAI ZAWA	KANAGAWA 228 JAPAN
TK1462	YAMAICHI ELECTRONICS CO LTD 2ND FLOOR NEW KYOEI BLDG 17-11	3-CHROME SHIBAURA MINATO-KU	TOKYO JAPAN
TK1468	LINEAR TECHNOLOGY CORP	1630 MCCARTHY BLVD	MILPITAS CA 95037
TK1573	WILHELM WESTERMAN	PO BOX 2345 AUGUSTA-ANLAGE 56	6800 MANNHEIM 1 WEST GERMANY
TK1913	WIMA THE INTER-TECHNICAL GROUP IND	2269 SAW MILL RIVER ROAD PO BOX 127	ELMSFORD NY 10523
TK2278	COMTEK MANUFACTURING OF OREGON (METALS)		

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1	671-2271-06		B052098	CIRCUIT BD ASSY:POWER SUPPLY	80009	671-2271-06
A1	671-2271-07	B052099		CIRCUIT BD ASSY:POWER SUPPLY	80009	671-2271-07
A2	671-2272-02			CIRCUIT BD ASSY:FRONT PANEL	80009	671-2272-02
A3	672-0306-10		B051734	CIRCUIT BD ASSY:MAIN	80009	672-0306-10
A3	672-0306-11	B051735	B051811	CIRCUIT BD ASSY:MAIN	80009	672-0306-11
A3	672-0306-12	B051812	B051895	CIRCUIT BD ASSY:MAIN	80009	672-0306-12
A3	672-0306-13	B051896	B051905	CIRCUIT BD ASSY:MAIN	80009	672-0306-13
A3	672-0306-14	B051906		CIRCUIT BD ASSY:MAIN	80009	672-0306-14
A3A1	671-1796-01			CIRCUIT BD ASSY:GRATICULE LIGHT	80009	671-1796-01
A3A2	671-3899-00	B051735		CIRCUIT BD ASSY:CALIBRATOR	80009	671-3899-00
A4	671-2273-02			CIRCUIT BD ASSY:DAC	80009	671-2273-02
A5	671-2275-05		B051811	CIRCUIT BD ASSY:SERIAL	80009	671-2275-05
A5	671-2275-06	B051812		CIRCUIT BD ASSY:SERIAL	80009	671-2275-06

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1	671-2271-06		B052098	CIRCUIT BD ASSY:POWER SUPPLY	80009	671-2271-06
A1	671-2271-07	B052299		CIRCUIT BD ASSY:POWER SUPPLY	80009	671-2271-07
	334-8466-00			*ATTACHED PARTS*		
	337-3801-00			MKR,IDENT:MKD 1730D/1740A/1750A/1760 SER SHIELD,ELEC:PWR SPLY	80009	334-8466-00
				*END ATTACHED PARTS*		337-3801-00
A1C1	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	18796	DE1310Y5P102M6KV
A1C2	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A1C3	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	18796	DE1310Y5P102M6KV
A1C4	283-0639-01			CAP,FXD,MICA DI:56PF,1%,500V,T&A	09023	CDA15ED560F03
A1C5	283-0339-00			CAP,FXD,CER DI:0.22UF,10%,50V	04222	SR305C224KAA
A1C6	283-0261-00			CAP,FXD,CER DI:0.01UF,20%,4000V	51406	DHR28Z5U103M4KV
A1C7	283-0261-00			CAP,FXD,CER DI:0.01UF,20%,4000V	51406	DHR28Z5U103M4KV
A1C8	283-0261-00			CAP,FXD,CER DI:0.01UF,20%,4000V	51406	DHR28Z5U103M4KV
A1C9	285-1341-01			CAP,FXD,MTLZD:0.1UF,20%,100VDC	84411	X674L .1 20 100
A1C10	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A1C11	283-0021-00			CAP,FXD,CER DI:0.001UF,20%,5000V	18796	DE1310Y5P102M6KV
A1C12	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	80009	283-0000-00
A1C13	283-0189-00			CAP,FXD,CER DI:0.1UF,20%,400V	04222	SR508C104MAA
A1C14	285-1341-01			CAP,FXD,MTLZD:0.1UF,20%,100VDC	84411	X674L .1 20 100
A1C15	290-1277-00			CAP,FXD,AL:10UF,20%,50V,5 X 11:RDL,105 DEG	80009	290-1277-00
A1C16	283-0084-00			CAP,FXD,CER DI:270PF,5%,1000V	80009	283-0084-00
A1C17	285-1341-01			CAP,FXD,MTLZD:0.1UF,20%,100VDC	84411	X674L .1 20 100
A1C18	283-0189-00			CAP,FXD,CER DI:0.1UF,20%,400V	04222	SR508C104MAA
A1C19	285-1341-01			CAP,FXD,MTLZD:0.1UF,20%,100VDC	84411	X674L .1 20 100
A1C20	290-0939-00			CAP,FXD,ELCTL:10UF,+100-10%,100V	80009	290-0939-00
A1C21	283-0189-00			CAP,FXD,CER DI:0.1UF,20%,400V	04222	SR508C104MAA
A1C22	290-1277-00			CAP,FXD,AL:10UF,20%,50V,5 X 11:RDL,105 DEG,BULK	80009	290-1277-00
A1C23	285-1189-00			CAP,FXD,MTLZD:0.1 UF,5%,100 V	55112	160/.1/J/100/C
A1C24	285-1328-00			CAP,FXD,PLSTC:MTLZD FILM;0.01UF,5%, 2000V,POLYPROPYLENE,1.25X.95;RDL,T/A	TK1573	FKP1 .01/2000/5
A1C25	290-1310-00			CAP,FXD,ALUM:10UF,20%,160V,13 X 20MM;RDL,0.2LS,105 DEG,5000 HR	80009	290-1310-00
A1C26	290-1277-00		B052098	CAP,FXD,AL:10UF,20%,50V,5 X 11:RDL,105 DEG,BULK	80009	290-1277-00
A1C26	290-0920-00	B052099		CAP,FXD,ALUM:33UF,20%,50V,6 X 11MM,0.1SP,RADIAL,BULK	62643	SME50VB33RM6X11LL
A1C27	283-0339-00			CAP,FXD,CER DI:0.22UF,10%,50V	04222	SR305C224KAA
A1C28	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A1C29	290-1310-00			CAP,FXD,ALUM:10UF,20%,160V,13 X 20MM;RDL,0.2LS,105 DEG,5000 HR	80009	290-1310-00
A1C30	290-1267-00			CAP,FXD,AL:560UF,20%,50V,12.5 X 31.5,LOW IMP;RDL,BULK	80009	290-1267-00
A1C31	290-1302-00			CAP,FXD,ELCTL:1000UF,20%,35V,LOW IMP	80009	290-1302-00
A1C32	290-0939-00			CAP,FXD,ELCTL:10UF,+100-10%,100V	80009	290-0939-00
A1C33	290-0939-00			CAP,FXD,ELCTL:10UF,+100-10%,100V	80009	290-0939-00
A1C34	290-1314-00			CAP,FXD,ALUM:330UF,20%,63V,13 X 25MM;RDL	TK1424	UPL1J331MHH
A1C35	290-1302-00			CAP,FXD,ELCTL:1000UF,20%,35V,LOW IMP	80009	290-1302-00
A1C36	290-1309-00			CAP,FXD,AL:100UF,20%,63V,10 X 20MM,RDL,105 DEG,LOW Z,T&A	80009	290-1309-00
A1C37	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1C38	290-1309-00			CAP,FXD,AL:100UF,20%,63V,10 X 20MM,RDL,105 DEG,LOW Z,T&A	80009	290-1309-00
A1C39	290-1277-00			CAP,FXD,AL:10UF,20%,50V,5 X 11;RDL,105 DEG,BULK	80009	290-1277-00
A1C40	290-1267-00			CAP,FXD,AL:560UF,20%,50V,12.5 X 31.5,LOW IMP;RDL,BULK	80009	290-1267-00
A1C41	281-0772-00			CAP,FXD,CER:MLC:4700PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA101C472KAA
A1C42	290-1314-00			CAP,FXD,ALUM:330UF,20%,63V,13 X 25MM;RDL	TK1424	UPL1J331MHH
A1C43	285-1331-00			CAP,FXD,MTLZD:0.47UF,5%,400V	TK1573	MKS4 .47/400/5
A1C44	285-1331-00			CAP,FXD,MTLZD:0.47UF,5%,400V	TK1573	MKS4 .47/400/5
A1C45	285-1420-00			CAP,FXD,PLSTC:FILM&FOIL;4700PF,63V,5%,POLY-PROPYLENE,6X7.2MM,RDL, 5 MM LS	TK1913	FKP2 4700/63/5
A1C46	281-0773-00			CAP,FXD,CER:MLC:0.01UF,10%,100V,SAF,0.100 X 0.170;AXIAL,MI	80009	281-0773-00
A1C47	285-1251-00			CAP,FXD,PLSTC:0.033UF,10%,400VAC	80009	285-1251-00
A1C48	281-0786-00			CAP,FXD,CER:MLC:150PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA101A151KAA
A1C49	285-1470-00			CAP,FXD,PLSTC:	80009	285-1470-00
A1C50	285-1246-00			CAP,FXD,PPR DI:0.022UF,20%,250VAC	80009	285-1246-00
A1C51	281-0823-00			CAP,FXD,CER DI:470PF,10%,50V	04222	SA101A471KAA
A1C52	290-1309-00			CAP,FXD,AL:100UF,20%,63V,10 X 20MM,RDL,105 DEG,LOW Z,T&A	80009	290-1309-00
A1C53	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A1C54	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A1C55	281-0773-00			CAP,FXD,CER:MLC:0.01UF,10%,100V,SAF,0.100 X 0.170;AXIAL,MI	80009	281-0773-00
A1C56	281-0925-01			CAP,FXD,CER:MLC:0.22UF,20%,50V,Z5U,0.170 X 0.120;AXIAL,MI	04222	SA115E224MAA
A1C57	281-0759-00			CAP,FXD,CER:MLC:22PF,10%,100V,0.100 X 0.170;AXIAL,MI	80009	281-0759-00
A1C58	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A1C59	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A1C60	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A1C61	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A1C62	290-1275-00			CAP,FXD,AL:330UF,20%,400V,35 X 35;105 DEG,SNAP IN,BULK	80009	290-1275-00
A1C63	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A1C64	285-1246-00			CAP,FXD,PPR DI:0.022UF,20%,250VAC	80009	285-1246-00
A1C65	285-1222-00			CAP,FXD,PLSTC:0.068UF,20%,250V	37942	158/068/M/250/H
A1C66	290-0973-03			CAP,FXD,ELCTLT:100UF,20%,25VDC	55680	UVX1V101MPA1TD
A1CR1	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR2	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR3	152-0061-00			DIO,SIG:200V,0.1A,700NS,4.0PF;FDH2161,T&R	07263	FDH2161
A1CR4	152-0061-00			DIO,SIG:200V,0.1A,700NS,4.0PF;FDH2161,T&R	07263	FDH2161
A1CR5	152-0061-00			DIO,SIG:200V,0.1A,700NS,4.0PF;FDH2161,T&R	07263	FDH2161
A1CR6	152-0409-00			DIO,RECT:FAST RCVRY;12KV,10MA,250NS;CRVT150,AXIAL LEAD	80009	152-0409-00
A1CR7	152-0061-00			DIO,SIG:200V,0.1A,700NS,4.0PF;FDH2161,T&R	07263	FDH2161
A1CR8	152-0061-00			DIO,SIG:200V,0.1A,700NS,4.0PF;FDH2161,T&R	07263	FDH2161

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1CR9	152-0400-00			DIO,RECT:FAST RCVRY:400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A1CR10	152-0400-00			DIO,RECT:FAST RCVRY:400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A1CR11	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR12	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR13	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR14	152-0400-00			DIO,RECT:FAST RCVRY:400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A1CR16	152-0720-00			DIO,RECT:ULTRA FAST;100V,8A,25NS,100A IFSM:BYW29-100,TO-220 *MOUNTING PARTS*	80009	152-0720-00
	210-0406-00			NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
	211-0008-00			SCR,MACH:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	214-3841-00			HTSK,XSTR:TO-220 W/SLDR TABS,AL *END MOUNTING PARTS*	80009	214-3841-00
A1CR17	152-0720-00			DIO,RECT:ULTRA FAST;100V,8A,25NS,100A IFSM:BYW29-100,TO-220 *MOUNTING PARTS*	80009	152-0720-00
	210-0406-00			NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
	211-0008-00			SCR,MACH:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	214-3841-00			HTSK,XSTR:TO-220 W/SLDR TABS,AL *END MOUNTING PARTS*	80009	214-3841-00
A1CR18	152-0720-00			DIO,RECT:ULTRA FAST;100V,8A,25NS,100A IFSM:BYW29-100,TO-220 *MOUNTING PARTS*	80009	152-0720-00
	210-0406-00			NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
	211-0008-00			SCR,MACH:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	214-3841-00			HTSK,XSTR:TO-220 W/SLDR TABS,AL *END MOUNTING PARTS*	80009	214-3841-00
A1CR19	152-0863-00			SEMICON DVC,DI:RECT,SI,600V,1A,30NS	80009	152-0863-00
A1CR20	152-0400-00			DIO,RECT:FAST RCVRY:400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A1CR21	152-0897-00			DIO,RECT:FAST RCVRY;1000V,1.5A,300NS,SOFT RCVRY:BYV96E,T&R	80009	152-0897-00
A1CR22	152-0863-00			SEMICON DVC,DI:RECT,SI,600V,1A,30NS	80009	152-0863-00
A1CR23	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR24	152-0897-00			DIO,RECT:FAST RCVRY;1000V,1.5A,300NS,SOFT RCVRY:BYV96E,T&R	80009	152-0897-00
A1CR25	152-0400-00			DIO,RECT:FAST RCVRY:400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A1CR26	152-0863-00			SEMICON DVC,DI:RECT,SI,600V,1A,30NS	80009	152-0863-00
A1CR27	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR28	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A1CR29	152-1165-00			DIO,RECT:ULTRA FAST;600V,4A,50NS;MUR460	80009	152-1165-00
A1CR30	152-1165-00			DIO,RECT:ULTRA FAST;600V,4A,50NS;MUR460	80009	152-1165-00
A1CR31	152-1165-00			DIO,RECT:ULTRA FAST;600V,4A,50NS;MUR460	80009	152-1165-00
A1CR32	152-1165-00			DIO,RECT:ULTRA FAST;600V,4A,50NS;MUR460	80009	152-1165-00
A1CR33	152-0061-00			DIO,SIG:200V,0.1A,700NS,4.0PF;FDH2161,T&R	07263	FDH2161
A1DS1	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	74276	LT2-24-2 (NE2H)

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1DS2	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	74276	LT2-24-2 (NE2H)
A1DS3	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	74276	LT2-24-2 (NE2H)
A1DS4	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	74276	LT2-24-2 (NE2H)
A1DS5	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	74276	LT2-24-2 (NE2H)
A1DS6	150-1152-00			DIO,OPTO:LED;HI EFFIC. RED,635NM,INTEGRAL RES;HLMP-1600-002,T1,T&R	50434	HLMP-1600-002
A1DS7	150-0050-00			LAMP,GLOW:135V MAX,1.9MA,C2A-T,WIRE LEAD	74276	LT2-24-2 (NE2H)
A1F1	159-0021-00			FUSE,CRTG:3AG,2A,250V,FAST BLOW	75915	312 002
				*MOUNTING PARTS*		
	200-2264-00			CAP,FSHLDR:3AG FUSES	S3629	FEK 031 1666
	204-0906-00			BODY,FSHLDR:3AG & 5 X 20MM FUSES	S3629	TYPEFAU031.3573
				*END MOUNTING PARTS*		
A1J1	131-5338-00			CONN,HDR:	80009	131-5338-00
A1J2	131-4794-00			CONN,HDR:PCB:MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30 GLD,0.035 DIA PCB	80009	131-4794-00
A1J4	131-5337-00			CONN,HDR:	80009	131-5337-00
A1J5	131-3392-00			CONN,HDR:PCB:MALE,STR,1 X 10,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-3392-00
A1J7	131-4794-00			CONN,HDR:PCB:MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30 GLD,0.035 DIA PCB	80009	131-4794-00
A1J8	131-4794-00			CONN,HDR:PCB:MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30 GLD,0.035 DIA PCB	80009	131-4794-00
A1J9	131-4794-00			CONN,HDR:PCB:MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30 GLD,0.035 DIA PCB	80009	131-4794-00
A1J10	119-1946-00			FILTER,RF:1A,250V,400HZ W/PC TERM	S4307	FN326-1/02-K-D-T
A1J501	131-4794-00			CONN,HDR:PCB:MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30 GLD,0.035 DIA PCB	80009	131-4794-00
A1L1	108-1262-00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108-1262-00
A1L2	108-1262-00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108-1262-00
A1L3	108-1524-00			COIL,RF:TOROID,FXD,1.05 - 1.25UH/1.14UH,1.0 MILLIAMPS,4 TURN	80009	108-1524-00
A1L4	108-1412-00			COIL,RF:FXD, 4.7 UH, +/- 20 %, Q 25, SRF 50 MHZ, DCR 0.017 OHM I MAX 3.7 A, RDL LEAD	54583	TSL08074R7M3RO
A1L5	108-1411-00			COIL,RF:FXD, 47UH, 10%,Q=45,SRF11 MHZ,DCR 0.17 OHM,I MAX 0.96ARDL LEAD	54583	TSL0707-470 KR94
A1L6	108-1411-00			COIL,RF:FXD, 47UH, 10%,Q=45,SRF11 MHZ,DCR 0.17 OHM,I MAX 0.96ARDL LEAD	54583	TSL0707-470 KR94
A1L7	108-1411-00			COIL,RF:FXD, 47UH, 10%,Q=45,SRF11 MHZ,DCR 0.17 OHM,I MAX 0.96ARDL LEAD	54583	TSL0707-470 KR94
A1L8	108-0205-00			COIL,RF:IDCTR:FXD,1MH,+/-5%, DCR 2.12 OHMS, FERRITE CORE	76493	8209
A1L9	108-1411-00			COIL,RF:FXD, 47UH, 10%,Q=45,SRF11 MHZ,DCR 0.17 OHM,I MAX 0.96ARDL LEAD	54583	TSL0707-470 KR94
A1L83	108-0245-00			CHOKE,RF:FIXED,3.9UH, +/- 10 %, Q 35, DCR 0.264 OHM, SRF 61 MHZN POWERED IRON FORM	76493	B6310-1
A1P8	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPERLK,JUMPER	22526	131-3199-00
A1P9	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPERLK,JUMPER	22526	131-3199-00
A1Q1	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A1Q2	151-0749-00			XSTR,SIG:BIPOLAR,PNP:400V,500MA,50MHZ,AMPL:MPSA94,TO-92 EBC	80009	151-0749-00
A1Q3	151-0188-00			XSTR,SIG:BIPOLAR,PNP:40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1Q4	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A1Q5	151-0350-00			XSTR,SIG:BIPOLAR,PNP:150V,600MA,100MHZ,AMPL:2N5401,TO-92 EBC	04713	2N5401
A1Q6	151-0347-00			XSTR,SIG:BIPOLAR,NPN:160V,600MA,100MHZ,AMPL:2N5551,TO-92 EBC	80009	151-0347-00
A1Q7	151-0476-00			XSTR,PWR:BIPOLAR,NPN:100V,3.0A,3.0MHZ,AMPL:TIP31C,TO-220	80009	151-0476-00
				*MOUNTING PARTS*		
	210-0406-00			NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
	211-0008-00			SCR,MACH:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	214-3841-00			HTSK,XSTR:TO-220 W/SLDR TABS,AL	80009	214-3841-00
				*END MOUNTING PARTS*		
A1Q8	151-0216-00			XSTR,SIG:BIPOLAR,PNP:25V,100MA,170MHZ,AMPL:MPS6523,TO-92 EBC	80009	151-0216-00
A1Q9	151-0188-00			XSTR,SIG:BIPOLAR,PNP:40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A1Q10	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A1Q11	151-0528-00			THYRISTOR,PWR:BIPOLAR,SCR:50V,16A RMS,PHASE CONT:2N6400,TO-220	80009	151-0528-00
A1Q12	151-0216-00			XSTR,SIG:BIPOLAR,PNP:25V,100MA,170MHZ,AMPL:MPS6523,TO-92 EBC	80009	151-0216-00
A1Q13	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A1Q14	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A1Q15	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A1Q16	151-1286-00			XSTR,PWR:MOS,N-CH:800V,4.0A,3.0 OHM:BUK456-800A,TO-220	80009	151-1286-00
				*MOUNTING PARTS*		
	210-0406-00			NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
	211-0008-00			SCR,MACH:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
	214-4197-00			HTSK:XSTR,TO=218,AL	80009	214-4197-00
				*END MOUNTING PARTS*		
A1Q17	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A1Q18	151-0188-00			XSTR,SIG:BIPOLAR,PNP:40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A1Q19	151-0188-00			XSTR,SIG:BIPOLAR,PNP:40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A1R1	301-0225-02			RES,FXD,CMPSN:2.2M OHM,5%,0.5W	80009	301-0225-02
A1R2	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	80009	303-0155-00
A1R3	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	80009	303-0155-00
A1R4	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	80009	303-0155-00
A1R5	322-3344-00			RES,FXD,FILM:37.4K OHM,1%,0.2W,TC=T0	80009	322-3344-00
A1R6	322-3251-00			RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K02
A1R9	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A1R10	311-1256-00			RES,VAR,TRMR:CERMET:2.5M OHM,10%,0.5W,0.375 SQ,TOP ADJUST;BULK	80009	311-1256-00
A1R11	322-3385-00			RES,FXD:MET FILM:100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R12	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E



## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1R13	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A1R14	303-0155-00			RES,FXD,CMPSN:1.5M OHM,5%,1W	80009	303-0155-00
A1R15	322-3339-00			RES,FXD:MET FILM;33.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3339-00
A1R16	322-3481-00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	80009	322-3481-00
A1R17	315-0101-03			RES,FXD,CMPSN:100 OHM,5%,0.25W	80009	315-0101-03
A1R18	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	57668	CRB20 DYE 13K0
A1R19	322-3162-00			RES,FXD:MET FILM;475 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3162-00
A1R20	315-0223-03			RES,FXD,CMPSN:22K OHM,5%,0.25 W	80009	315-0223-03
A1R21	315-0102-03			RES,FXD,CMPSN:1K OHM,5%,0.25W	80009	315-0102-03
A1R22	322-3306-00			RES,FXD:MET FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A1R23	322-3105-00			RES,FXD:MET FILM;121 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3105-00
A1R24	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R25	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A1R26	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A1R27	315-0470-03			RES,FXD,CMPSN:47 OHM,5%,0.25W	80009	315-0470-03
A1R28	322-3162-00			RES,FXD:MET FILM;475 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3162-00
A1R29	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A1R30	315-0226-01			RES,FXD,CMPSN:22 M OHM,5%,0.25W	80009	315-0226-01
A1R31	315-0471-03			RES,FXD,CMPSN:470 OHM,5%,0.25W	80009	315-0471-03
A1R32	315-0471-03			RES,FXD,CMPSN:470 OHM,5%,0.25W	80009	315-0471-03
A1R33	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A1R34	315-0471-03			RES,FXD,CMPSN:470 OHM,5%,0.25W	80009	315-0471-03
A1R35	322-3273-00			RES,FXD:MET FILM;6.81K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3273-00
A1R36	315-0102-03			RES,FXD,CMPSN:1K OHM,5%,0.25W	80009	315-0102-03
A1R37	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R38	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 100K
A1R39	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A1R40	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A1R41	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R42	322-3273-00			RES,FXD:MET FILM;6.81K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3273-00
A1R43	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 100K
A1R44	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A1R45	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A1R46	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A1R47	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1R48	322-3024-00			RES,FXD,FILM:17.4 OHM,1%,0.2W,TC=T0	57668	CRB20FXE1K62
A1R49	322-3322-00			RES,FXD:MET FILM:22.1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3322-00
A1R50	322-3001-00			RES,FXD:MET FILM:10 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3001-00
A1R51	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R52	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 100K
A1R53	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R54	322-3481-00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	80009	322-3481-00
A1R55	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R56	322-3235-00			RES,FXD:MET FILM:2.74K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A1R57	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R58	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R59	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K99
A1R60	322-3261-00			RES,FXD,FILM:5.11K OHM,1%,0.2W,TC=T0	80009	322-3261-00
A1R62	322-3201-00			RES,FXD:MET FILM:1.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3201-00
A1R63	322-3385-00			RES,FXD:MET FILM:100K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R64	322-3385-00			RES,FXD:MET FILM:100K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R65	322-3339-00			RES,FXD:MET FILM:33.2K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3339-00
A1R66	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
A1R69	322-3289-00			RES,FXD:MET FILM:10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A1R70	311-2238-00			RES,VAR,TRMR:CERMET;50K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 50 K
A1R71	322-3001-00			RES,FXD:MET FILM:10 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3001-00
A1R72	322-3289-00			RES,FXD:MET FILM:10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A1R73	322-3222-00			RES,FXD:MET FILM:2K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A1R74	322-3001-00			RES,FXD:MET FILM:10 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3001-00
A1R75	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A1R76	322-3385-00			RES,FXD:MET FILM:100K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R77	322-3225-00			RES,FXD,FILM:2.15K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K15
A1R78	322-3306-00			RES,FXD:MET FILM:15K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A1R79	322-3327-00			RES,FXD,FILM:24.9K OHM,1%,0.2W,TC=T0	80009	322-3327-00
A1R80	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A1R81	322-3165-00			RES,FXD,FILM:511 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 511E
A1R82	322-3222-00			RES,FXD:MET FILM:2K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1R84	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A1R85	305-0242-00			RES,FXD,CMPSN:2.4K OHM,5%,2W	80009	305-0242-00
A1R86	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R87	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A1R88	322-3231-00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	80009	322-3231-00
A1R89	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R90	308-0793-00			RES,FXD:0.51 OHM,5%,1WTC=150PPM/DEG C,MI,T&R	80009	308-0793-00
A1R91	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R92	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A1R93	322-3121-00			RES,FXD:MET FILM;178 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3121-00
A1R94	322-3335-00			RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 30K1
A1R95	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A1R96	322-3081-00			RES,FXD:MET FILM;68.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3081-00
A1R97	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A1R98	322-3256-00			RES,FXD,FILM:4.53K OHM,1%,0.2W,TC=T0	80009	322-3256-00
A1R99	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A1R100	-----			(TEST SELECTED)		
A1R101	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322-3254-00
A1R102	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R103	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A1R104	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A1R105	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A1R106	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A1R107	301-0681-00			RES,FXD,FILM:680 OHM,5%,0.5W	01121	EB6815
A1R108	322-3431-00			RES,FXD,FILM:301K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301K
A1R109	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A1R110	301-0681-00			RES,FXD,FILM:680 OHM,5%,0.5W	01121	EB6815
A1R111	322-3339-00			RES,FXD:MET FILM;33.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3339-00
A1R112	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A1R113	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A1R114	322-3431-00			RES,FXD,FILM:301K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301K
A1R115	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A1R116	322-3351-00			RES,FXD:MET FILM;44.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3351-00
A1R117	322-3350-00			RES,FXD,FILM:43.2K OHM,1%,0.2W,TC=T0	80009	322-3350-00
A1R118	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A1R119	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A1R120	322-3452-00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TO	91637	CCF50-2-G4993FT
A1R121	322-3452-00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TO	91637	CCF50-2-G4993FT
A1R122	322-3331-00			RES,FXD:MET FILM;27.4K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3331-00
A1R123	322-3401-00			RES,FXD,FILM:147K OHM,1%,0.2W,TC=TO	80009	322-3401-00
A1R124	308-0838-00			RES,FXD,WW:12.0 OHM 1%,5.0 W	07088	
A1R125	307-0353-00			RES,THERMAL:5 OHM,10%	80009	307-0353-00
A1R129	322-3393-00			RES,FXD:MET FILM;121K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3393-00
A1R130	322-3393-00			RES,FXD:MET FILM;121K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3393-00
A1R131	307-0353-00			RES,THERMAL:5 OHM,10%	80009	307-0353-00
A1R132	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A1R200	306-0104-00			RES,FXD,CMPSN:100K OHM,10%,2W	01121	HB1041
A1R201	306-0104-00			RES,FXD,CMPSN:100K OHM,10%,2W	01121	HB1041
A1R202	305-0560-00			RES,FXD,CMPSN:56 OHM,5%,2W	80009	305-0560-00
A1R205	308-0555-00	B052099		RES,FXD,WW:5 OHM,5%,3W AXIAL LEAD	00213	1200S-5.0-5
A1R206	308-0555-00	B052099		RES,FXD,WW:5 OHM,5%,3W AXIAL LEAD	00213	1200S-5.0-5
A1T1	120-1695-00			XFMR,PWR:HI V,FDBK 3V, RESONANT 231V, 100V 1MA	80009	120-1695-00
A1T2	120-1855-00			XFMR,RF:FLYBACK,40V 0.385A,+/-15V 0.8A,5V 2A,W/SNUBBER,W/HSEKPG 15V 0.2A,70 KHZ	80009	120-1855-00
A1T3	120-1532-00			XFMR,RF:	75498	128-8036-EB
A1TP1	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A1TP2	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A1TP3	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A1U1	152-0900-00			MOD,HV:7.5KVAC IN,15KVDC OUT,POTTED MOD:MSL2556	80009	152-0900-00
A1U2	156-0067-00			IC,LIN:BIPOLAR,OP-AMP;741C,DIP08.3	80009	156-0067-00
A1U3	156-1719-00			IC,LIN:BIPOLAR,OP-AMP;LOW V OPN,W/V REF:LM10CN,DIP08.3	TK1468	LM10CN
A1U4	156-2524-00			IC,LIN:	12969	UC3842N
A1U5	156-0411-00			IC,LIN:BIPOLAR,COMPTR;QUAD,SGL SPLY,300NS;LM339N,DIP14.3	80009	156-0411-00
A1VR1	152-0195-00			DIO,ZENER:5.1V,5%,0.4W;1N751A FMLY,DO-35 OR 7	80009	152-0195-00
A1W61	131-0566-00			BUS,CNDCT:DUM RES,0.094 OD X 0.225 L	80009	131-0566-00
A1W67	131-0566-00			BUS,CNDCT:DUM RES,0.094 OD X 0.225 L	80009	131-0566-00
A1W68	131-0566-00			BUS,CNDCT:DUM RES,0.094 OD X 0.225 L	80009	131-0566-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A2	671-2272-02			CIRCUIT BD ASSY:FRONT PANEL	80009	671-2272-02
A2DS100	150-1138-00			DIO,OPTO:LED;RED,626NM,1MCD AT 20MA,RECT CASE;HLMP-0300	80009	150-1138-00
A2DS104	150-1292-00			LED ASSY:DIR:5 IN 5 GRN	80009	150-1292-00
A2DS110	150-1285-00			LED ASSY:DIR:2 IN 2 RED/GRN	80009	150-1285-00
A2DS117	150-1290-00			LED ASSY:DIR:3 IN 3 GRN	80009	150-1290-00
A2DS136	150-1290-00			LED ASSY:DIR:3 IN 3 GRN	80009	150-1290-00
A2DS144	150-1286-00			LED ASSY:DIR:2 IN 2 GRN	80009	150-1286-00
A2DS227	150-1284-00			LED ASSY:DIR:2 IN 2 GRN/RED	80009	150-1284-00
A2DS240	150-1290-00			LED ASSY:DIR:3 IN 3 GRN	80009	150-1290-00
A2DS314	150-1290-00			LED ASSY:DIR:3 IN 3 GRN	80009	150-1290-00
A2DS327	150-1290-00			LED ASSY:DIR:3 IN 3 GRN	80009	150-1290-00
A2DS340	150-1286-00			LED ASSY:DIR:2 IN 2 GRN	80009	150-1286-00
A2J303	175-9773-01			CA ASSY,SP,ELEC:34,26 AWG,5.0 L	TK1462	ORDER BY DESC
A2R212	311-2287-00			RES,VAR,NONWW:PNL,20K OHM,10%,0.5W	12697	CM45210
A2R245	311-2321-00			RES,VAR,WW:CLAROSTAT,3 TURN POT	80009	311-2321-00
				*MOUNTING PARTS*		
	210-1435-00			WASHER,FLAT:0.254 X 0.311 X 0.016,SST	86928	5710-56-15P
	210-1435-00			WASHER,FLAT:0.254 X 0.311 X 0.016,SST	86928	5710-56-15P
				*END MOUNTING PARTS*		
A2R345	311-2321-00			RES,VAR,WW:CLAROSTAT,3 TURN POT	80009	311-2321-00
				*MOUNTING PARTS*		
	210-1435-00			WASHER,FLAT:0.254 X 0.311 X 0.016,SST	86928	5710-56-15P
	210-1435-00			WASHER,FLAT:0.254 X 0.311 X 0.016,SST	86928	5710-56-15P
				*END MOUNTING PARTS*		
A2R412	311-2287-00			RES,VAR,NONWW:PNL,20K OHM,10%,0.5W	12697	CM45210
A2R429	311-2287-00			RES,VAR,NONWW:PNL,20K OHM,10%,0.5W	12697	CM45210
A2R443	311-2287-00			RES,VAR,NONWW:PNL,20K OHM,10%,0.5W	12697	CM45210
A2S100	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S105	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S112	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S130	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S145	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S222	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S235	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S309	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S322	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S335	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S509	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S521	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152
A2S534	260-2300-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F1152

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3	672-0306-10		B051734	CIRCUIT BD ASSY:MAIN	80009	672-0306-10
A3	672-0306-11	B051735	B051811	CIRCUIT BD ASSY:MAIN	80009	672-0306-11
A3	672-0306-12	B051812	B051895	CIRCUIT BD ASSY:MAIN	80009	672-0306-12
A3	672-0306-13	B051896	B051905	CIRCUIT BD ASSY:MAIN	80009	672-0306-13
A3	672-0306-14	B051906		CIRCUIT BD ASSY:MAIN	80009	672-0306-14
	337-0607-00			*ATTACHED PARTS* PLATE,ELEC SHLD:CIRCUIT BOARD (QUANTITY 3)	80009	337-0607-00
				*END ATTACHED PARTS*		
A3C1	281-0819-00			CAP,FXD,CER:MLC:33 PF,5%,50V,0.100 X 0.170;AXIAL,MI	04222	SA102A330JAA
A3C2	290-0183-00			CAP,FXD,TANT:DRY:1UF,10%,35V,TANT OX- IDE,0.151 X 0.317;AXIAL,MI	05397	T3228105K035AS
A3C3	281-0819-00			CAP,FXD,CER:MLC:33 PF,5%,50V,0.100 X 0.170;AXIAL,MI	04222	SA102A330JAA
A3C4	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C5	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C6	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C7	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C8	290-0748-00			CAP,FXD,ELCTL:10UF,+50-20%,25WVDC	24165	501D106F063LL4
A3C9	290-0183-00			CAP,FXD,TANT:DRY:1UF,10%,35V,TANT OX- IDE,0.151 X 0.317;AXIAL,MI	05397	T3228105K035AS
A3C10	290-0839-00			CAP,FXD,ELCTL:330UF,+50-20%,35V	55680	TLB1V331MCA
A3C11	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C12	290-0748-00			CAP,FXD,ELCTL:10UF,+50-20%,25WVDC	24165	501D106F063LL4
A3C13	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C15	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C16	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C17	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C18	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C19	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C20	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C21	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C22	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C23	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C24	281-0770-00		B051734	CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C24	281-0814-00	B051735		CAP,FXD,CERAMIC:MLC,100 PF,10%,100V,AXIAL	04222	SA102A101KAA
A3C25	281-0763-00			CAP,FXD,CER:MLC:47PF,10%,100V,0.100 X 0.170;AXIAL	04222	SA102A470KAA
A3C26	-----			(TEST SELECTED)		
A3C27	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3C28	283-0634-01			CAP,FXD,MICA DI:65PF,1%,500V,T&A	09023	CDA15ED650F03
A3C29	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C30	283-0645-01			CAP,FXD,MICA DI:790PF,1%,300V,T&A	09023	CDA15FC791F03
A3C31	281-0773-00			CAP,FXD,CER:MLC:0.01UF,10%,100V,SAF,0.100 X 0.170;AXIAL,MI	80009	281-0773-00
A3C32	283-0660-01			CAP,FXD,MICA DI:510PF,1%,500V,T&A	80009	283-0660-01
A3C33	283-0667-01			CAP,FXD,MICA DI:420PF,1%,500V,T&A	09023	CDA15FD421F03
A3C34	283-0660-01			CAP,FXD,MICA DI:510PF,1%,500V,T&A	80009	283-0660-01
A3C35	281-0773-00			CAP,FXD,CER:MLC:0.01UF,10%,100V,SAF,0.100 X 0.170;AXIAL,MI	80009	281-0773-00
A3C36	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM:5000 HRS,RDL,T&A	80009	290-1311-00
A3C37	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM:5000 HRS,RDL,T&A	80009	290-1311-00
A3C38	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C39	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C40	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C41	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C42	281-0767-00			CAP,FXD,CER:MLC:330PF,20%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102C331MAA
A3C43	281-0814-00			CAP,FXD,CER:MLC;100 PF,10%,100V,0.100 X 0.170;AXIAL,MI	80009	281-0814-00
A3C44	281-0813-00			CAP,FXD,CER:MLC:0.047UF,20%,50V,0.100 X 0.170;AXIAL,MI	04222	SA105E473MAA
A3C45	283-0634-01			CAP,FXD,MICA DI:65PF,1%,500V,T&A	09023	CDA15ED650F03
A3C46	283-0634-01			CAP,FXD,MICA DI:65PF,1%,500V,T&A	09023	CDA15ED650F03
A3C47	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C48	281-0763-00			CAP,FXD,CER:MLC:47PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102A470KAA
A3C49	281-0773-00			CAP,FXD,CER:MLC:0.01UF,10%,100V,SAF,0.100 X 0.170;AXIAL,MI	80009	281-0773-00
A3C50	285-1133-00			CAP,FXD,PLSTC:0.33MF,1%,100V	80009	285-1133-00
A3C51	283-0655-00			CAP,FXD,MICA DI:330PF,1%,500V	80009	283-0655-00
A3C52	281-0773-00			CAP,FXD,CER:MLC:0.01UF,10%,100V,SAF,0.100 X 0.170;AXIAL,MI	80009	281-0773-00
A3C53	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C54	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C55	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C56	281-0302-00			CAP,VAR,PLSTC:1.2-4PF,100V	52769	GXL4R000
A3C57	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A3C58	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C59	281-0810-00			CAP,FXD,CER:MLC;5.6PF,+/-0.5PF,100V,0.100 X 0.170;AXIAL,MI	04222	SA101A5R6DAA
A3C60	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C61	281-0811-00			CAP,FXD,CER:MLC;10PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102A100KAA
A3C62	290-0943-02			CAP,FXD,ELCTLT:47UF,20%,25V	55680	UVX1E470MDA1TD

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3C63	281-0811-00			CAP,FXD,CER:MCL:10PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102A100KAA
A3C64	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C65	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C66	290-0943-02			CAP,FXD,ELCTL:47UF,20%,25V	55680	UVX1E470MDA1TD
A3C67	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C68	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C69	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C70	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C71	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C72	281-0810-00			CAP,FXD,CER:MCL:5.6PF,+/-0.5PF,100V,0.100 X 0.170;AXIAL,MI	04222	SA101A5R6DAA
A3C73	281-0302-00			CAP,VAR,PLSTC:1.2-4PF,100V	52769	GXL4R000
A3C74	290-0943-02			CAP,FXD,ELCTL:47UF,20%,25V	55680	UVX1E470MDA1TD
A3C75	281-0903-00			CAP,FXD,CER DI:3.9PF,100V	80009	281-0903-00
A3C76	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C77	281-0814-00			CAP,FXD,CER:MCL:100 PF,10%,100V,0.100 X 0.170;AXIAL,MI	80009	281-0814-00
A3C78	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C79	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C80	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C81	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C83	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C84	281-0776-00			CAP,FXD,CER:MCL:120PF,5%,100V ,0.100 X 0.170;AXIAL,MI	04222	SA102A121JAA
A3C85	290-0782-01			CAP,FXD,ELCTL:4.7UF,20%,35VDC	55680	UVX1V4R7MAA1TD
A3C86	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C87	281-0816-00			CAP,FXD,CER:MCL:82 PF,5%,100V,0.100 X 0.170;AXIAL,MI	80009	281-0816-00
A3C88	290-0943-02			CAP,FXD,ELCTL:47UF,20%,25V	55680	UVX1E470MDA1TD
A3C89	290-0943-02			CAP,FXD,ELCTL:47UF,20%,25V	55680	UVX1E470MDA1TD
A3C90	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	80009	281-0762-00
A3C91	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	80009	281-0762-00
A3C92	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	80009	281-0762-00
A3C93	290-0782-01			CAP,FXD,ELCTL:4.7UF,20%,35VDC	55680	UVX1V4R7MAA1TD
A3C94	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C95	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C96	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C97	281-0158-00			CAP,VAR,CER DI:7-45PF,100WVDC SUBMIN CER DISC TOP ADJ	80009	281-0158-00
A3C98	283-0642-01			CAP,FXD,MICA DI:33PF,2%,500V	09023	CDA10ED330G03
A3C99	290-0943-02			CAP,FXD,ELCTL:47UF,20%,25V	55680	UVX1E470MDA1TD



## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3C100	281-0158-00			CAP,VAR,CER DI:7-45PF,100WVDC SUBMIN CER DISC TOP ADJ	80009	281-0158-00
A3C101	281-0874-00			CAP,FXD,CER DI:10PF,5%,500V	04222	MA107A100JAA
A3C102	281-0538-00			CAP,FXD,CER:MLC;1PF,20%,500V,0.170 X 0.220;AXIAL	80009	281-0538-00
A3C103	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	80009	281-0762-00
A3C104	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C105	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C106	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C107	281-0786-00			CAP,FXD,CER:MLC;150PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA101A151KAA
A3C108	281-0158-00			CAP,VAR,CER DI:7-45PF,100WVDC SUBMIN CER DISC TOP ADJ	80009	281-0158-00
A3C109	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C110	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C111	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C112	283-0594-02			CAP,FXD,MICA DI:1000PF,1%,100V,T&A	09023	CDA15FA102F03
A3C113	290-0782-01			CAP,FXD,ELCTLT:4.7UF,20%,35VDC	55680	UVX1V4R7MAA1TD
A3C114	283-0625-01			CAP,FXD,MICA DI:220PF,1%,500V	09023	CDA10FD221F03
A3C115	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C116	281-0158-00			CAP,VAR,CER DI:7-45PF,100WVDC SUBMIN CER DISC TOP ADJ	80009	281-0158-00
A3C117	283-0629-01			CAP,FXD,MICA DI:62PF,1%,500V,T&A	09023	CDA10ED620F03
A3C118	281-0123-00			CAP,VAR,CER DI:5-25PF,100V	59660	518-000A5-25
A3C119	283-0639-01			CAP,FXD,MICA DI:56PF,1%,500V,T&A	09023	CDA15ED560F03
A3C120	281-0816-00			CAP,FXD,CER:MLC;82 PF,5%,100V,0.100 X 0.170;AXIAL,MI	80009	281-0816-00
A3C121	290-0782-01			CAP,FXD,ELCTLT:4.7UF,20%,35VDC	55680	UVX1V4R7MAA1TD
A3C122	281-0814-00			CAP,FXD,CER:MLC;100 PF,10%,100V,0.100 X 0.170;AXIAL,MI	80009	281-0814-00
A3C123	290-0782-01			CAP,FXD,ELCTLT:4.7UF,20%,35VDC	55680	UVX1V4R7MAA1TD
A3C124	283-0167-02			CAP,FXD,CER DI:0.1UF,10%,100V,TAPED & RE-ELED,0.2 SPACING	04222	SR591C104KAAAP1
A3C125	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C126	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C127	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C128	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C129	283-0221-02			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305C474MAAAP1
A3C130	283-0625-01			CAP,FXD,MICA DI:220PF,1%,500V	09023	CDA10FD221F03
A3C131	283-0631-01			CAP,FXD,MICA DI:95PF,1%,500V	80009	283-0631-01
A3C132	281-0815-00			CAP,FXD,CER:MLC:0.027UF,20%,50V,0.100 X 0.260;AXIAL,MI	04222	SA205C273MAA
A3C133	281-0874-00			CAP,FXD,CER DI:10PF,5%,500V	04222	MA107A100JAA
A3C134	281-0826-00			CAP,FXD,CER:MLC;2200PF,10%,100V,0.100 X 0.170;AXIAL,MI	04222	SA101C222KAA
A3C135	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	80009	281-0762-00
A3C136	281-0823-00			CAP,FXD,CER DI:470PF,10%,50V	04222	SA101A471KAA

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3C137	281-0797-00			CAP,FXD,CER:MLC;15PF,10%,100V,SAF ,0.100 X 0.170;AXIAL,MI	80009	281-0797-00
A3C138	281-0893-00			CAP,FXD,CER:MLC;4.7PF,+/-0.5PF,100V,0.100 X 0.170;AXIAL,MI	04222	SA101A4R7DAA
A3C139	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C140	281-0756-00			CAP,FXD,CER:MLC;2.2PF,+/-0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A3C141	281-0874-00			CAP,FXD,CER DI:10PF,5%,500V	04222	MA107A100JAA
A3C142	281-0756-00			CAP,FXD,CER:MLC;2.2PF,+/-0.5PF,200V,0.100 X 0.170;AXIAL,MI	04222	SA102A2R2DAA
A3C143	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C144	281-0302-00			CAP,VAR,PLSTC:1.2-4PF,100V	52769	GXL4R000
A3C145	281-0182-00			CAP,VAR,PLSTC:1.8-10PF,300V	19701	2805D1R810BH03F0
A3C146	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C147	281-0302-00			CAP,VAR,PLSTC:1.2-4PF,100V	52769	GXL4R000
A3C148	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C149	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C150	281-0823-00			CAP,FXD,CER DI:470PF,10%,50V	04222	SA101A471KAA
A3C151	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C152	281-0810-00			CAP,FXD,CER:MLC;5.6PF,+/-0.5PF,100V,0.100 X 0.170;AXIAL,MI	04222	SA101A5R6DAA
A3C153	281-0903-00			CAP,FXD,CER DI:3.9PF,100V	80009	281-0903-00
A3C154	290-0848-00			CAP,FXD,ALUM:47UF,+100%-20%,16V,0.681 X 0.414;RDL	80009	290-0848-00
A3C155	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C156	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C157	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C158	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C159	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C160	281-0815-00			CAP,FXD,CER:MLC;0.027UF,20%,50V,0.100 X 0.260;AXIAL,MI	04222	SA205C273MAA
A3C161	281-0815-00			CAP,FXD,CER:MLC;0.027UF,20%,50V,0.100 X 0.260;AXIAL,MI	04222	SA205C273MAA
A3C162	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A3C163	281-0770-00			CAP,FXD,CER DI:1000PF,20%,100V	04222	SA101C102MAA
A3C164	290-0848-00			CAP,FXD,ALUM:47UF,+100%-20%,16V,0.681 X 0.414;RDL	80009	290-0848-00
A3C165	281-0775-01			CAP,FXD,CER:MCL;0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A3C166	290-0778-01			CAP,FXD,ELCTL:1UF,+20%,50V	55680	UVP1H010MAAITD
A3C167	290-0183-00			CAP,FXD,TANT:DRY;1UF,10%,35V,TANT OX-IDE,0.151 X 0.317;AXIAL,MI	05397	T3228105K035AS
A3C168	281-0819-00			CAP,FXD,CER:MLC;33 PF,5%,50V,0.100 X 0.170;AXIAL,MI	04222	SA102A330JAA
A3C169	281-0819-00			CAP,FXD,CER:MLC;33 PF,5%,50V,0.100 X 0.170;AXIAL,MI	04222	SA102A330JAA
A3C170	281-0767-00			CAP,FXD,CER:MLC;330PF,20%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102C331MAA

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Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3C171	281-0773-00			CAP,FXD,CER:MLC;0.01UF,10%,100V,SAF,0.100 X 0.170;AXIAL,MI	80009	281-0773-00
A3C172	283-0220-02	B051812		CAP,FXD,CER DI:0.01UF,20%,50V	18796	RPE121-911X7R103M5
A3CR1	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR2	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR3	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR4	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR6	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR7	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR8	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR9	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR10	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR11	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR12	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR13	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR14	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR15	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR16	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR17	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR18	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR19	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR20	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR21	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR22	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR23	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR24	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR25	152-0400-00			DIO,RECT:FAST RCVRY;400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A3CR26	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR27	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR28	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3CR29	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR30	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR31	152-0400-00			DIO,RECT:FAST RCVRY;400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A3CR32	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR33	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR34	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR35	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR36	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR37	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR38	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR39	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A3CR40	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A3CR41	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR42	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR43	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR44	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR45	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR46	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A3CR47	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR48	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A3CR49	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR50	152-0307-00			DIO,SIG:ULTRA FAST;100V,4.0NS,1.5PF,DUAL COM-CATHODE;MSD6100,TO-92	04713	SSD1150
A3CR51	152-0501-00			DIO,SIG:FAST RCVRY;70V,200MA,100NS,COM- ANODE;MSD6150,TO-92	80009	152-0501-00
A3CR52	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR53	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR54	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR55	152-0307-00			DIO,SIG:ULTRA FAST;100V,4.0NS,1.5PF,DUAL COM-CATHODE;MSD6100,TO-92	04713	SSD1150
A3CR56	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3CR57	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR58	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR59	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR60	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR61	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR62	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR63	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR64	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR65	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR66	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR67	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR68	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A3CR69	152-0400-00			DIO,RECT:FAST RCVRY;400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A3J1	131-3571-00			CONN,HDR:	80009	131-3571-00
A3J3	131-4752-00			CONN,HDR:PCB;MALE,45 DEG,1 X 2,0.1 CTR,0.240 MLG X 0.110 TAIL,30 GLD	80009	131-4752-00
A3J4	131-5431-00			CONN,HDR:	80009	131-5431-00
A3J5	131-4187-00			CONN,PLUG,ELEC:PCB,MALE,1 X 3,0.1 CTR,0.240 MLG X 0.110 TAIL,45 DEG	58050	082-0343-AS10
A3J6	131-3528-00			CONN,HDR:	15912	609-2407
A3J7	175-9797-00			CA ASSY,SP:FLAT FLEX;FLX,10,27 AWG,2.5 L,1X10,BOX X STR,SLDR TAB,CONN NON PLZ	00779	487729-1
A3J8	174-1195-00			CA ASSY,SP,ELEC:10 CON,8.0 L,FLAT FLEX	80009	174-1195-00
A3J9	131-5430-00			CONN,HDR:	80009	131-5430-00
A3J10	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-4530-00
A3J17	131-4752-00			CONN,HDR:PCB;MALE,45 DEG,1 X 2,0.1 CTR,0.240 MLG X 0.110 TAIL,30 GLD	80009	131-4752-00
A3J20	131-4752-00			CONN,HDR:PCB;MALE,45 DEG,1 X 2,0.1 CTR,0.240 MLG X 0.110 TAIL,30 GLD	80009	131-4752-00
A3J21	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-4530-00
A3J24	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-4530-00
A3L1	108-1268-00			COIL,RF:FIXED,56UH,10%,ON PDR	24226	10M562K
A3L2	108-1268-00			COIL,RF:FIXED,56UH,10%,ON PDR	24226	10M562K
A3L3	108-1262-00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108-1262-00
A3L4	108-1351-00			COIL,RF:	80009	108-1351-00
A3L5	108-1212-00			COIL,RF:FIXED,9UH,2%	TK1345	108-1212-00
A3L6	114-0500-00			COIL,RF,VAR:3.5-7.8 UH	80009	114-0500-00
A3L7	108-1352-00			COIL,RF:FIXED,22 UH	TK1345	108-1352-00
A3L8	108-1351-00			COIL,RF:FIXED,82 UH	80009	108-1351-00
A3L9	114-0500-00			COIL,RF,VAR:3.5-7.8 UH	80009	114-0500-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3P3	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPER	80009	131-3199-00
A3P5	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPER	80009	131-3199-00
A3P10	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPER	80009	131-3199-00
A3P21	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPER	80009	131-3199-00
A3P24	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPER	80009	131-3199-00
A3Q1	151-0195-02			XSTR,SIG:BIPOLAR,NPN;25V,100MA,150MHZ,AMPL;2N5223/MPS6521,TO-92 EBC	80009	151-0195-02
A3Q2	151-0216-04			XSTR,SIG:BIPOLAR,PNP;25V,100MA,170MHZ,AMPL;MPS6523,TO-92 EBC,T&A	80009	151-0216-04
A3Q3	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q4	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q5	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q6	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q7	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q8	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q9	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q10	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q11	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q12	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q13	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q14	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q15	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q16	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q17	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q18	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q19	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q20	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q21	151-0195-02			XSTR,SIG:BIPOLAR,NPN;25V,100MA,150MHZ,AMPL;2N5223/MPS6521,TO-92 EBC	80009	151-0195-02
A3Q22	151-0207-01			XSTR,SIG:BIPOLAR,NPN;45V,300MA,250MHZ,AMPL;PN100A,TO-92 EBC,T&A	80009	151-0207-01
A3Q23	151-0207-01			XSTR,SIG:BIPOLAR,NPN;45V,300MA,250MHZ,AMPL;PN100A,TO-92 EBC,T&A	80009	151-0207-01

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3Q24	151-0216-04			XSTR,SIG:BIPOLAR,PNP;25V,100MA,170MHZ,AMPL;MPS6523,TO-92 EBC,T&A	80009	151-0216-04
A3Q25	151-0710-02			XSTR,SIG:BIPOLAR,NPN;40V,1.0A,50MHZ,AMPL;2N6715/MP5W01A,TO-237/TO-226AE,T&A	80009	151-0710-02
A3Q26	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q27	151-0207-01			XSTR,SIG:BIPOLAR,NPN;45V,300MA,250MHZ,AMPL;PN100A,TO-92 EBC,T&A	80009	151-0207-01
A3Q28	151-0216-04			XSTR,SIG:BIPOLAR,PNP;25V,100MA,170MHZ,AMPL;MPS6523,TO-92 EBC,T&A	80009	151-0216-04
A3Q29	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q30	151-0347-00			XSTR,SIG:BIPOLAR,NPN;160V,600MA,100MHZ,AMPL;2N5551,TO-92 EBC	80009	151-0347-00
A3Q31	151-0350-00			XSTR,SIG:BIPOLAR,PNP;150V,600MA,100MHZ,AMPL;2N5401,TO-92 EBC	04713	2N5401
A3Q32	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q33	151-0347-00			XSTR,SIG:BIPOLAR,NPN;160V,600MA,100MHZ,AMPL;2N5551,TO-92 EBC	80009	151-0347-00
A3Q34	151-0350-00			XSTR,SIG:BIPOLAR,PNP;150V,600MA,100MHZ,AMPL;2N5401,TO-92 EBC	04713	2N5401
A3Q35	151-0216-04			XSTR,SIG:BIPOLAR,PNP;25V,100MA,170MHZ,AMPL;MPS6523,TO-92 EBC,T&A	80009	151-0216-04
A3Q36	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q37	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q38	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q39	151-0198-00			XSTR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ,AMPL;MPS918,TO-92 EBC	80009	151-0198-00
A3Q40	151-0198-00			XSTR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ,AMPL;MPS918,TO-92 EBC	80009	151-0198-00
A3Q41	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q42	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A3Q43	151-0195-02			XSTR,SIG:BIPOLAR,NPN;25V,100MA,150MHZ,AMPL;2N5223/MP56521,TO-92 EBC	80009	151-0195-02
A3Q44	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3Q45	151-0221-00			XSTR,SIG:BIPO-LAR,PNP;12V,80MA,SWING;MPS4258,TO-92 EBC	80009	151-0221-00
A3Q46	151-0221-00			XSTR,SIG:BIPO-LAR,PNP;12V,80MA,SWING;MPS4258,TO-92 EBC	80009	151-0221-00
A3Q47	151-0220-06			XSTR,SIG:BIPOLAR,PNP;40V,200MA,400MHZ,AMPL;2N3906(SEL),TO-92 EBC,T&A	80009	151-0220-06
A3Q48	151-0198-00			XSTR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ,AMPL;MPS918,TO-92 EBC	80009	151-0198-00
A3Q49	151-0223-00			XSTR,SIG:BIPOLAR,NPN;15V,500MA,SWING;MPS2369A,TO-92 EBC	80009	151-0223-00
A3Q50	151-0223-00			XSTR,SIG:BIPOLAR,NPN;15V,500MA,SWING;MPS2369A,TO-92 EBC	80009	151-0223-00
A3Q51	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3Q52	151-0198-00			XSTR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ, AMPL:MPS918,TO-92 EBC	80009	151-0198-00
A3Q53	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q54	151-0211-00			XSTR,SIG:BIPOLAR,NPN;30V VCEO,55V VCBO,400MA,500MHZ, AMPL:2N3866,TO-39	80009	151-0211-00
	214-1291-00			*ATTACHED PARTS* HTSK,XSTR:TO-5,SIL BRZ PTD BLK	05820	207SB
				*END ATTACHED PARTS*		
A3Q55	151-0220-06			XSTR,SIG:BIPOLAR,PNP;40V,200MA,400MHZ, AMPL:2N3906(SEL),TO-92 EBC,T&A	80009	151-0220-06
A3Q56	151-0198-00			XSTR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ, AMPL:MPS918,TO-92 EBC	80009	151-0198-00
A3Q57	151-0198-00			XSTR,SIG:BIPOLAR,NPN;15V,50MA,600 MHZ, AMPL:MPS918,TO-92 EBC	80009	151-0198-00
A3Q58	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q59	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q60	151-0220-06			XSTR,SIG:BIPOLAR,PNP;40V,200MA,400MHZ, AMPL:2N3906(SEL),TO-92 EBC,T&A	80009	151-0220-06
A3Q61	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q62	151-0211-00			XSTR,SIG:BIPOLAR,NPN;30V VCEO,55V VCBO,400MA,500MHZ, AMPL:2N3866,TO-39	80009	151-0211-00
	214-1291-00			*ATTACHED PARTS* HTSK,XSTR:TO-5,SIL BRZ PTD BLK	05820	207SB
				*END ATTACHED PARTS*		
A3Q63	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ, AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A3Q64	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q65	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q66	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q67	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q68	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q69	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q70	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ, AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A3Q71	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q72	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ, AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A3Q73	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A3Q74	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ, AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A3Q75	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ, AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A3Q76	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ, AMPL:2N3906,TO-92 EBC	80009	151-0188-00



## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3Q77	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A3R1	311-2265-00			RES,VAR,NONWWW:TRMR,200K OHM,20%,0.5W	80009	311-2265-00
A3R1	311-2265-00			RES,VAR,NONWWW:TRMR,200K OHM,20%,0.5W	80009	311-2265-00
A3R2	311-2269-00			RES,VAR,NONWWW:TRMR,20K OHM,20%,0.5W	80009	311-2269-00
A3R3	311-2269-00			RES,VAR,NONWWW:TRMR,20K OHM,20%,0.5W	80009	311-2269-00
A3R4	311-2269-00			RES,VAR,NONWWW:TRMR,20K OHM,20%,0.5W	80009	311-2269-00
A3R5	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 7K50
A3R6	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R7	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R8	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R9	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R10	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R11	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R12	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R13	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R14	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R15	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R16	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R17	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R18	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R19	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R20	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R21	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 20K
A3R22	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB47G5
A3R23	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R24	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R25	322-3363-00			RES,FXD,FILM:59K OHM,1%,0.2W,TC=TO	80009	322-3363-00
A3R26	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R27	307-0446-00			RES NTWK,FXD,FI:10K OHM,20%,(9)RES	80009	307-0446-00
A3R29	322-3251-00			RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 4K02
A3R30	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R31	311-2226-00			RES,VAR,NONWWW:TRMR,50 OHM,20%,0.5W LIN,T&R	TK1450	GF06UT 50 OHM
A3R32	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R33	322-3326-00			RES,FXD,FILM:24.3K OHM,1%,0.2W,TC=TO	91637	CCF50-2F24301F

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R34	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322-3254-00
A3R35	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R36	322-3402-00			RES,FXD:MET FILM;150K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3402-00
A3R37	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R38	322-3231-00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	80009	322-3231-00
A3R39	322-3190-00			RES,FXD,FILM:931 OHM,1%,0.2W,TC=T0	80009	322-3190-00
A3R40	322-3331-00			RES,FXD:MET FILM;27.4K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3331-00
A3R41	322-3402-00			RES,FXD:MET FILM;150K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3402-00
A3R42	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R43	307-0446-00			RES NTWK,FXD,FI:10K OHM,20%,(9)RES	80009	307-0446-00
A3R44	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R45	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R46	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R47	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R48	315-0225-00			RES,FXD,FILM:2.2M OHM,5%,0.25W	01121	CB2255
A3R49	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R50	311-2238-00			RES,VAR,TRMR:CERMET;50K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 50 K
A3R51	307-0696-00			RES NTWK,FXD,FI:7,10K OHM,2%,0.15W EACH	80009	307-0696-00
A3R52	315-0225-00			RES,FXD,FILM:2.2M OHM,5%,0.25W	01121	CB2255
A3R53	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R54	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R55	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R56	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R57	322-3369-00			RES,FXD:MET FILM;68.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3369-00
A3R58	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R59	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R60	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A3R61	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R62	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R63	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R64	322-3310-00			RES,FXD,FILM:16.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 16K5
A3R65	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R66	322-3147-00			RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R67	322-3273-00			RES,FXD:MET FILM;6.81K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3273-00
A3R68	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R69	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R70	322-3377-00			RES,FXD:MET FILM;82.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2F82501F
A3R71	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R72	322-3235-00			RES,FXD:MET FILM;2.74K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A3R73	322-3412-00			RES,FXD,FILM:191K OHM,1%,0.2W,TC=T0	80009	322-3412-00
A3R74	322-3412-00			RES,FXD,FILM:191K OHM,1%,0.2W,TC=T0	80009	322-3412-00
A3R75	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R76	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R77	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R78	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R79	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R80	322-3356-00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0	80009	322-3356-00
A3R81	322-3356-00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0	80009	322-3356-00
A3R82	322-3285-00			RES,FXD,FILM:9.09K OHM,1%,0.2W,TC=T0	80009	322-3285-00
A3R83	322-3246-00			RES,FXD,FILM:3.57K OHM,1%,0.2W,TC=T0	80009	322-3246-00
A3R84	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A3R85	301-0181-00			RES,FXD,FILM:180 OHM,5%,0.5W	80009	301-0181-00
A3R86	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R87	322-3377-00			RES,FXD:MET FILM;82.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2F82501F
A3R88	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R89	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R90	322-3262-00			RES,FXD,FILM:5.23K OHM,1%,0.2W,TC=T0	80009	322-3262-00
A3R91	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R92	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R93	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R94	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R95	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R96	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A3R97	322-3404-00			RES,FXD,FILM:158K OHM,1%,0.2W,TC=T0	91637	CCF50-2F15802F
A3R98	322-3418-00			RES,FXD:MET FILM;221K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 221K
A3R99	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R100	322-3379-00			RES,FXD,FILM:86.6K OHM,1%,0.2W,TC=T0	80009	322-3379-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R101	311-2238-00			RES,VAR,TRMR:CERMET;50K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 50 K
A3R102	322-3066-00			RES,FXD:MET FILM:47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A3R103	311-2232-00			RES,VAR,TRMR:CERMET,2K OHM,20%,0.5W	TK1450	GF06UT 2K
A3R104	322-3429-00			RES,FXD,FILM:287K OHM,1%,0.2W,TC=T0	80009	322-3429-00
A3R105	315-0225-00			RES,FXD,FILM:2.2M OHM,5%,0.25W	01121	CB2255
A3R106	322-3235-00			RES,FXD:MET FILM:2.74K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A3R107	322-3343-00			RES,FXD,FILM:36.5K OHM,1%,0.2W,TC=T0	80009	322-3343-00
A3R108	322-3285-00			RES,FXD,FILM:9.09K OHM,1%,0.2W,TC=T0	80009	322-3285-00
A3R109	322-3354-00			RES,FXD:MET FILM:47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R110	322-3235-00			RES,FXD:MET FILM:2.74K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A3R111	322-3330-00			RES,FXD,FILM:26.7K OHM,1%,0.2W,TC=T0	80009	322-3330-00
A3R112	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A3R113	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R114	322-3162-00			RES,FXD:MET FILM:475 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3162-00
A3R115	322-3258-00			RES,FXD:MET FILM:4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R116	322-3354-00			RES,FXD:MET FILM:47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R117	322-3162-00			RES,FXD:MET FILM:475 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3162-00
A3R118	322-3258-00			RES,FXD:MET FILM:4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R119	322-3410-00			RES,FXD:MET FILM:182K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3410-00
A3R120	322-3258-00			RES,FXD:MET FILM:4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R121	322-3293-00			RES,FXD:MET FILM:11K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3293-00
A3R122	322-3258-00			RES,FXD:MET FILM:4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R123	322-3318-00			RES,FXD:MET FILM:20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R124	322-3421-00			RES,FXD,FILM:237K OHM,1%,0.2W,TC=T0	91637	CCF50-2F23702F
A3R125	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R126	321-0486-00			RES,FXD,FILM:1.13 MEG OHM,1%,0.125W,T=T0	80009	321-0486-00
A3R127	322-3339-00			RES,FXD:MET FILM:33.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3339-00
A3R128	322-3258-00			RES,FXD:MET FILM:4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R129	322-3329-00			RES,FXD,FILM:26.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 26K1
A3R130	322-3318-00			RES,FXD:MET FILM:20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R131	322-3354-00			RES,FXD:MET FILM:47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R132	322-3220-00			RES,FXD,FILM:1.91K OHM,1%,0.2W,TC=T0	80009	322-3220-00
A3R133	322-3354-00			RES,FXD:MET FILM:47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R134	322-3354-00			RES,FXD:MET FILM:47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R135	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R136	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R137	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R138	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A3R139	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R140	322-3356-00			RES,FXD,FILM;49.9K OHM,1%,0.2W,TC=T0	80009	322-3356-00
A3R141	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A3R142	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R143	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R144	322-3412-00			RES,FXD,FILM;191K OHM,1%,0.2W,TC=T0	80009	322-3412-00
A3R145	322-3293-00			RES,FXD:MET FILM;11K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3293-00
A3R146	322-3481-00			RES,FXD,FILM;1M OHM.1%,0.2W,TC=T0	80009	322-3481-00
A3R147	322-3254-00			RES,FXD,FILM;4.32K OHM,1%,0.2W,TC=T0	80009	322-3254-00
A3R148	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A3R149	322-3231-00			RES,FXD,FILM;2.49K OHM,1%,0.2W,TC=T0	80009	322-3231-00
A3R150	322-3121-00			RES,FXD:MET FILM;178 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3121-00
A3R151	311-2226-00			RES,VAR,NONWW:TRMR,50 OHM,20%,0.5W LIN,T&R	TK1450	GF06UT 50 OHM
A3R152	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A3R153	322-3338-00			RES,FXD,FILM;32.4K OHM,1%,0.2W,TC=T0	91637	CCF50-2F32401F
A3R154	322-3429-00			RES,FXD,FILM;287K OHM,1%,0.2W,TC=T0	80009	322-3429-00
A3R155	322-3189-00			RES,FXD,FILM;909 OHM,1%,0.2W,TC=T0	57668	CRB 20 FXE 909E
A3R156	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R157	322-3452-00			RES,FXD,FILM;499K OHM,1%,0.2W,TC=T0	91637	CCF50-2-G4993FT
A3R158	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R159	322-3231-00			RES,FXD,FILM;2.49K OHM,1%,0.2W,TC=T0	80009	322-3231-00
A3R160	322-3089-00			RES,FXD:MET FILM;82.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3089-00
A3R161	311-2226-00			RES,VAR,NONWW:TRMR,50 OHM,20%,0.5W LIN,T&R	TK1450	GF06UT 50 OHM
A3R162	322-3089-00			RES,FXD:MET FILM;82.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3089-00
A3R163	322-3030-00			RES,FXD:MET FILM;20 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3030-00
A3R164	322-3310-00			RES,FXD,FILM;16.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 16K5
A3R165	322-3379-00			RES,FXD,FILM;86.6K OHM,1%,0.2W,TC=T0	80009	322-3379-00
A3R166	311-2234-00			RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ, TOP ADJUST;T&R	TK1450	GF06UT 5K
A3R167	322-3285-00			RES,FXD,FILM;9.09K OHM,1%,0.2W,TC=T0	80009	322-3285-00
A3R168	322-3308-00			RES,FXD,FILM;15.8K OHM,1%,0.2W,TC=T0	80009	322-3308-00
A3R169	322-3402-00			RES,FXD:MET FILM;150K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3402-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R170	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 20K
A3R171	322-3293-00			RES,FXD:MET FILM;11K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3293-00
A3R172	322-3435-00			RES,FXD:MET FILM;332K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3435-00
A3R173	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R174	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R175	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R176	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R177	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R178	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R179	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R180	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R181	322-3218-00			RES,FXD:MET FILM;1.82K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3218-00
A3R182	322-3200-00			RES,FXD,FILM:1.18K OHM,1%,0.2W,TC=T0	80009	322-3200-00
A3R183	322-3251-00			RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K02
A3R184	322-3200-00			RES,FXD,FILM:1.18K OHM,1%,0.2W,TC=T0	80009	322-3200-00
A3R185	311-2234-00			RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 5K
A3R186	322-3308-00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0	80009	322-3308-00
A3R187	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R188	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R189	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R190	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R191	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R192	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R193	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R194	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R195	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A3R196	322-3218-00			RES,FXD:MET FILM;1.82K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3218-00
A3R197	322-3179-00			RES,FXD,FILM:715 OHM,1%,0.2W,TC=T0	80009	322-3179-00
A3R198	322-3308-00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0	80009	322-3308-00
A3R199	322-3308-00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0	80009	322-3308-00
A3R200	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	57668	CRB20 DYE 13K0
A3R201	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R202	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R203	322-3281-00			RES,FXD:MET FILM;8.25K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3281-00
A3R204	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R205	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R206	322-3243-00			RES,FXD:MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A3R207	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R208	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ, TOP ADJUST;T&R	TK1450	GF06UT 500
A3R209	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R210	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R211	322-3165-00			RES,FXD,FILM:511 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 511E
A3R212	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R213	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R214	322-3414-00			RES,FXD:MET FILM;200K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF501G20002F
A3R215	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E
A3R216	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E
A3R217	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R218	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R218	322-3465-00			RES,FXD,FILM:681K OHM,1%,0.2W,TC=T0	91637	CCF-506813F
A3R219	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ, TOP ADJUST;T&R	TK1450	GF06UT 500
A3R220	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R221	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E
A3R222	322-3203-00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0	80009	322-3203-00
A3R223	322-3203-00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0	80009	322-3203-00
A3R224	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R225	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R226	322-3379-00			RES,FXD,FILM:86.6K OHM,1%,0.2W,TC=T0	80009	322-3379-00
A3R227	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R228	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	57668	CRB20 DYE 13K0
A3R229	322-3293-00			RES,FXD:MET FILM;11K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3293-00
A3R230	322-3335-00			RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 30K1
A3R231	322-3233-00			RES,FXD,FILM:2.61K OHM,1%,0.2W,TC=T0	80009	322-3233-00
A3R232	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R233	322-3233-00			RES,FXD,FILM:2.61K OHM,1%,0.2W,TC=T0	80009	322-3233-00
A3R234	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R235	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R236	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R237	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R238	322-3114-00			RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A3R239	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R241	322-3147-00			RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A3R242	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R243	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A3R244	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A3R245	322-3418-00			RES,FXD:MET FILM;221K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 221K
A3R246	322-3377-00			RES,FXD:MET FILM;82.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2F82501F
A3R247	322-3268-00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0	80009	322-3268-00
A3R248	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R249	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R250	322-3231-00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	80009	322-3231-00
A3R251	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	57668	CRB20 DYE 13K0
A3R252	322-3185-00			RES,FXD:MET FILM;825 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 825E
A3R253	322-3165-00			RES,FXD,FILM:511 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 511E
A3R254	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A3R255	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R256	322-3363-00			RES,FXD,FILM:59K OHM,1%,0.2W,TC=T0	80009	322-3363-00
A3R257	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A3R258	311-2240-00			RES,VAR,NONWW:TRMR,200K OHM,20%,0.5W LIN	TK1450	GF06UT 200K
A3R259	322-3306-00			RES,FXD:MET FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A3R260	322-3204-00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0	80009	322-3204-00
A3R261	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R262	322-3435-00			RES,FXD:MET FILM;332K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3435-00
A3R263	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A3R264	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R265	322-3339-00			RES,FXD:MET FILM;33.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3339-00
A3R266	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R267	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R268	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R269	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F



## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R270	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R271	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A3R272	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R273	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R274	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3001-00
A3R275	322-3243-00			RES,FXD:MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A3R276	301-0681-00			RES,FXD,FILM:680 OHM,5%,0.5W	01121	EB6815
A3R277	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A3R278	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R279	322-3190-00			RES,FXD,FILM:931 OHM,1%,0.2W,TC=T0	80009	322-3190-00
A3R280	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R281	322-3243-00			RES,FXD:MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A3R282	322-3206-00			RES,FXD,FILM:1.37K OHM,1%,0.2W,TC=T0	80009	322-3206-00
A3R283	322-3114-00			RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A3R284	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E
A3R285	322-3175-00			RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	80009	322-3175-00
A3R286	322-3216-00			RES,FXD,FILM:1.74K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K74
A3R287	322-3242-00			RES,FXD,FILM:3.24K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K24
A3R288	322-3204-00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0	80009	322-3204-00
A3R289	322-3175-00			RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	80009	322-3175-00
A3R290	322-3235-00			RES,FXD:MET FILM;2.74K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A3R291	322-3335-00			RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 30K1
A3R292	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R293	322-3335-00			RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 30K1
A3R294	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3258-00
A3R295	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3258-00
A3R296	322-3207-00			RES,FXD,FILM:1.4K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K4
A3R297	322-3085-00			RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A3R298	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3258-00
A3R299	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A3R300	322-3235-00			RES,FXD:MET FILM;2.74K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A3R301	311-2232-00			RES,VAR,TRMR:CERMET,2K OHM,20%,0.5W,0.197 SQ,TOP ADJUST:T&R	TK1450	GF06UT 2K
A3R302	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A3R303	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A3R304	322-3201-00			RES,FXD:MET FILM;1.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3201-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R305	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A3R306	322-3141-00			RES,FXD,FILM:287 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 287E
A3R307	322-3256-00			RES,FXD,FILM:4.53K OHM,1%,0.2W,TC=T0	80009	322-3256-00
A3R308	322-3311-00			RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0	56845	CCF-50-2-1692F
A3R309	322-3156-00			RES,FXD,FILM:412 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 412E
A3R310	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R311	322-3333-02			RES,FXD,FILM:28.7K OHM,0.2W,.5%,TAPED&RE- ELED,SM BODY	80009	322-3333-02
A3R312	322-3367-00			RES,FXD,FILM:64.9K OHM,1%,0.2W,TC=T0	80009	322-3367-00
A3R313	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R314	322-3251-00			RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K02
A3R315	322-3197-00			RES,FXD,FILM:1.1K OHM,1%,0.2W,TC=T0	80009	322-3197-00
A3R316	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R317	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R318	322-3170-00			RES,FXD,FILM:576 OHM,1%,0.2W,TC=T0	80009	322-3170-00
A3R319	322-3274-00			RES,FXD,FILM:6.98K OHM,1%,0.2W,TC=T0	91637	CCF502G69800FT
A3R320	301-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.5W	80009	301-0472-00
A3R321	322-3256-00			RES,FXD,FILM:4.53K OHM,1%,0.2W,TC=T0	80009	322-3256-00
A3R322	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R323	322-3155-00			RES,FXD,FILM:402 OHM,1%,0.2W,TC=T0	80009	322-3155-00
A3R324	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A3R325	322-3367-00			RES,FXD,FILM:64.9K OHM,1%,0.2W,TC=T0	80009	322-3367-00
A3R326	322-3346-00			RES,FXD:MET FILM;39.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3346-00
A3R327	322-3179-00			RES,FXD,FILM:715 OHM,1%,0.2W,TC=T0	80009	322-3179-00
A3R328	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R329	311-2233-00			RES,VAR,TRMR:CERMET;3K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	80009	311-2233-00
A3R330	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R331	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R332	308-0783-00			RES,FXD,WW:1K OHM,1%,3W,TC=30PPM	80009	308-0783-00
A3R333	322-3271-00			RES,FXD,FILM:6.49K OHM,1%,0.2W,TC=T0	91637	CCF502G64900FT
A3R334	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A3R335	322-3062-00			RES,FXD,FILM:43.2 OHM,1%,0.2W,TC=T0	57668	RB20FXE43E2
A3R336	322-3156-00			RES,FXD,FILM:412 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 412E
A3R337	322-3083-00			RES,FXD,FILM:71.5 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 71E5
A3R338	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 500
A3R339	322-3242-00			RES,FXD,FILM:3.24K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K24
A3R340	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R341	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R342	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R343	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R344	308-0783-00			RES,FXD,VVW:1K OHM,1%,3W,TC=30PPM	80009	308-0783-00
A3R345	322-3244-00			RES,FXD,FILM:3.4K OHM,1%,0.2W,TC=T0	80009	322-3244-00
A3R346	322-3274-00			RES,FXD,FILM:6.98K OHM,1%,0.2W,TC=T0	91637	CCF502G69800FT
A3R347	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R348	322-3275-00			RES,FXD,FILM:7.15K OHM,1%,0.2W,TC=T0	80009	322-3275-00
A3R349	322-3268-00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0	80009	322-3268-00
A3R350	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A3R351	301-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.5W	80009	301-0472-00
A3R352	322-3271-00			RES,FXD,FILM:6.49K OHM,1%,0.2W,TC=T0	91637	CCF502G64900FT
A3R353	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A3R354	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R355	322-3268-00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0	80009	322-3268-00
A3R356	322-3218-00			RES,FXD:MET FILM;1.82K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3218-00
A3R357	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R358	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R359	311-2234-00			RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ, TOP ADJUST;T&R	TK1450	GF06UT 5K
A3R360	322-3201-00			RES,FXD:MET FILM;1.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3201-00
A3R361	322-3273-00			RES,FXD:MET FILM:6.81K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3273-00
A3R362	322-3250-00			RES,FXD:MET FILM;3.92K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2F39200F
A3R363	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R364	322-3231-00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	80009	322-3231-00
A3R365	322-3302-00			RES,FXD,FILM:13.7K OHM,1%,0.2W,TC=T0	80009	322-3302-00
A3R366	322-3339-00			RES,FXD:MET FILM;33.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3339-00
A3R367	322-3281-00			RES,FXD:MET FILM;8.25K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3281-00
A3R368	322-3354-00			RES,FXD:MET FILM;47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A3R369	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R370	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R371	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K99
A3R372	322-3235-00			RES,FXD:MET FILM;2.74K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A3R373	322-3250-00			RES,FXD:MET FILM;3.92K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2F39200F
A3R374	322-3105-00			RES,FXD:MET FILM;121 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3105-00
A3R375	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R376	322-3273-00			RES,FXD:MET FILM:6.81K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3273-00
A3R377	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A3R378	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R379	322-3306-00			RES,FXD:MET FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A3R380	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A3R381	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A3R382	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R383	321-0754-07			RES,FXD,FILM:900 OHM,0.1%,0.125W,TC=T9	2M627	
A3R384	321-0754-07			RES,FXD,FILM:900 OHM,0.1%,0.125W,TC=T9	2M627	
A3R385	322-3410-00			RES,FXD:MET FILM;182K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3410-00
A3R386	311-0614-00			RES,VAR,NONWWW:TRMR,30K OHM,0.5W	80009	311-0614-00
A3R387	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R388	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R389	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R390	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A3R391	322-3105-00			RES,FXD:MET FILM;121 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3105-00
A3R392	322-3318-00			RES,FXD:MET FILM;20K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 20K0
A3R393	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R394	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R395	322-3410-00			RES,FXD:MET FILM;182K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3410-00
A3R396	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A3R397	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R398	322-3297-00			RES,FXD:MET FILM;12.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 12K1
A3R399	322-3235-00			RES,FXD:MET FILM;2.74K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K74
A3R400	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R401	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A3R402	322-3250-00			RES,FXD:MET FILM;3.92K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2F39200F
A3R403	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R404	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A3R405	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A3R406	322-3410-00			RES,FXD:MET FILM;182K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3410-00
A3R407	321-0603-07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9	80009	321-0603-07
A3R408	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R409	322-3243-00			RES,FXD:MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R410	322-3418-00			RES,FXD:MET FILM;221K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 221K
A3R411	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R412	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A3R413	322-3243-00			RES,FXD:MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A3R414	322-3147-00			RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A3R415	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R416	322-3147-00			RES,FXD:MET FILM;4.32K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A3R417	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A3R418	321-0603-07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9	80009	321-0603-07
A3R419	322-3243-00			RES,FXD:MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A3R420	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322-3254-00
A3R421	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A3R422	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A3R423	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R424	321-0603-07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9	80009	321-0603-07
A3R425	322-3185-00			RES,FXD:MET FILM;825 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 825E
A3R426	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A3R427	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R428	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R430	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A3R431	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R432	321-0603-07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9	80009	321-0603-07
A3R433	322-3185-00			RES,FXD:MET FILM;825 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 825E
A3R434	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A3R435	322-3306-00			RES,FXD:MET FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A3R436	322-3306-00			RES,FXD:MET FILM;15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A3R437	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R438	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R439	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R440	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R441	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R442	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3R443	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R444	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R445	-----			(TEST SELECTED)		
A3R446	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 500
A3R447	322-3356-00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0	80009	322-3356-00
A3R448	311-2236-00			RES,VAR,TRMR:CERMET;20K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST;T&R	TK1450	GF06UT 20K
A3R449	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A3R450	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R451	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R452	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R453	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A3R454	322-3338-00			RES,FXD,FILM:32.4K OHM,1%,0.2W,TC=T0	91637	CCF50-2F32401F
A3R455	311-2231-00			RES,VAR,TRMR:CERMET;1K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 1K
A3R456	307-0103-00			RES,FXD,CMPSN:2.7 OHM,5%,0.25W	80009	307-0103-00
A3R460	315-0106-00			RES,FXD,FILM:10M OHM,5%,0.25W	01121	CB1065
A3S1	260-2301-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F3152
A3S2	260-2301-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F3152
A3S3	260-2301-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F3152
A3S4	260-2301-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F3152
A3S5	260-2301-00			SW,PUSH:SPST,25MA,15VAC	34361	B3F3152
A3U1	156-0259-00			IC,LIN:	80009	156-0259-00
A3U2	156-1430-00			IC,DGTL:CMOS,MISC;4-DIGIT LED DISPLAY CONT- TLER;74C911,DIP28.6,TUBE	27014	MM74C911 N
A3U4	160-8682-02	B050000	B051734	IC,DGTL:CMOS,EPROM;MICROCON- TLER,8-BIT,87C541	80009	160-8682-02
A3U4	163-0648-00	B051735	B051895	IC,PROCESSOR:CMOS,MICROCOMPUTER,8-BIT, 33 MHZ,16KX8 OTP EPROM,256X8 RAM,SERIAL CHANNEL,80C51 F	TK0198	DALLAS DS87C520-MCL W/163-0648-00 C
A3U4	163-0648-01	B051896	B051905	IC,PROCESSOR:PRGM 156-4649-00,CMOS,MICROCOMPUTER,8-BIT,33 MHZ,16K X 8 OTP EPROM,256 X 8 RAM,S	TK0198	163-0648-01 (PRGRM DALLAS DS87C520-
A3U4	163-0648-02	B051906		IC,PROCESSOR:PRGM 156-4649-00,CMOS,MICROCOMPUTER,8-BIT,33 MHZ,16K X 8 OTP EPROM,256 X 8 RAM,S  *MOUNTING PARTS*	TK0198	163-0648-02
	136-0757-00			SKT,DIP:  *END MOUNTING PARTS*	09922	DILB40P-108
A3U5	156-1373-00			IC,DGTL:LSTTL,BFR/DRV;QUAD, 3-STATE;74LS125,DIP14.3,TUBE	80009	156-1373-00
A3U6	156-1150-00			IC,LIN:BIPO- LAR,VR,NEG,-5.0V,100MA,4%;MC79L05ACP;TO-92	80009	156-1150-00
A3U7	156-2396-00			IC,MISC:	01295	TL7705 ACP
A3U8	156-2029-00			IC,MEM:NMOS,NVRAM;16 X 16, SER DATA;X2443,DIP8  *MOUNTING PARTS*	60395	X2444P
	136-0727-00			SKT,PL-IN ELEK;MICROCKT,8 CONT  *END MOUNTING PARTS*	09922	DILB8P-108

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3U9	156-1126-00			IC,LIN:BIPOLAR,COMPTR:OPEN COLL,200NS;LM311N,DIP08.3	80009	156-1126-00
A3U10	156-2493-00			IC,CONV:	80009	156-2493-00
A3U11	156-2111-00			IC,DGTL:ALSTTL,LATCH;OCTAL D-TYPE TRANS, 3-STATE;74ALS373A,DIP20.3,TUBE	01295	SN74ALS373N3
A3U12	156-0913-00			IC,DGTL:LSSTTL,FLIP FLOP;OCTAL D-TYPE, ENABLE;74LS377,DIP20.3,TUBE	80009	156-0913-00
A3U13	156-0991-00			IC,LIN:BIPO-LAR,VR:POS,5.0V,100MA,5%;MC78L05ACP,TO-92	80009	156-0991-00
A3U14	156-1191-00			IC,LIN:BIFET,OP-AMP;DUAL;TL072CN/LF353N,DIP08.3	80009	156-1191-00
A3U15	156-0910-00		B051734	IC,DGTL:LSSTTL,CNTR;DUAL 4-BIT DE-CADE;74LS390,DIP16.3,TUBE	80009	156-0910-00
A3U15	136-0729-00	B051735		SOCKET,DIP:PCB,FEMALE,STR,2 X 8,16 POS,0.1 X 0.3 CTR,0.175 H X 0.130 TAIL,BECU,TIN	98291	DIPS16PIT
A3U16	156-0956-00			IC,DGTL:LSSTTL,BFR/DRVR;OCTAL NONINV, 3-STATE;74LS244,DIP20.3,TUBE	80009	156-0956-00
A3U17	156-0941-00			IC,DGTL:CMOS,GATE;QUAD 2-INPUT NAND;74C00,DIP14.3,TUBE	27014	MM74C00 J OR N
A3U18	156-0575-00			IC,DGTL:CMOS,GATE:TPL 3-INPUT NOR;4025B,DIP14.3,TUBE	80009	156-0575-00
A3U19	156-0913-00			IC,DGTL:LSSTTL,FLIP FLOP;OCTAL D-TYPE, ENABLE;74LS377,DIP20.3,TUBE	80009	156-0913-00
A3U20	160-8803-00			IC,DGTL:CMOS,PLD:EEPLD,16V8,25NS,DIP20.3	80009	160-8803-00
A3U21	160-8681-00			IC,DGTL:CMOS,PLD:EEPLD,16V8,25NS,DIP20.3	80009	160-8681-00
A3U22	156-1225-00			IC,LIN:BIPOLAR,COMPTR:DUAL,OPEN COLL,300NS;LM393N,DIP08.3	01295	LM393P
A3U23	156-2009-00			IC,DGTL:HCMOS,FLIP FLOP;DUAL D-TYPE;74HC74,DIP14.3,TUBE	80009	156-2009-00
A3U24	156-0750-03			IC,DGTL:CMOS,MULTIVIBRATOR;DUAL MONOST-ABLE;74C221,DIP16.3	27014	74C221N
A3U25	156-0704-00			IC,MISC:CMOS,PLL:LOW SPEED;MC14046BCP,DIP16.3	04713	MC14046CP
A3U26	156-0941-00			IC,DGTL:CMOS,GATE;QUAD 2-INPUT NAND;74C00,DIP14.3,TUBE	27014	MM74C00 J OR N
A3U27	156-1225-00			IC,LIN:BIPOLAR,COMPTR:DUAL,OPEN COLL,300NS;LM393N,DIP08.3	01295	LM393P
A3U28	156-0750-03			IC,DGTL:CMOS,MULTIVIBRATOR;DUAL MONOST-ABLE;74C221,DIP16.3	27014	74C221N
A3U29	156-1191-00			IC,LIN:BIFET,OP-AMP;DUAL;TL072CN/LF353N,DIP08.3	80009	156-1191-00
A3U30	156-0048-00			IC,LIN:	80009	156-0048-00
A3U31	156-1191-00			IC,LIN:BIFET,OP-AMP;DUAL;TL072CN/LF353N,DIP08.3	80009	156-1191-00
A3U32	156-1225-00			IC,LIN:BIPOLAR,COMPTR:DUAL,OPEN COLL,300NS;LM393N,DIP08.3	01295	LM393P
A3U33	156-1191-00			IC,LIN:BIFET,OP-AMP;DUAL;TL072CN/LF353N,DIP08.3	80009	156-1191-00
A3U34	156-1225-00			IC,LIN:BIPOLAR,COMPTR:DUAL,OPEN COLL,300NS;LM393N,DIP08.3	01295	LM393P
A3U35	156-1451-00			IC,LIN:BIPOLAR,VR:NEG,ADJUST,1.5A,4%;LM337T,TO-220	80009	156-1451-00
A3U36	156-0048-00			IC,LIN:	80009	156-0048-00
A3U37	156-1225-00			IC,LIN:BIPOLAR,COMPTR:DUAL,OPEN COLL,300NS;LM393N,DIP08.3	01295	LM393P
A3U38	156-1161-00			IC,LIN:BIPOLAR,VR:POS,ADJUST,1.5A,4%;LM317T,TO-220	04713	LM317T

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A3U39	156-1850-00			IC,MISC:CMOS,ANALOG SW;QUAD;DG211,DIP16.3	17856	SDG21107
A3U40	156-2460-00			IC,MISC:BIPOLAR,MOD/DEMODO;BAL- ANCED;MC1496P,DIP14.3	04713	MC1496P
A3U41	156-0048-00			IC,LIN:	80009	156-0048-00
A3U42	156-1850-00			IC,MISC:CMOS,ANALOG SW;QUAD;DG211,DIP16.3	17856	SDG21107
A3U43	156-1149-00			IC,LIN:BIFET,OP-AMP;LF351N,DIP08.3	27014	LF351N/GLEA134
A3U44	156-3972-00			IC,MISC:CMOS,ANALOG SW;QUAD SPST,100 OHM,400NS;DG444,DIP16.3	80009	156-3972-00
A3U45	156-1917-00			IC,DGTL:LSTTL,SHIFT RGTR;8-BIT W/OUT LATCH;74LS595,DIP16.3,TUBE	80009	156-1917-00
A3U46	156-2460-00			IC,MISC:BIPOLAR,MOD/DEMODO;BAL- ANCED;MC1496P,DIP14.3	04713	MC1496P
A3U47	156-0048-00			IC,LIN:	80009	156-0048-00
A3U48	156-1381-00			IC,LIN:BIPOLAR,XSTR ARRAY;THREE NPN,TWO PNP,INDEPENDENT;CA3096AE,DIP16.3	02735	CA3096AE-17
A3U49	156-1850-00			IC,MISC:CMOS,ANALOG SW;QUAD;DG211,DIP16.3	17856	SDG21107
A3U50	156-1191-00			IC,LIN:BIFET,OP-AMP;DUAL;TL072CN/ LF353N,DIP08.3	80009	156-1191-00
A3U51	156-0048-00			IC,LIN:	80009	156-0048-00
A3U52	156-2476-00			IC,MISC:HCMOS,ANALOG MUX;DUAL 4 CHAN- NEL;74HC4052,DIP16.3	80009	156-2476-00
A3U53	156-2029-00			IC,MEM:NMOS,NVRAM;16 X 16, SER DATA;X2443,DIP8	60395	X2444P
	136-0727-00			*MOUNTING PARTS* SKT,PL-IN ELEK;MICROCKT,8 CONT	09922	DILB8P-108
				*END MOUNTING PARTS*		
A3VR1	152-0688-00			DIO,ZENER:2.4V,5%,0.4W;1N4370A,DO-7 OR 35	04713	1N4370A
A3VR2	152-0243-00			DIO,ZENER:15V,5%,0.4W;1N965B,DO-7 OR 35,TR	14433	Z5412
A3VR3	152-0359-00			DIO,ZENER:9V,500MW,5%,TEMP COMPEN- SATED;1N935,DO-35	04713	SZ50850
A3VR4	152-0175-00			DIO,ZENER:5.6V,5%,0.4W;1N752A,DO-7 OR 35,TR	14552	TD3810976
A3VR5	152-0175-00			DIO,ZENER:5.6V,5%,0.4W;1N752A,DO-7 OR 35,TR	14552	TD3810976
A3VR6	152-0175-00			DIO,ZENER:5.6V,5%,0.4W;1N752A,DO-7 OR 35,TR	14552	TD3810976
A3W1	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A3W2	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A3W4	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A3W6	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A3W7	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A3W9	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A3W10	174-0334-00			CA ASSY,RF:50 OHM COAX,5.25 L,9-N	80009	174-0334-00
A3W20	196-3146-00			FLEX STRIP:SGL JUMPER,1.0 L	15912	FSN-LA
A3W21	196-3146-00			FLEX STRIP:SGL JUMPER,1.0 L	15912	FSN-LA
A3W22	196-3146-00			FLEX STRIP:SGL JUMPER,1.0 L	15912	FSN-LA
A3W23	196-3146-00			FLEX STRIP:SGL JUMPER,1.0 L	15912	FSN-LA
A3Y1	158-0300-00			XTAL UNIT,QTZ:12 MHZ,0.05%,SER RESONANT	80009	158-0300-00
A3A1	671-1796-01			CIRCUIT BD ASSY:GRATICULE LIGHT	80009	671-1796-01
A3A1DS100	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MOUNT	80009	150-0168-00
	136-1119-01			*MOUNTING PARTS* SKT,LPHLDR:PCB,LPHLDR;FEM,STR,SGL,0.404 H X 0.218 TAIL,TIN,T-1.75 WEDGE BASE	80009	136-1119-01
				*END MOUNTING PARTS*		
A3A1DS200	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MOUNT	80009	150-0168-00
				*MOUNTING PARTS*		



## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
	136-1119-01			SKT,LPHLDR:PCB,LPHLDR:FEM,STR,SGL,0.404 H X 0.218 TAIL,TIN,T-1.75 WEDGE BASE *END MOUNTING PARTS*	80009	136-1119-01
A3A1DS300	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MOUNT *MOUNTING PARTS*	80009	150-0168-00
	136-1119-01			SKT,LPHLDR:PCB,LPHLDR:FEM,STR,SGL,0.404 H X 0.218 TAIL,TIN,T-1.75 WEDGE BASE *END MOUNTING PARTS*	80009	136-1119-01
A3A1J100	131-4530-00			CONN,HDR:PCB:MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-4530-00
A3A1P100	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPER	80009	131-3199-00
A3A1P200	131-2790-00			CONN,HDR:PCB:RTANG,1 X 2,0.15 CTR,0.230 MLG X 0.120 TAIL,30 GLD	80009	131-2790-00
A3A1P800	131-2790-00			CONN,HDR:PCB:RTANG,1 X 2,0.15 CTR,0.230 MLG X 0.120 TAIL,30 GLD	80009	131-2790-00
A3A2	671-3899-00			CIRCUIT BD ASSY:CALIBRATOR	80009	671-3899-00
A3A2U1	156-5710-01			IC,DIGITAL:HCMOS,FLIP FLOP,DUAL J-K, PRESET, CLEAR,74HC109,SO16.150	04713	MC74HC109D
A3A2U2	156-5566-00			IC,DIGITAL:HCTCMOS,COUNTER,DUAL 4-BIT DECADE,ASYNCH RESET,74HCT390,SO16.150	01295	74HCT390
A3A2J1-J2	131-6129-00			CONN,HDR:PCB,ADAPTER,MALE,STR,2 X 8,0.3 CTR,0.155 MLG X 0.166 TAIL,GOLD/GOLD	63058	DST 316-876S

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A4	671-2273-02			CIRCUIT BD ASSY:DAC *ATTACHED PARTS*	80009	671-2273-02
	214-3841-00			HTSK,XSTR:TO-220 W/SLDR TABS,AL (QUANTITY 2)	80009	214-3841-00
	337-0896-00			PLATE,ELEC SHLD:B SWEEP CKT BD *END ATTACHED PARTS*	TK2278	ORDER BY DESCR
A4C1	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C2	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C3	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C4	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C5	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C6	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C7	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C8	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C9	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C10	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C11	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C12	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	80009	283-0203-00
A4C13	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C14	283-0633-01			CAP,FXD,MICA DI:77PF,1%,500V	09023	CDA15ED770F03
A4C15	283-0775-00			CAP,FXD,MICA DI:1764 PF,1%,500V	80009	283-0775-00
A4C16	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C17	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A4C18	283-0635-01			CAP,FXD,MICA DI:51PF,1%,500V	09023	CDA15ED510F03
A4C19	283-0631-01			CAP,FXD,MICA DI:95PF,1%,500V	80009	283-0631-01
A4C20	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A4C21	283-0672-00			CAP,FXD,MICA DI:200PF,1%,500V	80009	283-0672-00
A4C22	283-0615-01			CAP,FXD,MICA DI:33PF,5%,500V	09023	CDA15ED330J03
A4C23	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C24	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C25	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A4C26	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A4C27	283-0687-00			CAP,FXD,MICA DI:560PF,2%,300V	80009	283-0687-00
A4C28	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C29	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C30	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C31	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C32	283-0674-00			CAP,FXD,MICA DI:85PF,1%,500V	80009	283-0674-00
A4C33	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C34	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A4C35	283-0689-01			CAP,FXD,MICA DI:550PF,1%,300V,T&A	09023	CDA15FC551F03
A4C36	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C37	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C38	283-0647-01			CAP,FXD,MICA DI:70PF,1%,500V,T&A	09023	CDA15ED700F03
A4C39	283-0646-01			CAP,FXD,MICA DI:170PF,1%,500V,T&A	80009	283-0646-01
A4C40	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	24165	513D107M025BB4D
A4C41	281-0810-00			CAP,FXD,CER:MCL:5.6PF,+/-0.5PF,100V	04222	SA101A5R6DAA
A4C42	281-0810-00			CAP,FXD,CER:MCL:5.6PF,+/-0.5PF,100V	04222	SA101A5R6DAA
A4C43	281-0182-00			CAP,VAR,PLSTC:1.8-10PF,300V	19701	2805D1R810BH03F0
A4C44	281-0756-00			CAP,FXD,CER:MCL:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A4C46	281-0797-00			CAP,FXD,CER:MCL:15PF,10%,100V,SAF	80009	281-0797-00
A4C47	281-0184-00			CAP,VAR,PLSTC:2-18PF,500VDC	80009	281-0184-00
A4C48	281-0811-00			CAP,FXD,CER:MCL:10PF,10%,100V	04222	SA102A100KAA
A4C49	281-0763-00			CAP,FXD,CER:MCL:47PF,10%,100V	04222	SA102A470KAA
A4C50	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A4C51	281-0810-00			CAP,FXD,CER:MLC;5.6PF,+/-0.5PF,100V	04222	SA101A5R6DAA
A4C52	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C53	281-0811-00			CAP,FXD,CER:MLC;10PF,10%,100V	04222	SA102A100KAA
A4C54	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V	04222	SA105E104MAA
A4C55	290-0939-00			CAP,FXD,ELCTLT:10UF,+100-10%,100V	80009	290-0939-00
A4C56	290-1302-00			CAP,FXD,ELCTLT:1000UF,20%,35V,LOW IMP	80009	290-1302-00
A4C57	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A4C58	290-1314-00			CAP,FXD,ALUM:330UF,20%,63V,13 X 25MM;RDL	TK1424	UPL1J331MHH
A4C59	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A4C60	290-1312-00			CAP,FXD,AL:2.2UF,20%,315V;10 X 125MM,0.2SP,RDL,105 DEG,T&A	80009	290-1312-00
A4C61	285-1329-00			CAP,FXD,PLSTC:MTLZD FILM;680PF,10%,1600V, POLYPROPYLENE,.70X.43; RDL,T/A	80009	285-1329-00
A4C62	283-0179-00			CAP,FXD,CER DI:0.68UF,10%,100V	80009	283-0179-00
A4C63	281-0863-00			CAP,FXD,CER:MLC;240PF,5%,100V,0.100 X 0.170;AXIAL,MI	04222	SA101A241JAA
A4CR1	152-0720-00			DIO,RECT:ULTRA FAST;100V,8A,25NS,100A IFSM;BYW29-100,TO-220	80009	152-0720-00
A4CR2	152-0400-00			DIO,RECT:FAST RCVRY;400V,1A,200NS;1N4936,DO-41,T&R	80009	152-0400-00
A4CR3	152-0400-00			DIO,RECT:FAST RCVRY;400V,1A,200NS;1N4936	80009	152-0400-00
A4CR4	152-0400-00			DIO,RECT:FAST RCVRY;400V,1A,200NS;1N4936	80009	152-0400-00
A4J1	131-3362-00			CONN,HDR:	53387	2526-6002UB
A4J2	131-3362-00			CONN,HDR:	53387	2526-6002UB
A4J3	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-4530-00
A4J4	131-3392-00			CONN,HDR:PCB;MALE,STR,1 X 10,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-3392-00
A4J5	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30 GLD,0.035 DIA PCB	80009	131-4794-00
A4J6	131-4794-00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR,0.235 MLG X 0.112 TAIL,30 GLD,0.035 DIA PCB	80009	131-4794-00
A4J7	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-4530-00
A4L1	114-0415-00			COIL,RF:VAR,775-925NH	80009	114-0415-00
A4L2	114-0366-00			COIL,RF:VAR,2.40-2.70UH,Q MIN 190 @ 2.6 UH	54937	114-0366-00
A4L3	114-0367-00			COIL,RF:VAR,2.70-3.30UH	80009	114-0367-00
A4L4	114-0369-00			COIL,RF:VAR,2.19-2.53UH	80009	114-0369-00
A4L5	108-0408-00			COIL,RF:FIXED,91NH	80009	108-0408-00
A4L6	108-1262-00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108-1262-00
A4L7	108-1262-00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108-1262-00
A4L8	108-1412-00			COIL,RF:FXD, 4.7 UH, +/- 20 %,Q 25, SRF 50 MHZ, DCR 0.017 OHM I MAX 3.7 A,RDL LEAD	54583	TSL08074R7M3RO
A4L9	108-1262-00			COIL,RF:FXD,100UH,10%,Q=30,SRF 8.2MHZ,DCR 0.23 OHM,I MAX 0.75ARDL LEAD	80009	108-1262-00
A4P1	131-3396-00			CONN,DSUB:	80009	131-3396-00
A4P3	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPERLK,JUMPER	22526	131-3199-00
A4P7	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPERLK,JUMPER	22526	131-3199-00
A4Q1	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A4Q2	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q3	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A4Q4	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q5	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A4Q6	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q7	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q8	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q9	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q10	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q11	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A4Q12	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL:2N3906,TO-92 EBC	80009	151-0188-00
A4Q13	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4Q14	151-1137-01			XSTR,PWR:MOS,N-CH;200V,9.0A,0.4 OHM;IRF630,TO-220	80009	151-1137-01
A4Q15	151-0301-00			XSTR,SIG:BIPOLAR,PNP;60V,600MA,200MHZ,AMPL:2N2907A,TO-18	80009	151-0301-00
A4Q16	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL:2N3904,TO-92 EBC	80009	151-0190-00
A4R1	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R2	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R3	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R4	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R5	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R6	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R7	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R8	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R9	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R10	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R11	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A4R12	307-0539-00			RES NTWK,FXD,FI:(7)510 OHM,10%,1W	80009	307-0539-00
A4R13	307-0539-00			RES NTWK,FXD,FI:(7)510 OHM,10%,1W	80009	307-0539-00
A4R14	307-0539-00			RES NTWK,FXD,FI:(7)510 OHM,10%,1W	80009	307-0539-00
A4R15	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A4R16	307-0819-00			RES NTWK,FXD,FI:9,62 OHM,2%,0.15W EACH	80009	307-0819-00
A4R17	307-0819-00			RES NTWK,FXD,FI:9,62 OHM,2%,0.15W EACH	80009	307-0819-00
A4R18	307-0819-00			RES NTWK,FXD,FI:9,62 OHM,2%,0.15W EACH	80009	307-0819-00
A4R19	322-3243-00			RES,FXD,MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A4R20	322-3189-00			RES,FXD,FILM:909 OHM,1%,0.2W,TC=TO	57668	CRB 20 FXE 909E
A4R21	322-3189-00			RES,FXD,FILM:909 OHM,1%,0.2W,TC=TO	57668	CRB 20 FXE 909E
A4R22	322-3201-00			RES,FXD,MET FILM;1.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3201-00
A4R23	307-0539-00			RES NTWK,FXD,FI:(7)510 OHM,10%,1W	80009	307-0539-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A4R24	307-0539-00			RES NTWK,FXD,FI:(7)510 OHM,10%,1W	80009	307-0539-00
A4R25	307-1318-00			RES NTWK,FXD,FI:(2) 162 OHM,(2) 260 OHM,2%,0.125W	80009	307-1318-00
A4R26	322-3039-00			RES,FXD,FILM:24.9 OHM,1%,0.2W,TC=T0	80009	322-3039-00
A4R27	322-3201-00			RES,FXD:MET FILM:1.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3201-00
A4R28	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A4R29	322-3121-00			RES,FXD:MET FILM:178 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3121-00
A4R30	322-3377-00			RES,FXD:MET FILM:82.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2F82501F
A4R31	322-3354-00			RES,FXD:MET FILM:47.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3354-00
A4R32	322-3030-00			RES,FXD:MET FILM:20 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3030-00
A4R33	322-3243-00			RES,FXD:MET FILM:3.32K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A4R34	311-2271-00			RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ,SIDE ADJUST:T&A	80009	311-2271-00
A4R35	322-3215-00			RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	91637	CCF50-2F16900F
A4R36	322-3181-00			RES,FXD,FILM:750 OHM,1%,0.2W,TC=T0	80009	322-3181-00
A4R37	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A4R38	322-3085-00			RES,FXD:MET FILM:75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A4R39	322-3177-02			RES,FXD,FILM:681 OHM,0.5%,0.2W,TC=T2	80009	322-3177-02
A4R40	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A4R41	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R42	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A4R43	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R44	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A4R45	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R46	322-3188-00			RES,FXD,FILM:887 OHM,1%,0.2W,TC=T0	80009	322-3188-00
A4R47	322-3135-00			RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A4R48	322-3066-00			RES,FXD:MET FILM:47.5 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A4R49	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R50	322-3246-00			RES,FXD,FILM:3.57K OHM,1%,0.2W,TC=T0	80009	322-3246-00
A4R51	322-3402-00			RES,FXD:MET FILM:150K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3402-00
A4R52	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A4R53	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A4R54	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R55	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A4R56	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A4R57	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 500
A4R58	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R59	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A4R60	322-3030-00			RES,FXD:MET FILM;20 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3030-00
A4R61	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A4R62	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A4R63	311-2235-00			RES,VAR,TRMR:CERMET;10K OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	80009	311-2235-00
A4R64	322-3363-00			RES,FXD,FILM:59K OHM,1%,0.2W,TC=T0	80009	322-3363-00
A4R65	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A4R66	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A4R67	322-3251-00			RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K02
A4R68	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A4R69	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R70	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R71	322-3066-00			RES,FXD:MET FILM:47.5 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A4R72	322-3201-00			RES,FXD:MET FILM;1.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3201-00
A4R73	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R74	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A4R75	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A4R76	322-3085-00			RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A4R77	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A4R78	322-3085-00			RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A4R79	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R80	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W,0.197 SQ,TOP ADJUST;T&R	TK1450	GF06UT 500
A4R81	322-3066-00			RES,FXD:MET FILM;47.5 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	09969	CCF502G47R50F
A4R82	322-3001-00			RES,FXD:MET FILM;10 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3001-00
A4R83	322-3226-00			RES,FXD:MET FILM:2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A4R84	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A4R85	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A4R86	308-0827-00			RES,FXD,WW:0.22 OHM,10%,2W	80009	308-0827-00
A4R87	322-3336-00			RES,FXD,FILM:30.9K OHM,1%,0.2W,TC=T0	91637	CCF50-2F30901F
A4R88	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20FXE2K94

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A4R89	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A4R90	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A4R91	311-2267-00			RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W	80009	311-2267-00
A4R92	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A4R93	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A4R94	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A4R95	322-3385-00			RES,FXD:MET FILM;100K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100K
A4R96	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A4R97	322-3314-00			RES,FXD:MET FILM;18.2K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3314-00
A4R98	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A4R99	303-0102-00			RES,FXD,CMPSN:1K OHM,5%,1W	80009	303-0102-00
A4R100	322-3265-00			RES,FXD:MET FILM;5.62K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3265-00
A4R101	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322-3254-00
A4T1	120-1180-00			XFMR,RF:VAR	80009	120-1180-00
A4T2	120-1851-00			XFMR,PWR,STPDN:FBCK,100KHZ,40V IN,5 V OUT	75498	128-9033-E
A4TP1	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A4TP2	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A4TP3	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A4TP4	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A4U1	156-2059-00			IC,DGTL:ECL,RCVR:TPL LINE;10114,DIP16.3,TUBE	04713	MC10114
A4U2	156-2059-00			IC,DGTL:ECL,RCVR:TPL LINE;10114,DIP16.3,TUBE	04713	MC10114
A4U3	156-2059-00			IC,DGTL:ECL,RCVR:TPL LINE;10114,DIP16.3,TUBE	04713	MC10114
A4U4	156-2059-00			IC,DGTL:ECL,RCVR:TPL LINE;10114,DIP16.3,TUBE	04713	MC10114
A4U5	156-5933-00			MICROCKT,DGTL:ECL,10KH,10 BIT VIDEO LINE DRV, SMPTE RP-125 COMPATIBLE	80009	156-5933-00
				*MOUNTING PARTS*		
	136-0959-00			SKT,PL-IN ELEK:PLCC,52,PCB,0.361 H X 0.147 TAIL,TIN	80009	136-0959-00
				*END MOUNTING PARTS*		
A4U6	156-0746-01			IC,DGTL:ECL,MUX:QUAD 2-INPUT MUX;10158,DIP16.3,TUBE	80009	156-0746-01
A4U7	156-0746-01			IC,DGTL:ECL,MUX:QUAD 2-INPUT MUX;10158,DIP16.3,TUBE	80009	156-0746-01
A4U8	156-0746-01			IC,DGTL:ECL,MUX:QUAD 2-INPUT MUX;10158,DIP16.3,TUBE	80009	156-0746-01
A4U9	155-0316-02			IC,ASIC:BIPOLAR,12 BIT D/A CONV;FULL CUS- TOM,M460;TEQ1D68,BOX	80009	155-0316-02
				*MOUNTING PARTS*		
	136-0871-00			SKT,PLCC:	80009	136-0871-00
				*END MOUNTING PARTS*		
A4U10	156-1173-00			IC,LIN:BIPOLAR,VREF;POS,2.5V,1.0%,;MC1403U	80009	156-1173-00
A4U11	156-1149-00			IC,LIN:BIFET,OP-AMP;LF351N,DIP08.3	27014	LF351N/GLEA134
A4U12	156-0933-02			IC,LIN:BIPOLAR,SW-RGLTR CONTLER;PWM, PUSH-PULL,OC/OE;SG3524BN,DIP16.3	34333	SG3524BN

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5	671-2275-05		B051811	CIRCUIT BD ASSY:SERIAL	80009	671-2275-05
A5	671-2275-06	B051812		CIRCUIT BD ASSY:SERIAL	80009	671-2275-06
	337-3551-00			*ATTACHED PARTS*		
				SHIELD,ELEC:OSCILLATOR,ECB,BRS	80009	337-3551-00
				*END ATTACHED PARTS*		
A5C1	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C2	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C3	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C4	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C5	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C6	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C7	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C9	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C10	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C11	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C12	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C13	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C14	281-0811-00			CAP,FXD,CER:MLC:10PF,10%,100V,0.100 X 0.170:AXIAL,MI	04222	SA102A100KAA
A5C16	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C17	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C18	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C19	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C20	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM:5000 HRS,RDL,T&A	80009	290-1311-00
A5C21	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C22	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C23	281-0865-00			CAP,FXD,CER DI:1000PF,5%,100V	04222	SA201A102JAA
A5C24	281-0777-00			CAP,FXD,CER:MLC:51PF,5%,100V,0.100 X 0.170:AXIAL,MI	80009	281-0777-00
A5C25	281-0777-00			CAP,FXD,CER:MLC:51PF,5%,100V,0.100 X 0.170:AXIAL,MI	80009	281-0777-00
A5C26	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM:5000 HRS,RDL,T&A	80009	290-1311-00
A5C27	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C28	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA
A5C29	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100:AXIAL	04222	SA105E104MAA



## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5C30	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C31	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C32	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C33	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C34	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C35	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C36	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C37	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C38	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C39	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C40	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C41	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM:5000 HRS,RDL,T&A	80009	290-1311-00
A5C42	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C43	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C44	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C45	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C46	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C47	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C48	283-0788-01			CAP,FXD,MICA DI:267PF,1%,500V,T&A	09023	CDA15FD(267)F03
A5C49	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM:5000 HRS,RDL,T&A	80009	290-1311-00
A5C50	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM:5000 HRS,RDL,T&A	80009	290-1311-00
A5C51	281-0909-00			CAP,FXD,CER:MLC:0.022UF,20%,50V,0.100 X 0.170;AXIAL,MI	04222	SA105C223MAA
A5C52	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C53	281-0767-00			CAP,FXD,CER:MLC:330PF,20%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102C331MAA
A5C54	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C55	281-0302-00			CAP,VAR,PLSTC:1.2-4PF,100V	52769	GXL4R000
A5C56	281-0861-00			CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A5C57	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C58	283-0597-00			CAP,FXD,MICA DI:470PF,10%,300V	80009	283-0597-00
A5C59	281-0909-00			CAP,FXD,CER:MLC:0.022UF,20%,50V,0.100 X 0.170;AXIAL,MI	04222	SA105C223MAA
A5C60	290-1313-00			CAP,FXD,AL:10UF,20%,50V,8 X 11MM:105 DEG,RDL,T&A	80009	290-1313-00
A5C62	281-0767-00			CAP,FXD,CER:MLC:330PF,20%,100V,0.100 X 0.170;AXIAL,MI	04222	SA102C331MAA
A5C63	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C64	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C65	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5C66	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,0.170 X 0.100;AXIAL	04222	SA105E104MAA
A5C67	290-1274-00			CAP,FXD,AL:47UF,20%,16V,8 X 11.5;85 DEG,NON-POLAR,RDL,BULK	80009	290-1274-00
A5C68	281-0823-00			CAP,FXD,CER DI:470PF,10%,50V	04222	SA101A471KAA
A5C69	281-0823-00			CAP,FXD,CER DI:470PF,10%,50V	04222	SA101A471KAA
A5C70	281-0861-00			CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A5C71	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,AXIAL	04222	SA105E104MAA
A5C72	281-0773-00			CAP,FXD,CER:MLC:0.01UF,10%,100V,SAF,AXIAL,MI	80009	281-0773-00
A5C73	281-0861-00			CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A5C74	281-0823-00			CAP,FXD,CER DI:470PF,10%,50V	04222	SA101A471KAA
A5C75	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,AXIAL	04222	SA105E104MAA
A5C76	281-0861-00			CAP,FXD,CER DI:270PF,5%,50V	04222	SA101A271JAA
A5C77	281-0777-00			CAP,FXD,CER:MLC:51PF,5%,100V,AXIAL,MI	80009	281-0777-00
A5C78	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,AXIAL	04222	SA105E104MAA
A5C79	281-0777-00			CAP,FXD,CER:MCL:51PF,5%,100V,AXIAL,MI	80009	281-0777-00
A5C80	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,AXIAL	04222	SA105E104MAA
A5C81	281-0775-01			CAP,FXD,CER:MCL:0.1UF,20%,50V,Z5U,AXIAL	04222	SA105E104MAA
A5C82	281-0813-00			CAP,FXD,CER:MLC:0.047UF,20%,50V,AXIAL,MI	04222	SA105E473MAA
A5C83	281-0813-00			CAP,FXD,CER:MLC:0.047UF,20%,50V,AXIAL,MI	04222	SA105E473MAA
A5C84	281-0813-00			CAP,FXD,CER:MLC:0.047UF,20%,50V,AXIAL,MI	04222	SA105E473MAA
A5C85	281-0813-00			CAP,FXD,CER:MLC:0.047UF,20%,50V,AXIAL,MI	04222	SA105E473MAA
A5C86	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAAAP1
A5C87	290-1311-00			CAP,FXD,AL:10UF,20%,50V,5 X 11MM;5000 HRS,RDL,T&A	80009	290-1311-00
A5CR1	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR2	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR3	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR4	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR5	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR6	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR7	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR8	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR9	152-0246-00			SEMICON DVC,DI:SW,SI,40V,200MA,DO-7	80009	152-0246-00
A5CR10	152-0246-00			SEMICON DVC,DI:SW,SI,40V,200MA,DO-7	80009	152-0246-00
A5CR11	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A5CR12	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A5CR13	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A5CR14	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A5CR15	152-0141-02			DIO,SIG:ULTRA FAST;40V,150MA,4NS,2PF;1N4152,DO-35,T&R	80009	152-0141-02
A5CR16	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5CR17	152-0066-00			DIO,RECT:400V,1A,IFSM=30A,1.2VF,2US;GP10G/1 N5060,T&R,SAF CONTLED	05828	GP10G-020
A5CR18	152-0269-01			DIO,SIG:VVC:C4=33PF,5%,C4/C20=2;SMV1263-1,D O-7,T&R	04713	SMV1263-1
A5CR19	152-0246-00			SEMICON DVC,DI:SW,SI,40V,200MA,DO-7	80009	152-0246-00
A5CR20	152-0246-00			SEMICON DVC,DI:SW,SI,40V,200MA,DO-7	80009	152-0246-00
A5CR21	152-0246-00			SEMICON DVC,DI:SW,SI,40V,200MA,DO-7	80009	152-0246-00
A5CR22	152-0246-00			SEMICON DVC,DI:SW,SI,40V,200MA,DO-7	80009	152-0246-00
A5CR26	153-0044-00			DIO,SIG:SCHTKY,1 OF 4, MATCHED SET	80009	153-0044-00
A5CR27	153-0044-00			DIO,SIG:SCHTKY,1 OF 4, MATCHED SET	80009	153-0044-00
A5CR28	153-0044-00			DIO,SIG:SCHTKY,1 OF 4, MATCHED SET	80009	153-0044-00
A5CR29	153-0044-00			DIO,SIG:SCHTKY,1 OF 4, MATCHED SET	80009	153-0044-00
A5J1	131-0265-00			CONN,RF PLUG:SMB;PCB,MALE,RTANG,50 OHM, 0.381 H X 0.15 TAIL,0.043 DIA CTR COND,0.040 SQ TAIL	80009	131-0265-00
A5J2	131-4530-00			CONN,HDR:PCB;MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120 TAIL,30 GLD,BD RETENTION	80009	131-4530-00
A5J12	174-2651-00			CA ASSY,SP:	80009	174-2651-00
A5J17	131-3152-00			CONN,HDR:	22526	66506-043
A5J18	131-4752-00			CONN,HDR:PCB;MALE,45 DEG,1 X 2,0.1 CTR,0.240 MLG X 0.110 TAIL,30 GLD	80009	131-4752-00
A5J19	131-0265-00			CONN,RF PLUG:SMB;PCB,MALE,RTANG,50 OHM,0.381 H X 0.15 TAIL,0.043 DIA CTR COND,0.040 SQ TAIL	80009	131-0265-00
A5P2	131-3199-00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2H,LOW PROFILE,JUMPER	80009	131-3199-00
A5Q1	151-0944-00			XSTR,SIG:BIPOLAR,NPN:15V,30MA,4.5GHZ, AMPL;MPS901,TO-92 BEC,T&A	80009	151-0944-00
A5Q2	151-0944-00			XSTR,SIG:BIPOLAR,NPN:15V,30MA,4.5GHZ, AMPL;MPS901,TO-92 BEC,T&A	80009	151-0944-00
A5Q3	151-0711-00			XSTR,SIG:BIPOLAR,NPN:25V,50MA,650MHZ, AMPL;MPSH10,TO-92 BEC	80009	151-0711-00
A5Q4	151-0188-00			XSTR,SIG:BIPOLAR,PNP:40V,200MA,250MHZ, AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A5Q5	151-0188-00			XSTR,SIG:BIPOLAR,PNP:40V,200MA,250MHZ, AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A5Q6	151-0711-00			XSTR,SIG:BIPOLAR,NPN:25V,50MA,650MHZ, AMPL;MPSH10,TO-92 BEC	80009	151-0711-00
A5Q7	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ, AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A5Q8	151-0190-00			XSTR,SIG:BIPOLAR,NPN:40V,200MA,300MHZ, AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A5Q9	151-0188-00			XSTR,SIG:BIPOLAR,PNP:40V,200MA,250MHZ, AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A5Q10	151-0712-00			XSTR,SIG:BIPOLAR,PNP:20V,50MA,600MHZ, AMPL;MPSH81,TO-92 BEC	80009	151-0712-00
A5Q11	151-0711-00			XSTR,SIG:BIPOLAR,NPN:25V,50MA,650MHZ, AMPL;MPSH10,TO-92 BEC	80009	151-0711-00
A5Q12	151-0711-00			XSTR,SIG:BIPOLAR,NPN:25V,50MA,650MHZ, AMPL;MPSH10,TO-92 BEC	80009	151-0711-00
A5Q13	151-0944-00			XSTR,SIG:BIPOLAR,NPN:15V,30MA,4.5GHZ, AMPL;MPS901,TO-92 BEC,T&A	80009	151-0944-00
A5Q14	151-0369-00			XSTR,SIG:BIPOLAR,PNP:12V,30MA,2.0GHZ, AMPL;MPSH69,TO-92 EBC	80009	151-0369-00
A5Q15	151-0711-00			XSTR,SIG:BIPOLAR,NPN:25V,50MA,650MHZ, AMPL;MPSH10,TO-92 BEC	80009	151-0711-00

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Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5Q16	151-0712-00			XSTR,SIG:BIPOLAR,PNP;20V,50MA,600MHZ,AMPL;MPSH81,TO-92 BEC	80009	151-0712-00
A5Q17	151-0711-00			XSTR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ,AMPL;MPSH10,TO-92 BEC	80009	151-0711-00
A5Q18	151-0711-00			XSTR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ,AMPL;MPSH10,TO-92 BEC	80009	151-0711-00
A5Q19	151-0190-00			XSTR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL;2N3904,TO-92 EBC	80009	151-0190-00
A5Q20	151-0216-04			XSTR,SIG:BIPOLAR,PNP;25V,100MA,170MHZ,AMPL;MPS6523,TO-92 EBC,T&A	80009	151-0216-04
A5Q21	151-1078-00			XSTR,SIG:JFET,N-CH;3.5V,75MA,90 OHM,SW;MPF4393,TO-92,SDG	22229	F2651
A5Q22	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A5Q23	151-0221-00			XSTR,SIG:BIPO-LAR,PNP;12V,80MA,SWING;MPS4258,TO-92 EBC	80009	151-0221-00
A5Q25	151-0411-00			XSTR,SIG:BIPOLAR,NPN;30V,400MA,1.2GHZ,AMPL;2N5943,TO-39	80009	151-0411-00
A5Q26	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A5Q27	151-0369-00			XSTR,SIG:BIPOLAR,PNP;12V,30MA,2.0GHZ,AMPL;MPSH69,TO-92 EBC	80009	151-0369-00
A5Q28	151-0441-00			XSTR,SIG:BIPOLAR,NPN;15V,40MA,1.0GHZ,AMPL;2N2857/2N3839,TO-72	80009	151-0441-00
A5Q29	151-0188-00			XSTR,SIG:BIPOLAR,PNP;40V,200MA,250MHZ,AMPL;2N3906,TO-92 EBC	80009	151-0188-00
A5R1	322-3114-00			RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A5R2	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A5R3	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R4	322-3181-00			RES,FXD,FILM;750 OHM,1%,0.2W,TC=T0	80009	322-3181-00
A5R5	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R6	322-3181-00			RES,FXD,FILM;750 OHM,1%,0.2W,TC=T0	80009	322-3181-00
A5R7	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A5R8	322-3114-00			RES,FXD:MET FILM;150 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	91637	CCF50-2-G1500F
A5R9	322-3285-00			RES,FXD,FILM;9.09K OHM,1%,0.2W,TC=T0	80009	322-3285-00
A5R10	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R11	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R12	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R13	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R14	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A5R15	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A5R16	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A5R17	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5R18	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R19	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A5R20	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R21	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A5R22	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A5R24	311-2226-00			RES,VAR,NONWW:TRMR,50 OHM,20%,0.5W LIN,T&R	TK1450	GF06UT 50 OHM
A5R25	322-3222-00			RES,FXD:MET FILM;2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K00
A5R26	322-3265-00			RES,FXD:MET FILM;5.62K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3265-00
A5R27	322-3058-00			RES,FXD:MET FILM;39.2 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3058-00
A5R28	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R29	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R30	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R31	311-2227-00	B051812		RES,VAR,TRMR:CERMET,100 OHM,20%,0.5W,0.197 SQ, TOP ADJUST,T&R	30983	ORDER BY DESCRIPTION
A5R32	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R33	322-3339-00			RES,FXD:MET FILM;33.2K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3339-00
A5R34	322-3300-02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	57668	CRB20 DYE 13K0
A5R35	322-3191-00			RES,FXD,FILM:953 OHM,1%,0.2W,TC=T0	80009	322-3191-00
A5R36	322-3191-00			RES,FXD,FILM:953 OHM,1%,0.2W,TC=T0	80009	322-3191-00
A5R37	322-3072-00			RES,FXD,FILM:54.9 OHM,1%,0.2W,TC=T0	80009	322-3072-00
A5R38	322-3034-00			RES,FXD:MET FILM;22.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20FXE2K94
A5R39	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R40	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R41	322-3201-00			RES,FXD:MET FILM;1.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3201-00
A5R42	322-3166-00			RES,FXD,FILM:523 OHM,1%,0.2W,TC=T0	80009	322-3166-00
A5R43	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R44	322-3143-00			RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A5R45	322-3162-00			RES,FXD:MET FILM;475 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3162-00
A5R46	322-3081-00			RES,FXD:MET FILM;68.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3081-00
A5R47	322-3147-00			RES,FXD:MET FILM;332 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3147-00
A5R48	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R49	322-3135-00			RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	80009	322-3135-00
A5R50	322-3081-00			RES,FXD:MET FILM;68.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3081-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5R51	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A5R52	322-3081-00			RES,FXD:MET FILM;68.1 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3081-00
A5R53	322-3068-00			RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3068-00
A5R54	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A5R55	322-3062-00			RES,FXD,FILM:43.2 OHM,1%,0.2W,TC=T0	57668	RB20FXE43E2
A5R56	322-3191-00			RES,FXD,FILM:953 OHM,1%,0.2W,TC=T0	80009	322-3191-00
A5R57	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A5R58	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R59	322-3162-00			RES,FXD:MET FILM;475 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3162-00
A5R60	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R61	322-3030-00			RES,FXD:MET FILM;20 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3030-00
A5R62	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R63	322-3231-00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	80009	322-3231-00
A5R64	311-2234-00			RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ, TOP ADJUST;T&R	TK1450	GF06UT 5K
A5R65	322-3085-00			RES,FXD:MET FILM;75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A5R66	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A5R67	322-3481-00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	80009	322-3481-00
A5R68	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R69	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R70	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A5R71	322-3322-00			RES,FXD:MET FILM;22.1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3322-00
A5R72	307-0541-00			RES NTWK,FXD,FI:(7)1K OHM,10%,1W	01121	108A102
A5R73	307-0541-00			RES NTWK,FXD,FI:(7)1K OHM,10%,1W	01121	108A102
A5R74	322-3481-00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	80009	322-3481-00
A5R76	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R79	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R81	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A5R82	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R83	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R84	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R85	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R86	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R89	322-3210-00			RES,FXD:MET FILM;1.5K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K50
A5R90	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A5R91	322-3261-00			RES,FXD,FILM:5.11K OHM,1%,0.2W,TC=T0	80009	322-3261-00
A5R92	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 3K01
A5R93	322-3246-00			RES,FXD,FILM:3.57K OHM,1%,0.2W,TC=T0	80009	322-3246-00

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5R94	307-0730-00			RES NTWK,FXD,FI:7.47K OHM,2%,0.18W EA	11236	
A5R95	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A5R96	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A5R98	322-3201-00			RES,FXD:MET FILM;1.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3201-00
A5R99	322-3261-00			RES,FXD,FILM:5.11K OHM,1%,0.2W,TC=T0	80009	322-3261-00
A5R100	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R101	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R102	322-3154-00			RES,FXD:MET FILM;392 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	RB20FX392E
A5R103	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A5R104	322-3226-00			RES,FXD:MET FILM;2.21K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 2K21
A5R105	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R106	322-3392-00			RES,FXD,FILM:118K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 118K
A5R112	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R113	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R114	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R115	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R116	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A5R117	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E
A5R118	322-3193-00			RES,FXD:MET FILM;1K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A5R119	322-3258-00			RES,FXD:MET FILM;4.75K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3258-00
A5R120	131-4566-00			BUS,CNDCT:0 OHM,300 SPACING,SM BODY	80009	131-4566-00
A5R121	307-0730-00			RES NTWK,FXD,FI:7.47K OHM,2%,0.18W EA	11236	
A5R122	322-3169-00			RES,FXD:MET FILM;562 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	91637	CCF50-2F562R0F
A5R123	322-3250-00			RES,FXD:MET FILM;3.92K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	91637	CCF50-2F39200F
A5R124	322-3250-00			RES,FXD:MET FILM;3.92K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	91637	CCF50-2F39200F
A5R126	322-3289-00			RES,FXD:MET FILM;10K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3289-00
A5R127	322-3342-00			RES,FXD,FILM:35.7K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 35K7
A5R128	322-3254-00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0	80009	322-3254-00
A5R129	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A5R130	322-3097-00			RES,FXD:MET FILM;100 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R131	322-3260-00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K99
A5R132	322-3068-00			RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3068-00
A5R133	322-3068-00			RES,FXD:MET FILM;49.9 OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	80009	322-3068-00
A5R134	322-3243-00			RES,FXD:MET FILM;3.32K OHM,1%,0.2W,TC=100 PPM:AXIAL,T&R,SM BODY	91637	CCF50-1-G33200F
A5R135	322-3164-00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 499E

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5R136	311-2234-00			RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W,0.197 SQ, TOP ADJUST;T&R	TK1450	GF06UT 5K
A5R137	322-3311-00			RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0	56845	CCF-50-2-1692F
A5R138	322-3185-00			RES,FXD:MET FILM:825 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 825E
A5R139	322-3185-00			RES,FXD:MET FILM:825 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 825E
A5R140	322-3258-00			RES,FXD:MET FILM:4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A5R141	322-3356-00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0	80009	322-3356-00
A5R142	322-3058-00			RES,FXD:MET FILM:39.2 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3058-00
A5R143	322-3289-00			RES,FXD:MET FILM:10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R144	322-3258-00			RES,FXD:MET FILM:4.75K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3258-00
A5R145	322-3356-00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0	80009	322-3356-00
A5R146	311-2229-00			RES,VAR,NONWW:TRMR,250 OHM,20%,0.5W LIN	TK1450	GF06UT 250
A5R147	322-3289-00			RES,FXD:MET FILM:10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R148	322-3058-00			RES,FXD:MET FILM:39.2 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3058-00
A5R149	322-3170-00			RES,FXD,FILM:576 OHM,1%,0.2W,TC=T0	80009	322-3170-00
A5R150	322-3289-00			RES,FXD:MET FILM:10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R151	322-3193-00			RES,FXD:MET FILM:1K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 1K00
A5R152	322-3093-00			RES,FXD,FILM:90.9 OHM,1%,0.2W,TC=T0	91637	CCF50-2F90R90F
A5R153	322-3085-00			RES,FXD:MET FILM:75 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 75E0
A5R154	322-3306-00			RES,FXD:MET FILM:15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A5R155	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A5R156	322-3306-00			RES,FXD:MET FILM:15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A5R157	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A5R158	322-3001-00			RES,FXD:MET FILM:10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A5R159	322-3001-00			RES,FXD:MET FILM:10 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3001-00
A5R160	322-3097-00			RES,FXD:MET FILM:100 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 100E
A5R161	322-3289-00			RES,FXD:MET FILM:10K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	80009	322-3289-00
A5R162	322-3185-00			RES,FXD:MET FILM:825 OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 825E
A5R163	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	80009	322-3126-00
A5R164	322-3306-00			RES,FXD:MET FILM:15K OHM,1%,0.2W,TC=100 PPM;AXIAL,T&R,SM BODY	57668	CRB20 FXE 15K0
A5RT1	307-0126-00			RES,THERMAL:100 OHM,10%,NTC	14193	2D21-101-D
A5RT2	307-0477-00			RES,THERMAL:1K OHM,10%,6MW/DEG C	91275	1C1001
A5T1	120-1394-00			XFMR,RF:TOROID	80009	120-1394-00
A5T2	120-1397-00			XFMR,RF:TOROID	80009	120-1397-00
A5T3	120-1396-00			XFMR,RF:TOROID	80009	120-1396-00
A5TP1	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02



## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5TP2	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A5TP3	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A5TP4	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A5TP5	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A5TP6	214-4085-00			TERM,TEST PT:0.070 ID,0.220 H,0.063 DIA PCB,0.015 X 0.032 BRS,W/ RED NYL CLR	26364	104-01-02
A5U1	156-4158-00			IC,MISC:ECL,DECODER:SER DATA XMSN TO PRL DATA;SBX1602A,PGA37	80009	156-4158-00
	136-1159-00			*MOUNTING PARTS* SKT,PGA: *END MOUNTING PARTS*	80009	136-1159-00
A5U2	156-0316-04			IC,DGTL:ECL,XLTR:QUAD ECL TO TTL;10125	04713	MC10125P/L
A5U3	156-0316-04			IC,DGTL:ECL,XLTR:QUAD ECL TO TTL;10125	04713	MC10125P/L
A5U4	156-0316-04			IC,DGTL:ECL,XLTR:QUAD ECL TO TTL;10125	04713	MC10125P/L
A5U5	156-6357-00			IC,DGTL:CMOS,PLD:FPGA,100 MHZ;3090-100	80009	156-6357-00
	136-0965-00			*MOUNTING PARTS* SKT,PLCC:PCB;84,0.05 CTR,0.360 H X 0.125 TAIL,TIN,0.055-0.075 SHLDR HEIGHT *END MOUNTING PARTS*	80009	136-0965-00
A5U6	156-5966-00			MICROCKT,DGTL:BIPOLAR,10-BIT VIDEO LINE DRVR,SMPTE RP-125 COMPATIBLE	80009	156-5966-00
	136-0959-00			*MOUNTING PARTS* SKT,PL-IN ELEK:PLCC,52,PCB,0.361 H X 0.147 TAIL,TIN *END MOUNTING PARTS*	80009	136-0959-00
A5U7	160-8877-02			IC,DGTL:CMOS,PROM;20 X 8 RGTR,7C245-35,PRGM 156-3045-00,DIP24	80009	160-8877-02
	136-0727-00			*MOUNTING PARTS* SKT,PL-IN ELEK:MICROCKT,8 CONT *END MOUNTING PARTS*	09922	DILB8P-108
A5U8	156-1611-00			IC,DGTL:F TTL,FLIP FLOP:DUAL D-TYPE;74F74,DIP14.3,TUBE	80009	156-1611-00
A5U9	156-1611-00			IC,DGTL:F TTL,FLIP FLOP:DUAL D-TYPE;74F74,DIP14.3,TUBE	80009	156-1611-00
A5U10	156-2558-00			IC,LIN:BIPO-LAR,VR;POS,12V,1.5A,2%;MC7812ACT,TO-220	80009	156-2558-00
A5U11	156-2559-00			IC,LIN:BIPO-LAR,VR;NEG,-12V,1.5A,2%;MC7912ACT,TO-220	80009	156-2559-00
A5U12	156-1172-00			IC,DGTL:LSTTL,CNTR:DUAL 4-BIT BIN;74LS393,DIP14.3,TUBE	80009	156-1172-00
A5U13	156-1800-00			IC,DGTL:F TTL,GATE:QUAD 2-INPUT XOR;74F86,DIP14.3,TUBE	80009	156-1800-00
A5U14	160-8679-01			IC,DGTL:CMOS,PLD:EEPLD,16V8,25NS,DIP20.3	80009	160-8679-01
A5U15	156-1126-00			IC,LIN:BIPOLAR,COMPTR:OPEN COLL,200NS;LM311N,DIP08.3	80009	156-1126-00
A5U16	156-0910-00			IC,DGTL:LSTTL,CNTR;74LS390	80009	156-0910-00
A5U17	156-0124-00			IC,LIN:TTL,MISC:PHASE-FREQ DETEC-TOR,DUAL;MC4044P,DIP14.3	04713	MC4044
A5U18	156-1126-00			IC,LIN:BIPOLAR,COMPTR:OPEN COLL,200NS;LM311N,DIP08.3	80009	156-1126-00
A5U19	160-8680-00			IC,DGTL:CMOS,PLD:EEPLD,16V8,25NS,DIP20.3	80009	160-8680-00
A5U20	156-1149-00			IC,LIN:BIFET,OP-AMP;LF351N,DIP08.3	27014	LF351N/GLEA134

## Replaceable Electrical Parts

Component Number	Tektronix Part Number	Serial / Assembly Number		Name & Description	Mfr. Code	Mfr. Part Number
		Effective	Discontinued			
A5U21	156-2009-00			IC,DGTL:HCMOS,FLIP FLOP;74HC74,	80009	156-2009-00
A5U22	156-1149-00			IC,LIN:BIFET,OP-AMP;LF351N,DIP08.3	27014	LF351N/GLEA134
A5U23	156-1149-00			IC,LIN:BIFET,OP-AMP;LF351N,DIP08.3	27014	LF351N/GLEA134
A5U24	156-2349-00			IC,DGTL:HCMOS,RGTR;8-BIT SIPO, LATCHED 3-STATE;74HC595,DIP16.3,TUBE	80009	156-2349-00
A5U25	156-0991-02			IC,LIN:BIPOLAR,VR;POS;5.0V,100MA,5%; MC78L05ACP,TO-92	80009	156-0991-02
A5U26	156-1172-00			IC,DGTL:LSTTL,CNTR;DUAL 4-BIT BIN;74LS393	80009	156-1172-00
A5W1	174-2652-01			CA ASSY,RF:COAX;SLDR,75 OHM,12.0 L,SMB,RTANG,MALE X SMB,RTANG,MALE	80009	174-2652-01
A5Y1	158-0353-00			XTAL UNIT,QTZ;17.734480MHZ,0.002%,PRL,CL 30 PF, 4 PIN MINI DIP PKG	14301	016-210-00041
E22	276-0569-00			CORE,EM:TOROID,FERRITE,UO=125,FREQ<5MHZ (LOCATED ON CH 1 LOOP-THRU INPUT)	0JR03	276-0569-00
E23	276-0569-00			CORE,EM:TOROID,FERRITE,UO=125,FREQ<5MHZ (LOCATED ON CH 2 LOOP-THRU INPUT)	0JR03	276-0569-00
E25	276-0569-00			CORE,EM:TOROID,FERRITE,UO=125,FREQ<5MHZ (LOCATED ON EXT REF LOOP-THRU INPUT)	0JR03	276-0569-00
V1	154-0903-00			ELECTRON TUBE:CRT NTSC,FIN- ISHED,T1710-3.30	80009	154-0903-00
W1	174-1862-00			CA ASSY,SP,ELEC:25,28 AWG,4,75 L,RBN (CONNECTED AT "DIGITAL PRL OUT" BNC ON REAR PANEL TO A4J1)	80009	174-1862-00
	214-3903-01			*MOUNTING PARTS* SCR,JACK:4-40 X 0.312 EXT THD,4-40 INT THD,0.188 HEX,STEEL,CAD PLATE (QUANTITY 2) *END MOUNTING PARTS*	80009	214-3903-01
W5	174-2649-00			CA ASSY,RF:COAX;CRIMP;50 OHM,12.75 L,0.1 CTR RCPT 1 X 2 CUT/STRIP 0.250 (CONNECTED AT "DAC OUT" BNC ON REAR PAN- EL TO A4J5)	80009	174-2649-00
W6	174-0123-01			CA ASSY,SP,ELEC:24,26 AWG,21.0 L,RBN (CONNECTED AT "AUX OUT" & "REMOTE"ON REAR PANEL TO A3J6)	80009	174-0123-01
	214-3903-01			*MOUNTING PARTS* SCR,JACK:4-40 X 0.312 EXT THD,4-40 INT THD,0.188 HEX,STEEL,CAD PLATE (QUANTITY 4) *END MOUNTING PARTS*	80009	214-3903-01
W9	174-2647-00			CA ASSY,SP,BR;RBN;IDC,20,28 AWG,7.5 L,W/FOLD X 4.4 L W/FOLD,0.1 CTR RCPT 2 X 10 (CONNECTED AT A5J17 TO A3J9 & A3J16)	80009	174-2647-00
W15	174-0335-01			LEAD,ELECTRICAL:22 AWG,9.75 L,9-N (CONNECTED FROM "PIKMON OUT" BNC ON REAR PANEL TO A3J15)	80009	174-0335-01
W17	174-2650-00			CA ASSY,RF:COAX;CRIMP;50 OHM,8.5 L,0.1 CTR RCPT 1 X 2 X 0.1 CTR,RCPT,1 X 2 (CONNECTED AT A3J17 & A5J18)	80009	174-2650-00
W20	174-1656-00			CA ASSY,RF:50 OHM COAX,16,0 L (CONNECTED AT A3J20 AND A4J6)	80009	174-1656-00



# Diagrams



# Diagrams/Circuit Board Illustrations

## Symbols

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.

Overline, parenthesis, or leading slash indicate a low asserting state.

Example: ID CONTROL, (ID CONTROL), or /ID CONTROL.

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.

American National Standard Institute  
1430 Broadway, New York, New York 10018

## Component Values

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

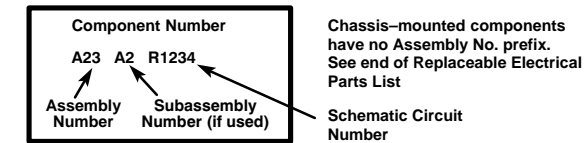
- Capacitors: Values one or greater are in picofarads (pF).  
Values less than one are in microfarads ( $\mu$ F).
- Resistors = Ohms ( $\Omega$ ).

The following information and special symbols may appear in this manual.

## Assembly Numbers

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the diagram (in circuit board outline), circuit board illustration title, and lookup table for the schematic diagram.

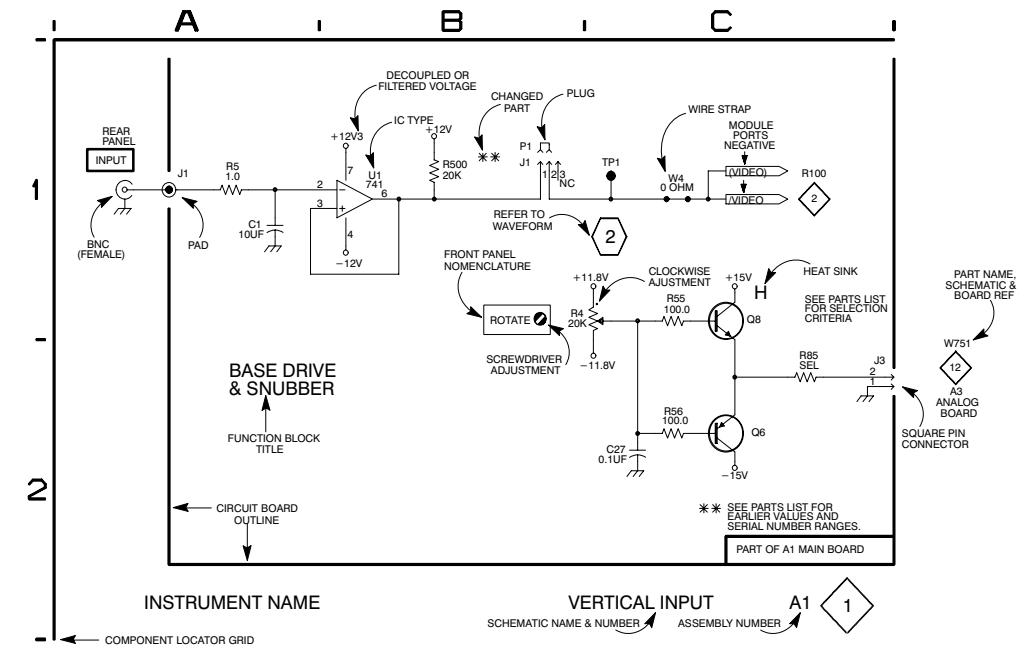
The Replaceable Electrical Parts List is arranged by assembly number in numerical sequence; the components are listed by component number. Example:

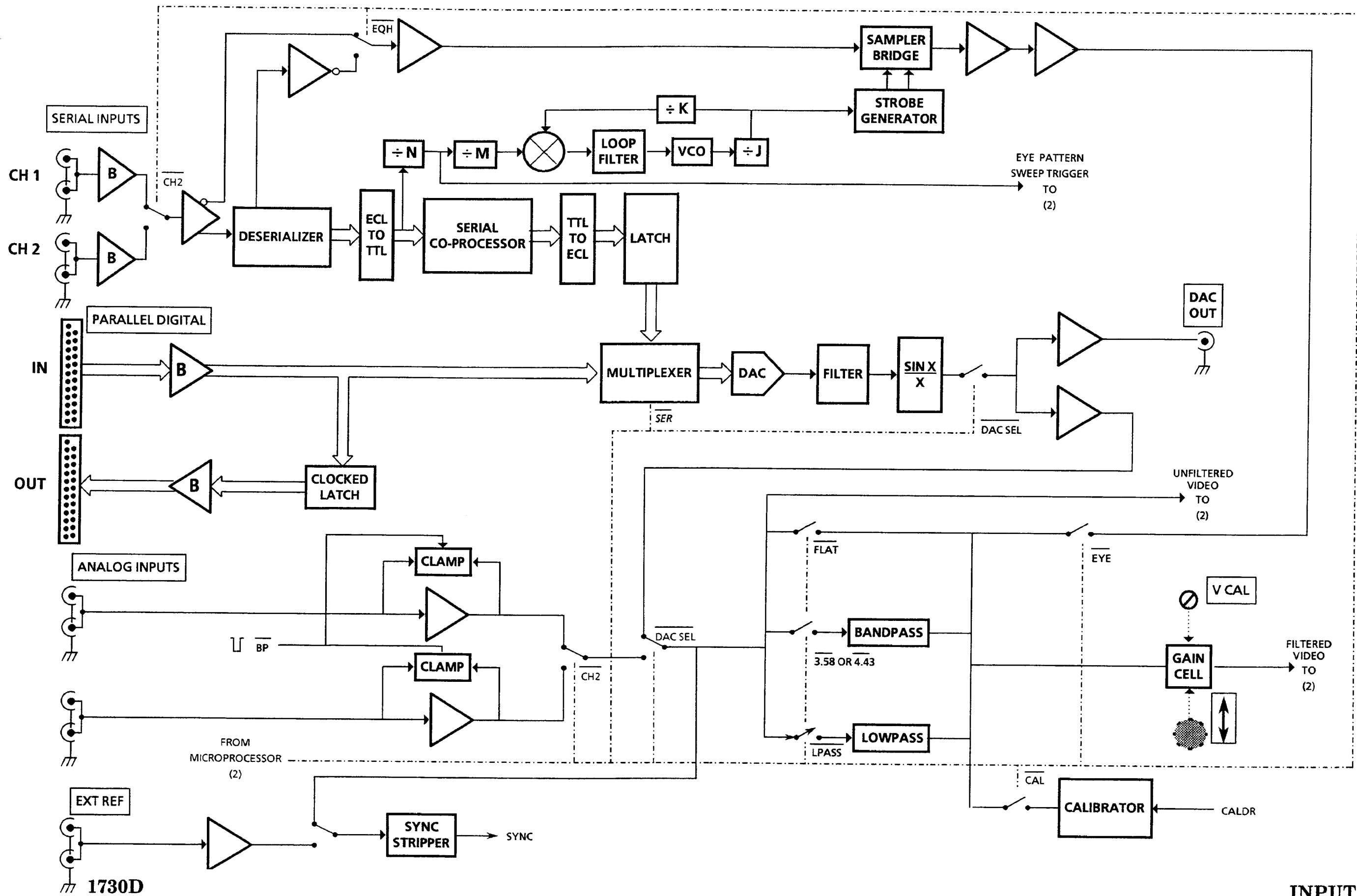


## Grid Coordinates

The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table.

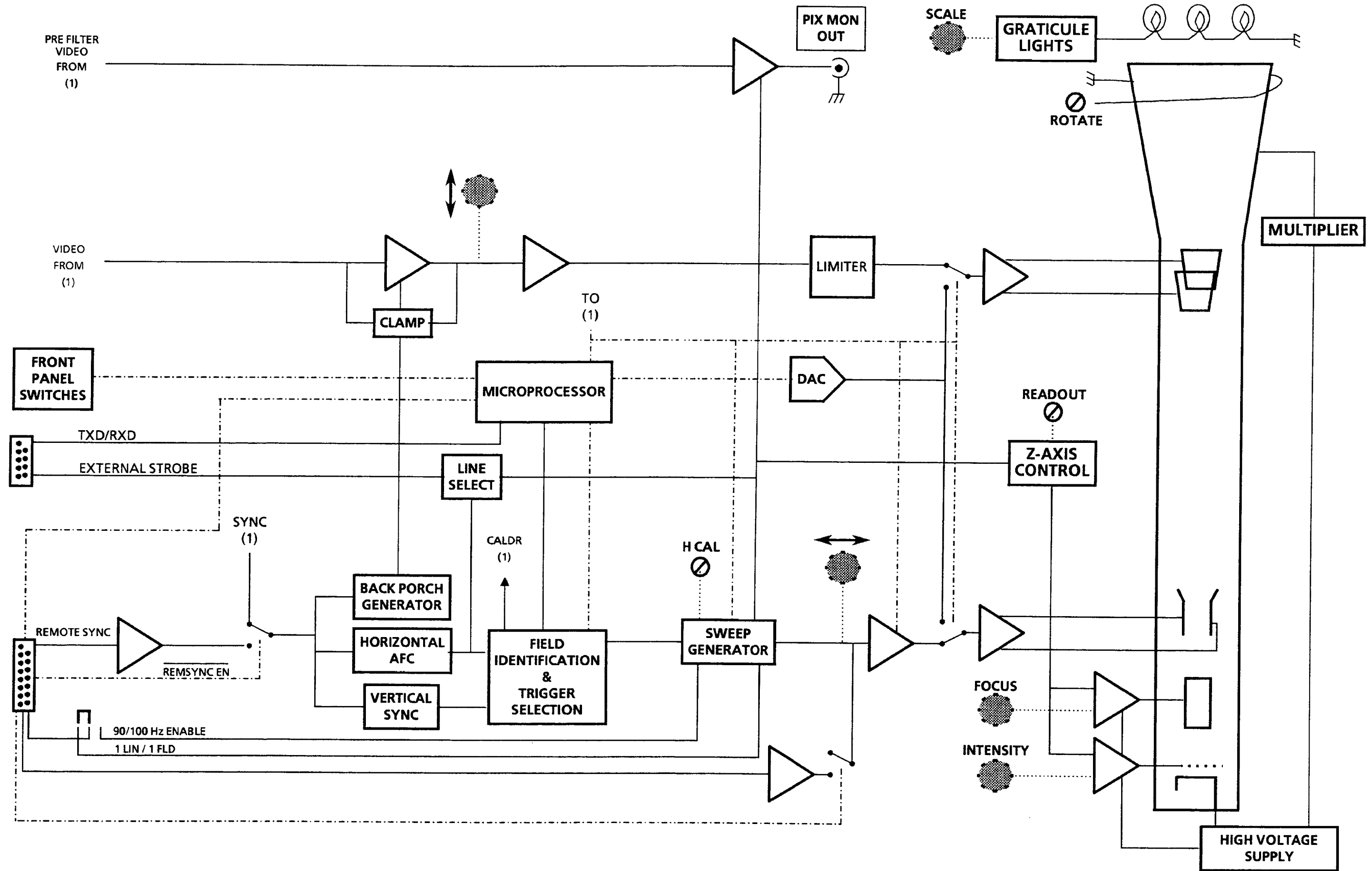
When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration will only appear opposite the first diagram; the lookup table will list the diagram number of other diagrams that the other circuitry appears on.





1730D

INPUT

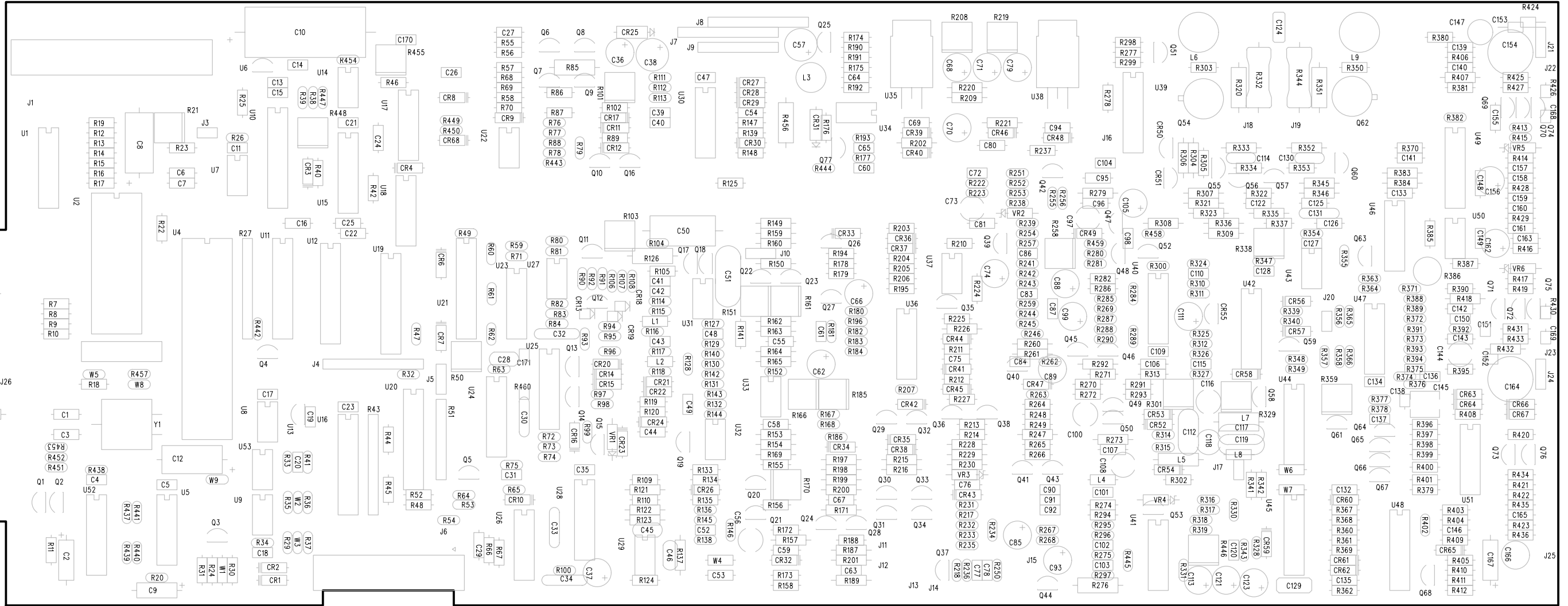


1730D

DISPLAY

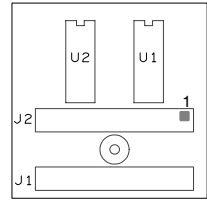
A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q

1  
2  
3  
4  
5  
6



**A3 MAIN BOARD**

⚡ STATIC SENSITIVE DEVICES



**A3A2 CAL BOARD**

**MAIN CIRCUIT BOARD LOOKUP TABLE**

CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC				
C1	C3	5	B5	C33	B2	3	G6	C65	F4	6	J2	C98	E3	2	L3	C130	H3	2	N2	C162	C4	1	P3	CR23	C3	3	G5	CR55	B2	2	M4
C2	H3	3	B6	C34	A3	3	G6	C66	F5	4	J4	C99	A2	2	L4	C131	G3	2	N3	C163	C3	1	P3	CR24	C3	4	H5	CR56	E2	1	N4
C3	C4	5	B5	C35	E2	3	G5	C67	H4	4	J5	C100	G3	1	L5	C132	F4	1	O5	C164	A4	1	P4	CR25	F4	5	G1	CR57	E3	1	N4
C4	B5	3	B5	C36	A4	6	G1	C68	B5	6	K1	C101	E1	2	L5	C133	D3	1	O2	C165	D5	1	P6	CR26	F5	3	H5	CR58	A3	2	N4
C5	B5	3	C5	C37	E5	3	G6	C69	D5	6	J2	C102	F2	2	L6	C134	D1	1	O4	C166	C5	1	P6	CR27	D1	6	I1	CR59	E4	1	N6
C6	A5	3	C2	C38	F4	5	H1	C70	A5	6	K2	C103	G1	2	L6	C135	G5	1	O6	C167	E5	1	P6	CR28	D1	6	I1	CR60	G4	1	O5
C7	A5	3	C2	C39	E3	6	H2	C71	C5	6	K1	C104	F4	2	L2	C136	C2	1	O4	C168	C1	1	Q2	CR29	D1	6	I2	CR61	F5	1	O6
C8	C3	5	C2	C40	E3	6	H2	C72	D4	2	K2	C105	B2	2	L2	C137	F1	1	O5	C169	B4	1	Q4	CR30	D1	6	I2	CR62	F5	1	O6
C9	G3	3	C6	C41	E2	4	H3	C73	F4	2	K3	C106	A5	2	M4	C138	E1	1	O4	C170	G2	4	F1	CR31	G4	6	I2	CR63	E5	1	P4
C10	G4	5	D1	C42	D2	4	H3	C74	F2	4	K3	C107	G3	1	L5	C139	A2	1	P1	C171	B2	3	F4	CR32	F1	3	I6	CR64	E4	1	P5
C11	C3	5	D2	C43	D4	4	H4	C75	F1	4	K4	C108	G3	1	L5	C140	B2	1	P1					CR33	E5	4	J3	CR65	F4	1	P6
C12	F4	5	C5	C44	C3	3	H5	C76	H2	4	K5	C109	C2	2	M4	C141	D3	1	O2					CR34	G3	4	J5	CR66	D5	1	P5
C13	F2	5	D1	C45	B1	3	H6	C77	O2	3	K6	C110	B3	2	M3	C142	B4	1	P4					CR35	F3	4	J5	CR67	D5	1	P5
				C46	E4	3	H6	C78	C2	3	K6	C111	C2	2	M4	C143	A4	1	P4					CR36	E5	4	J3	CR68	G2	4	F2
C15	A5	3	D1	C47	D2	6	H1	C79	D5	6	K1	C112	G2	1	M5	C144	A4	1	P4					CR37	E3	4	J3				
C16	A5	3	D3	C48	D2	4	H4	C80	F4	2	K2	C113	F1	2	M6	C145	E1	1	P4					CR6	E5	4	F3				
C17	F4	5	D4	C49	C2	3	H4	C81	F4	2	K3	C114	G3	2	N2	C146	E4	1	P6					CR7	G5	3	F4				
C18	F4	5	D6	C50	E4	4	H3	C83	D5	2	K3	C115	B1	2	M4	C147	B1	1	P1					CR8	B2	6	F1				
C19	D4	2	D5	C51	E2	4	I3	C84	C3	2	K4	C116	H2	1	M4	C148	B2	1	P2					CR9	B3	6	F2				
C20	E4	5	D5	C52	F5	3	H6	C85	H1	1	K6	C117	G2	1	N5	C149	B4	1	P3					CR10	B2	6	F5				
C21	B5	3	E2	C53	F2	3	H6	C86	C5	2	K3	C118	G2	1	M5	C150	C2	1	P4					CR11	D2	6	G2				
C22	A5	3	E3	C54	E1	6	I2	C87	D3	2	L3	C119	G1	1	N5	C151	C4	1	P4					CR12	D2	6	G2				
C23	A5	3	E5	C55	F5	4	I4	C88	B5	3	L3	C120	E4	1	N6	C152	A4	1	P4					CR13	B5	4	G3				
				C56	F1	3	I6	C89	D2	2	L4	C121	F1	2	M6	C153	A1	1	P1					CR14	C5	4	G4				
C25	C2	4	E3	C57	G3	6	I1	C90	G3	1	L5	C122	G3	2	N3	C154	A1	1	P1					CR15	D5	4	G4				
C26	F4	4	F1	C58	D1	4	I5	C91	G3	1	L5	C123	H5	2	N6	C155	C1	1	P2					CR16	D5	4	G5				
C27	G2	6	F1	C59	G2	3	I6	C92	G3	1	L6	C124	G2	2	N1	C156	C1	1	P2					CR17	E3	6	G2				
C28	B2	4	F4	C60	G3	6	J2	C93	G1	2	L6	C125	H4	2	N3	C157	C3	1	P2					CR18	B5	4	H3				
C29	C5	3	F6	C61	F2	4	I4	C94	C5	6	L2	C126	D1	1	N3	C158	B2	1	P2					CR19	C5	4	H4				
C30	B3	3	F5	C62	E1	4	I4	C95	C4	2	L2	C127	B5	2	N3	C159	C1	1	P2					CR20	C5	4	G4				
C31	C3	4	F5	C63	G3	4	J6	C96	E3	2	L3	C128	B5	2	N3	C160	B3	1	P3					CR21	D5	4	H4				
C32	B2	3	G4	C64	F4	6	J1	C97	E4	2	L3	C129	F5	5	N6	C161	B3	1	P3					CR22	C3	3	H4				

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A3.** Partial Assembly A3 shown on Schematics 1 through 6.

Use this circuit board lookup table for schematic < 1 >.



1  
2  
3  
4  
5

REAR PANEL

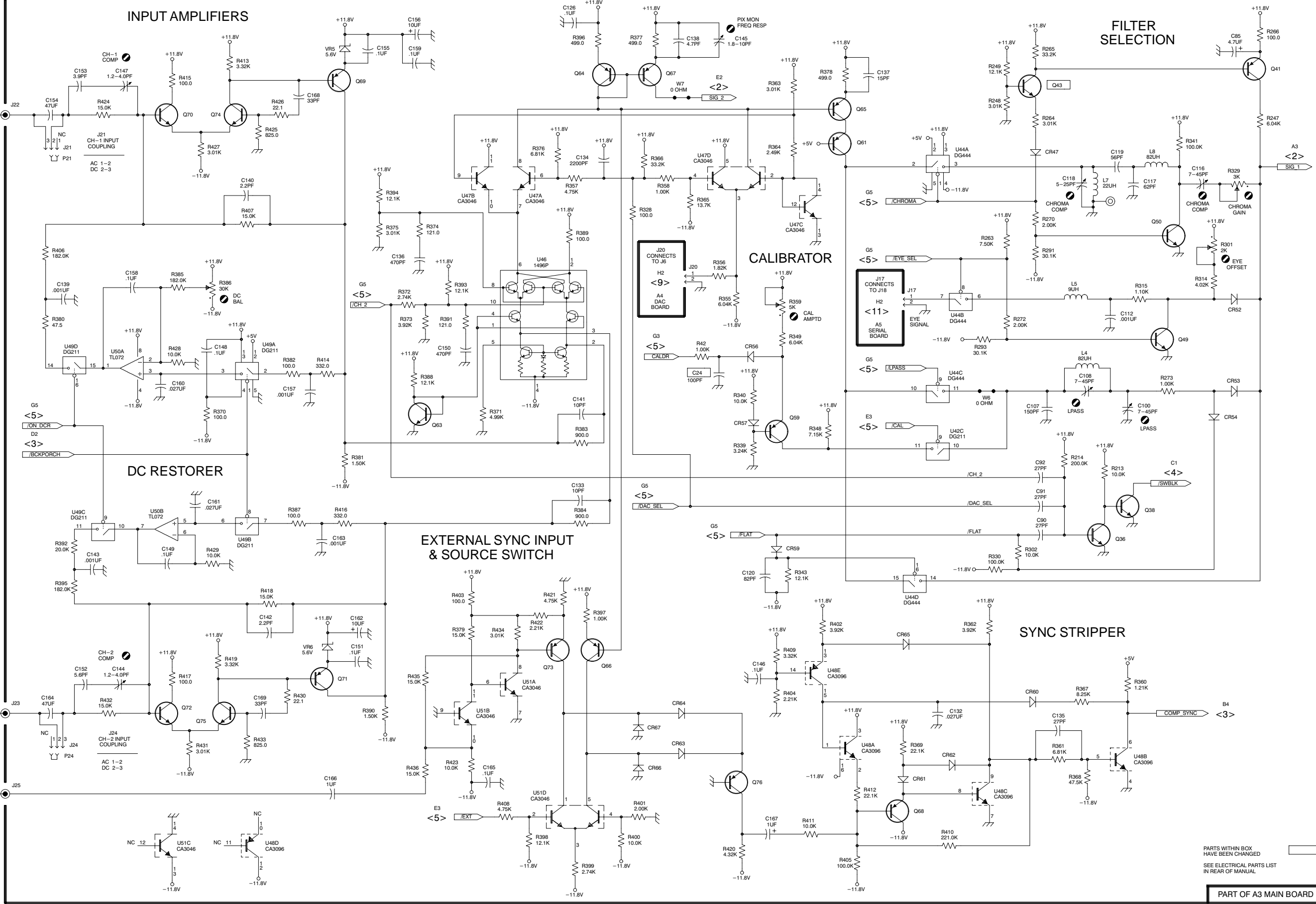
ANALOG INPUTS

CH-1

CH-2

EXIT REF

REAR PANEL



PARTS WITHIN BOX  
HAVE BEEN CHANGED  
SEE ELECTRICAL PARTS LIST  
IN REAR OF MANUAL

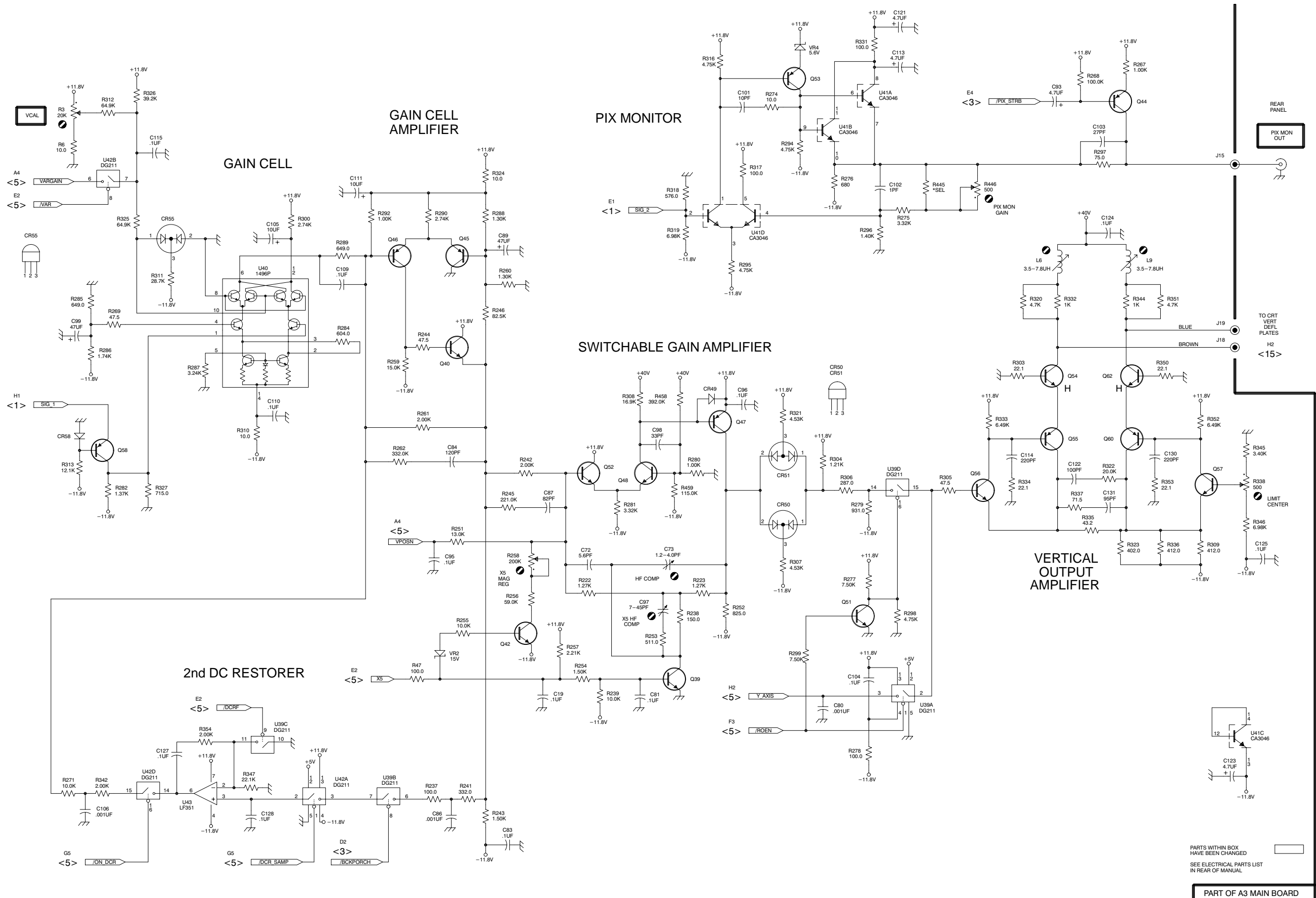
PART OF A3 MAIN BOARD

## SCHEMATIC DIAGRAM <2> MAIN BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A3.** Partial Assembly A3 also shown on Schematics 1 and 3 through 6.

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C19	D4	D5	Q57	H3	N2	R308	E3	M3
C72	D4	K2	Q58	A3	N4	R309	H3	M3
C73	E4	K3	Q60	G3	O2	R310	B3	M3
C80	F4	K2	Q62	G3	O2	R311	B2	M3
C81	E4	K3				R312	A1	M4
C83	D5	K3	R3	A1	A5	R313	A3	M4
C84	C3	K4	R6	A1	A5	R316	E1	M5
C86	C5	K3	R47	C4	E4	R317	E1	M6
C87	D3	L3	R222	D4	K2	R318	E2	M6
C89	D2	L4	R223	E4	K2	R319	E2	M6
			R237	C5	L2			
C93	G1	L6	R238	E4	K3	R320	G2	N1
C95	C4	L2	R239	D4	K3	R321	E3	M3
C96	E3	L3	R241	C5	K3	R322	G3	N2
C97	E4	L3	R242	D3	K3	R323	G3	M3
C98	E3	L3				R324	D1	M3
C99	A2	L4	R243	D5	K3	R325	B2	M4
C101	E1	L5	R244	C2	K4	R326	B1	M4
C102	F2	L6	R245	D3	K4	R327	B3	M4
C103	G1	L6	R246	D2	K4	R331	F1	M6
C104	F4	L2	R251	C3	K2	R332	G2	N1
			R252	E4	K2			
C105	B2	L2	R253	E4	K2	R333	G3	N2
C106	A5	M4	R254	D4	K3	R334	G3	N2
C109	C2	M4	R255	C4	L2	R335	G3	N3
C110	B3	M3	R256	D4	L2	R336	H3	M3
C111	C2	M4				R337	G3	N3
C113	F1	M6	R257	D4	K3	R338	H3	N3
C114	G3	N2	R258	D4	L3	R342	A5	N5
C115	B1	M4	R259	C2	K4	R344	G2	N1
C121	F1	M6	R260	D2	K4	R345	H3	N2
C122	G3	N3	R261	C3	K4	R346	H3	N2
			R262	C3	L4			
C123	H5	N6	R267	G1	L6	R347	B5	N3
C124	G2	N1	R268	G1	L6	R350	H3	O1
C125	H4	N3	R269	A2	L4	R351	H2	N1
C127	B5	N3	R271	A5	L4	R352	H3	N2
C128	B5	N3				R353	H3	N2
C130	H3	N2	R274	E1	L6	R354	B5	N3
C131	G3	N3	R275	F2	L6	R445	F2	L6
			R276	F1	L6	R446	F2	M6
CR49	E3	L3	R277	F4	L1	R458	E3	M3
CR50	E3	M2	R278	F5	L1	R459	E3	L3
CR51	E3	M2	R279	F3	L2			
CR55	B2	M4	R280	E3	L3	U39A	F4	M1
CR58	A3	N4	R281	D3	L3	U39B	C5	M1
			R282	A3	L3	U39C	B5	M1
J15	H1	L6	R284	C2	M3	U39D	F3	M1
J18	H2	N2				U40	B2	M3
J19	H2	N2	R285	A2	L3	U41A	F1	M6
			R286	A2	L3	U41B	F1	M6
L6	G2	M1	R287	B3	L4			
L9	G2	O1	R288	D2	L4	U41C	H5	M6
			R289	C2	M4	U41D	E2	M6
Q39	E4	K3	R290	C2	L4	U42A	C5	N3
Q40	C2	K4	R292	C2	L4	U42B	A1	N3
Q42	D4	L2	R294	E1	L6	U42D	B5	N3
Q44	G1	L6	R295	E2	L6	U43	B5	N3
Q45	C2	L4	R296	F2	L6			
Q46	C2	L4				VR2	C4	K3
Q47	E3	L3	R297	G1	L6	VR4	E1	M5
Q48	E3	L3	R298	F4	L1			
Q51	F4	M1	R299	E4	L1			
Q52	D3	M3	R300	B2	M3			
			R303	G3	M1			
Q53	E1	M6	R304	F3	M2			
Q54	G3	M2	R305	F3	M2			
Q55	G3	M2	R306	F3	M2			
Q56	F3	N2	R307	E4	M2			



PARTS WITHIN BOX  
HAVE BEEN CHANGED  
SEE ELECTRICAL PARTS LIST  
IN REAR OF MANUAL

PART OF A3 MAIN BOARD

### SCHEMATIC DIAGRAM <3> MAIN BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A3.** *Partial Assembly A3 also shown on Schematics 1, 2, 4, 5, and 6.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C2	H3	B6	R49	H3	F3
C4	B5	B5	R50	B2	F4
C5	B5	C5	R51	D4	F5
C6	A5	C2	R52	C5	E5
C7	A5	C2	R53	B2	F6
C9	G3	C6	R54	C5	F6
C15	A5	D1	R61	G4	F3
C16	A5	D3	R62	H4	F4
C21	B5	E2	R64	A2	F5
C22	A5	E3	R65	B2	F5
C23	A5	E5	R66	E1	F6
C29	C5	F6	R67	E1	F6
C30	B3	F5	R72	C2	G5
C32	B2	G4	R73	B3	G5
C33	B2	G6	R74	B3	G5
C34	A3	G6	R100	A3	G6
C35	E2	G5	R109	F5	H5
C37	E5	G6	R110	C2	H5
C44	C3	H5	R119	C3	H5
C45	B1	H6	R121	F5	H5
C46	E4	H6	R122	C2	H6
C49	C2	H4	R123	B1	H6
C52	F5	H6	R124	E4	H6
C53	F2	H6	R133	E5	H5
C56	F1	I6	R134	E5	H5
C59	G2	I6	R135	F5	H5
C77	C2	K6	R136	F5	H6
C78	C2	K6	R137	C2	H6
C88	B5	L3	R138	E5	H6
C171	B2	F4	R145	F5	H6
CR2	H2	D6	R146	F1	I6
CR7	G5	F4	R155	G2	I5
CR22	C3	H4	R156	G1	I6
CR23	C3	G5	R157	G1	I6
CR26	F5	H5	R158	F1	I6
CR32	F1	I6	R170	G1	I5
J5	C4	F4	R172	G2	I6
J13	D2	J6	R173	F1	I6
J14	D2	K6	R218	C2	K6
J16	D2	L2	R236	C1	K6
P5	C4		R250	C2	K6
Q1	H3	B5	R460	B2	F4
Q2	H3	B5	U20	D4	E4
Q3	G2	C6	U21	G3	F4
Q5	B1	F5	U25	B2	G4
Q20	G1	I5	U26A	C4	F6
Q21	G1	I6	U26B	D5	F6
Q37	C2	K6	U26C	F1	F6
R11	H3	B6	U26D	D2	F6
R20	G3	C6	U28A	B1	G5
R24	G2	C6	U28B	A3	G5
R31	G2	C6	U29A	E5	G6
R37	H2	D6	U29B	D2	G6
R44	D3	E5	U32B	F5	I5
R45	C3	E5			
R48	C5	E6			

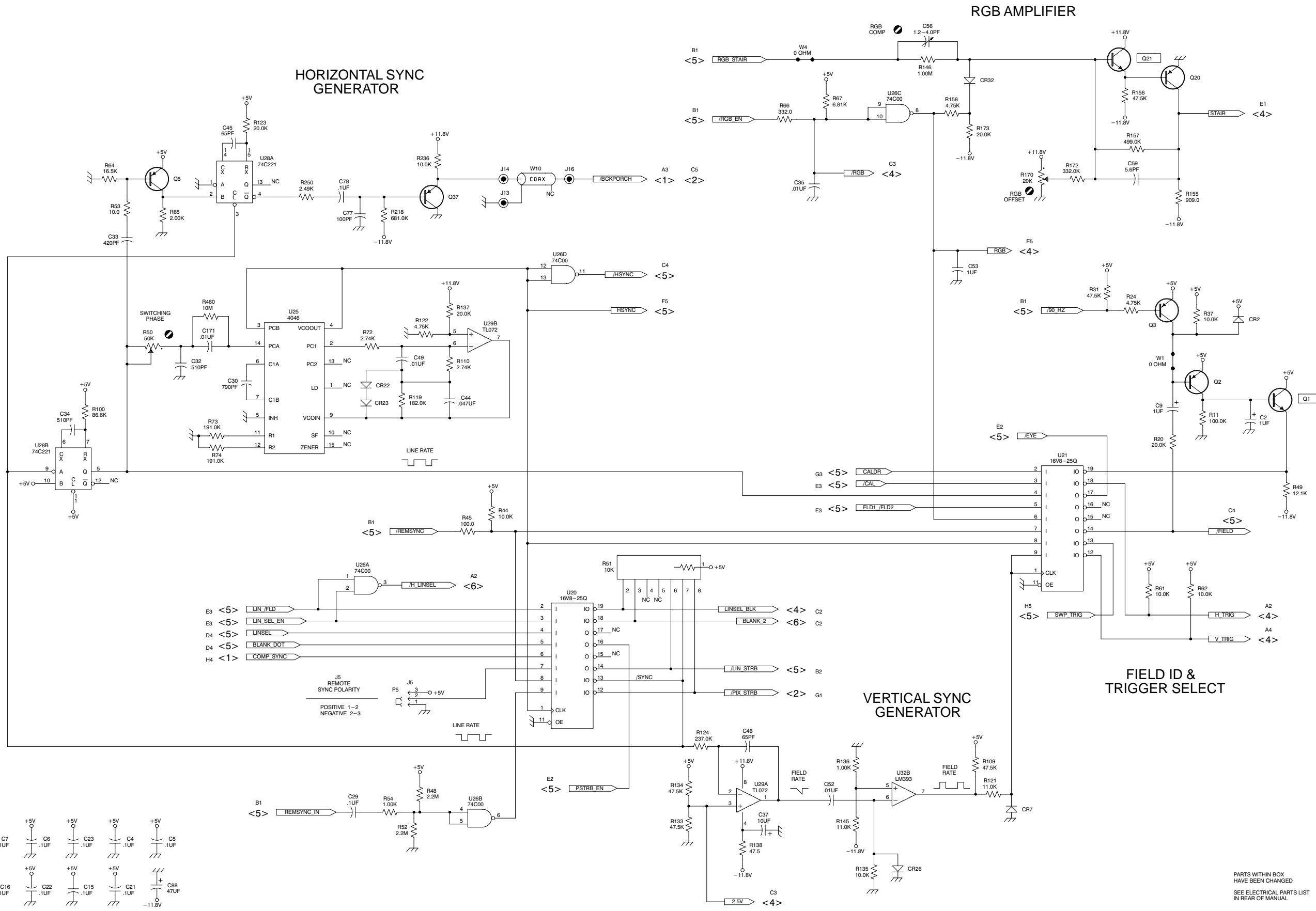
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PARTS WITHIN BOX HAVE BEEN CHANGED SEE ELECTRICAL PARTS LIST IN REAR OF MANUAL

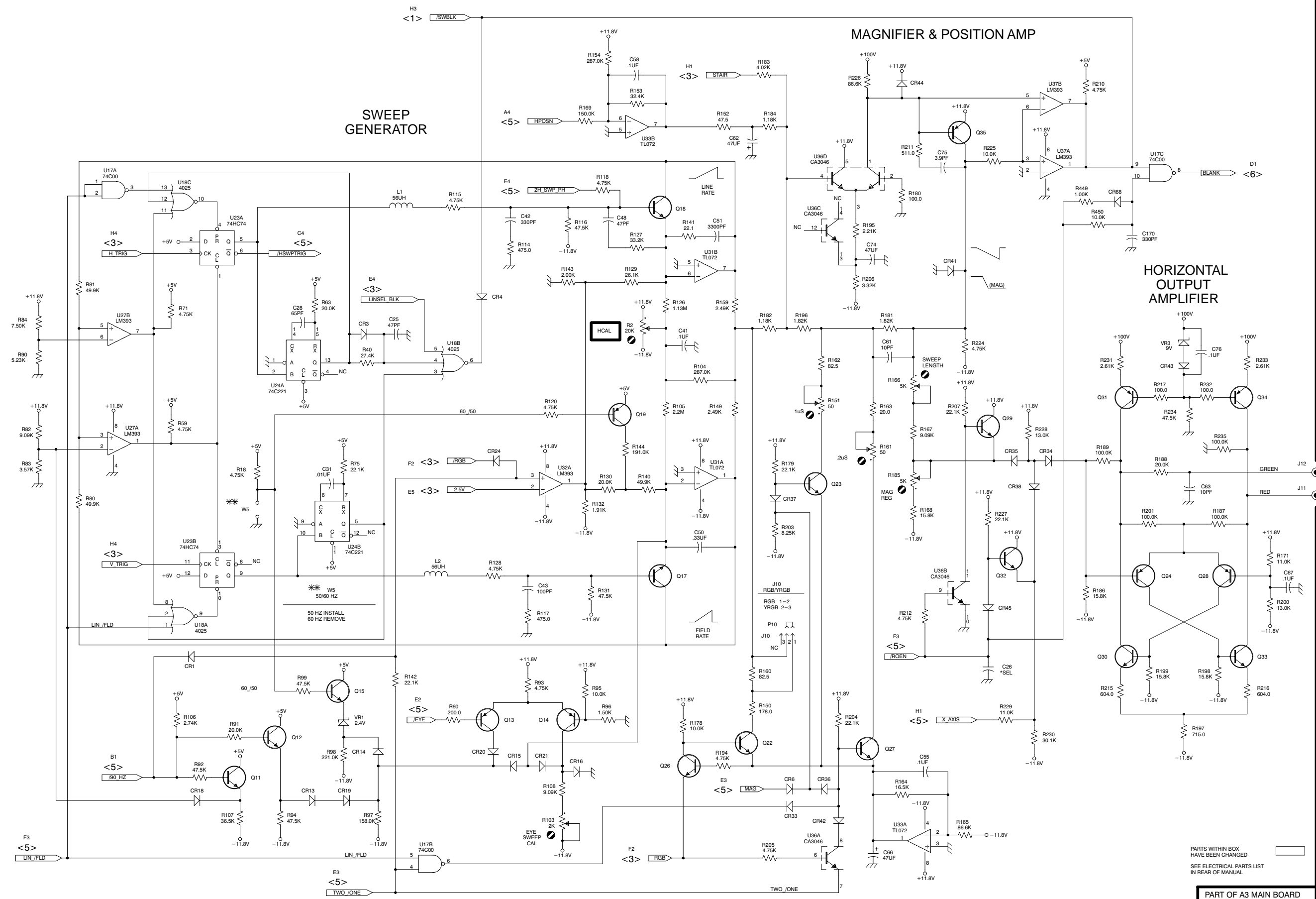
PART OF A3 MAIN BOARD

## SCHEMATIC DIAGRAM <4> MAIN BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A3.** *Partial Assembly A3 also shown on Schematics 1, 2, 3, 5, and 6.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C25	C2	E3	Q11	B5	G3	R117	D4	H4	R204	E4	J3
C26	F4	F1	Q12	B5	G3	R118	D2	H4	R205	E5	J3
C28	B2	F4	Q13	C4	G4	R120	D3	H5	R206	F2	J3
C31	C3	F5	Q14	D4	G5	R126	D2	H3	R207	F3	J4
C41	E2	H3	Q15	C4	G5	R127	D2	H4	R210	G1	K3
C42	D2	H3	Q17	D4	H3	R128	C4	H4	R211	F1	K4
C43	D4	H4	Q18	D2	H3	R129	D2	H4	R212	F4	K4
C48	D2	H4	Q19	D3	H5	R130	D3	H4	R215	G4	J5
C50	E4	H3	Q22	E5	I3	R131	D4	H4	R216	H4	J5
C51	E2	I3	Q23	E3	I3	R132	D3	H5	R217	G3	K6
C55	F5	I4	Q24	G4	I6	R140	D3	H4	R224	F2	K3
C58	D1	I5	Q26	E5	J3	R141	E2	I4	R225	F1	K4
C61	F2	I4	Q27	F5	I4	R142	C4	H4	R226	F1	K4
C62	E1	I4	Q28	H4	J6	R143	D2	H4	R227	F3	K4
C63	G3	J6	Q29	F3	J5	R144	D3	H5	R228	G3	K5
C66	F5	J4	Q30	G4	J5	R149	E3	I3	R229	F4	K5
C67	H4	J5	Q31	G3	J6	R150	E4	I3	R230	G5	K5
C74	F2	K3	Q32	F4	J5	R151	E3	H4	R231	G2	K6
C75	F1	K4	Q33	H4	J5	R152	E1	I4	R232	H3	K6
C76	H2	K5	Q34	H3	J6	R153	D1	I5	R233	H2	K6
C170	G2	E1	Q35	F1	K4	R154	D1	I5	R234	G3	K6
CR1	B4	D6	R2	D2	A4	R159	E2	I3	R235	H3	K6
CR3	C2	D2	R18	B3	B4	R160	E4	I3	R449	G2	F2
CR4	C2	E2	R40	C3	D2	R161	F3	I3	R450	G2	F2
CR6	E5	F3	R59	B3	F3	R162	E2	I4	U17A	A2	E1
CR13	B5	G3	R60	C4	F3	R163	F3	I4	U17B	C5	E1
CR14	C5	G4	R63	B2	F4	R164	F5	I4	U17C	G1	E1
CR15	D5	G4	R71	B2	F3	R165	F5	I4	U18A	B4	E2
CR16	D5	G5	R75	C3	F5	R166	F3	I5	U18B	C2	E2
CR18	B5	H3	R80	A3	G3	R167	F3	I5	U18C	B2	E2
CR19	C5	H4	R81	A2	G3	R168	F3	I5	U23A	B2	F3
CR20	C5	G4	R82	A3	G4	R169	D1	I5	U23B	B4	F3
CR21	D5	H4	R83	A3	G4	R171	H4	J6	U24A	B2	F4
CR24	C3	H5	R84	A2	G4	R178	E4	J3	U24B	B3	F4
CR33	E5	J3	R90	A2	G3	R179	E3	J3	U27A	A3	G3
CR34	G3	J5	R91	B5	G3	R180	F2	J4	U27B	A2	G3
CR35	F3	J5	R92	B5	G3	R181	F2	J4	U31A	E3	H4
CR36	E5	J3	R93	D4	G4	R182	E2	J4	U31B	E2	H4
CR37	E3	J3	R94	B5	G4	R183	E1	J4	U32A	D3	I5
CR38	G3	J5	R95	D4	G4	R184	E1	J4	U33A	F5	I4
CR41	F2	K4	R96	D4	G4	R185	F3	J4	U33B	D1	I4
CR42	E5	J5	R97	C5	G4	R186	G4	J5	U36A	E5	J4
CR43	G3	K5	R98	C5	G5	R187	H3	J6	U36B	F4	J4
CR44	F1	K4	R99	B4	G5	R188	G3	J6	U36C	E2	J4
CR45	F4	K4	R103	D5	G3	R189	G3	J6	U36D	E1	J4
CR68	G2	F2	R104	E3	H3	R194	E5	J3	U37A	G1	K3
J10	E4	I3	R105	D3	H3	R195	F2	J3	U37B	G1	K3
J11	H3	J6	R106	B4	G3	R196	E2	J4	VR1	C4	G5
J12	H3	J6	R107	B5	G3	R197	G4	J5	VR3	G2	K5
L1	C2	H4	R108	D5	H3	R198	H4	J5			
L2	C4	H4	R114	D2	H4	R199	G4	J5			
P10	E4		R115	C2	H4	R200	H4	J5			
			R116	D2	H4	R201	G3	J6			
						R203	E3	J3			



PARTS WITHIN BOX  
HAVE BEEN CHANGED  
SEE ELECTRICAL PARTS LIST  
IN REAR OF MANUAL

PART OF A3 MAIN BOARD

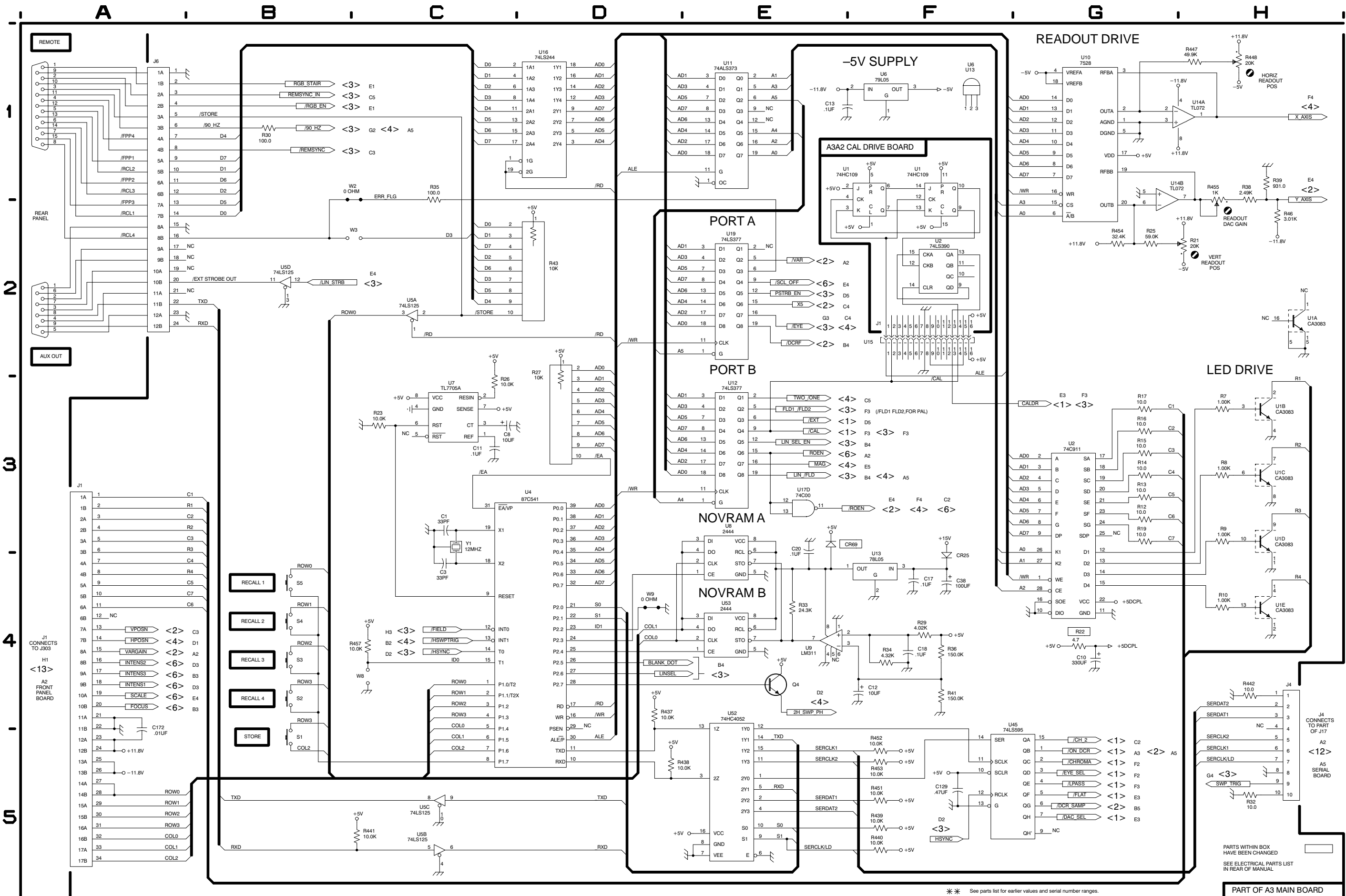
## SCHEMATIC DIAGRAM <5> MAIN BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A3.** *Partial Assembly A3 also shown on Schematics 1, 2, 3, 4, and 6.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C1	C3	B5	R441	C5	C6
C3	C4	B5	R442	H4	D4
C8	C3	C2	R447	H1	D1
C10	G4	D1	R448	H1	E2
C11	C3	D2	R451	F5	B5
C12	F4	C5	R452	F5	B5
C13	F2	D1	R453	F5	B5
C17	F4	D4	R454	G2	E1
C18	F4	D6	R455	H2	E1
C20	E4	D5	R457	C4	C4
C38	F4	H1	S1	B5	A3
C129	F5	N6	S2	B4	A4
CR25	F4	G1	S3	B4	A4
J1	A3	B2	S4	B4	A5
J4	H4	D4	S5	B4	A5
J6	A1	F6	U1A	H2	B2
Q4	E4	D4	U1B	H3	B2
R7	H3	B4	U1C	H3	B2
R8	H3	B4	U1D	H3	B2
R9	H3	B4	U1E	H4	B2
R10	H4	B4	U2	G3	B2
R12	G3	B2	U4	C3	C3
R13	G3	B2	U5A	C2	C5
R14	G3	B2	U5B	C5	C5
R15	G3	B2	U5C	C5	C5
R16	G3	B2	U5D	B2	C5
R17	G3	B2	U6	F1	D1
R19	G3	B2	U7	C3	C2
R21	G2	C2	U8	E3	D5
R22	G4	C3	U9	E4	D5
R23	C3	C2	U10	G1	D2
R25	G2	D1	U11	E1	D3
R26	C2	D2	U12	E3	D3
R27	D2	D3	U13	E4	D5
R29	F4	D6	U14A	G1	D1
R30	B1	D6	U14B	G1	D1
R32	H5	E4	U15A	G2	D3
R33	E4	D5	U15B	G2	D3
R34	F4	D6	U16	D1	D5
R35	C1	D5	U17D	E3	E1
R36	F4	D5	U19	E2	E3
R38	H2	D1	U45	F5	N5
R39	H1	D1	U52	E4	B5
R41	F4	D5	U53	E4	D5
R43	D2	E5	Y1	C3	C5
R46	H2	E1			
R437	D4	C5			
R438	D5	B5			
R439	F5	C6			
R440	F5	C6			





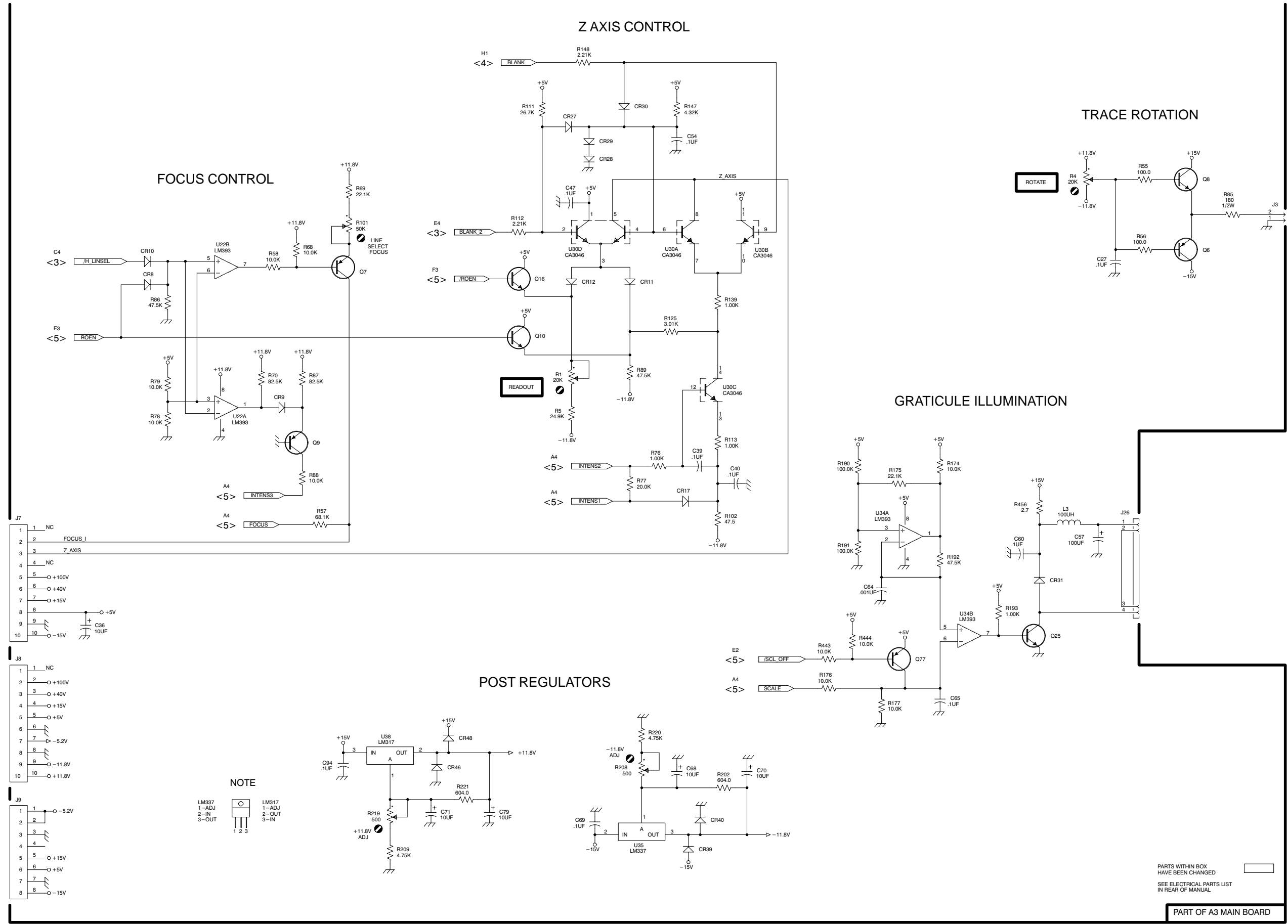
## SCHEMATIC DIAGRAM <6> MAIN BOARD

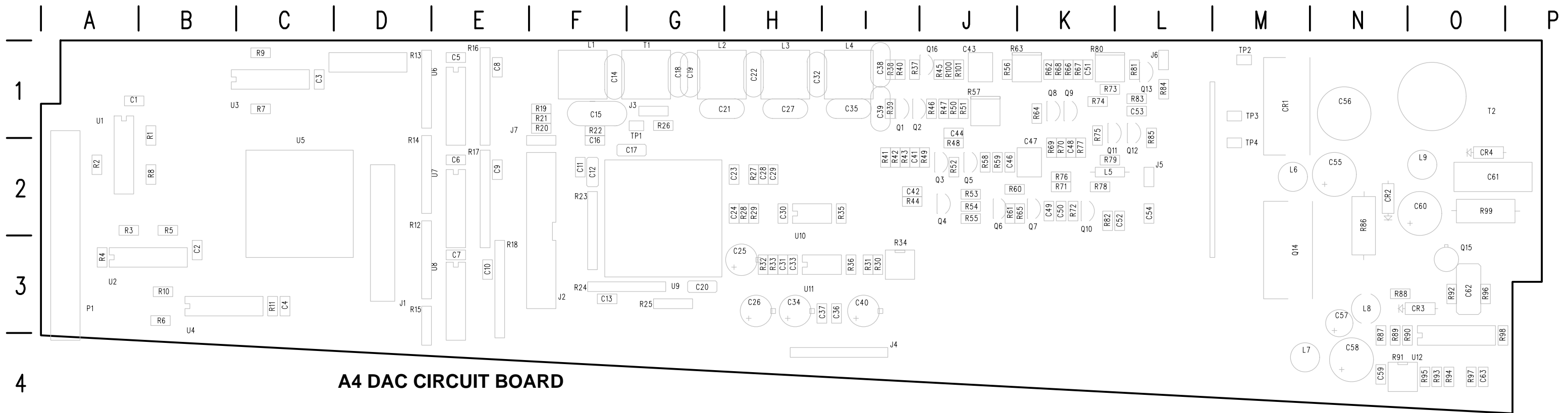
The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A3.** *Partial Assembly A3 also shown on Schematics 1 through 5.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C27	G2	F1	R70	B3	F2
C36	A4	G1	R76	E3	G2
C39	E3	H2	R77	D3	G2
C40	E3	H2	R78	B3	G2
C47	D2	H1	R79	B3	G2
C54	E1	I2	R85	H2	G1
C57	G3	I1	R86	B2	G1
C60	G3	J2	R87	C3	G2
C64	F4	J1	R88	C3	G2
C65	F4	J2	R89	D2	G2
C68	E5	K1	R101	C2	G1
C69	D5	J2	R102	E3	G2
C70	E5	K2	R111	D1	H1
C71	C5	K1	R112	D2	H1
C79	D5	K1	R113	E3	H1
C94	C5	L2	R125	E2	H2
CR8	B2	F1	R139	E2	I2
CR9	B3	F2	R147	E1	I2
CR10	B2	F5	R148	D1	I2
CR11	D2	G2	R174	F3	J1
CR12	D2	G2	R175	F3	J1
CR17	E3	G2	R176	F4	I2
CR27	D1	I1	R177	F4	J2
CR28	D1	I1	R190	F3	J1
CR29	D1	I2	R191	F3	J1
CR30	D1	I2	R192	F3	J1
CR31	G4	I2	R193	G4	J2
CR39	E5	J2	R202	E5	J2
CR40	E5	J2	R208	D5	K1
CR46	C5	K2	R209	C5	K1
CR48	C4	L2	R219	C5	K1
J3	H2	C2	R220	D4	K1
J7	A3	H1	R221	C5	K2
J8	A4	H1	R443	F4	G2
J9	A5	H1	R444	F4	I2
J26	G3	A4	R456	G3	I2
L3	G3	I1	U22A	B3	F2
Q6	H2	G1	U22B	B2	F2
Q7	C2	G1	U30A	E2	H1
Q8	H1	G1	U30B	E2	H1
Q9	B3	G1	U30C	E3	H1
Q10	D2	G2	U30D	D2	H1
Q16	D2	H2	U34A	F3	J2
Q25	G4	I1	U34B	F4	J2
Q77	F4	I2	U35	D5	J1
R1	D3	A4	U38	C5	L1
R4	G1	A5	<b>A3A1</b>		
R5	D3	A3	DS100	H3	
R55	G1	F1	DS200	H4	
R56	G2	F1	DS300	H4	
R57	C3	F1	J100	H3	
R58	B2	F1	P100	H3	
R68	C2	F1	P200	G3	
R69	C2	F1	P800	G4	

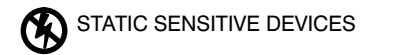
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**A4 DAC CIRCUIT BOARD**

**DAC CIRCUIT BOARD  
LOOKUP TABLE**



The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A4.**

Use this circuit board lookup table for schematic <7>.

CKT NO.	SCHEM LOC	SCHEM BD LOC	CKT NO.	SCHEM LOC	SCHEM BD LOC	CKT NO.	SCHEM LOC	SCHEM BD LOC	CKT NO.	SCHEM LOC	SCHEM BD LOC	CKT NO.	SCHEM LOC	SCHEM BD LOC	CKT NO.	SCHEM LOC	SCHEM BD LOC	CKT NO.	SCHEM LOC	SCHEM BD LOC				
C1	F5	8 A1	C31	C4	8 H3	C62	B4	9 O3	Q4	D2	9 J2	R17	D3	7 E2	R47	D2	9 J1	R77	F1	9 K2	TP3	E4	9 M1	
C2	F5	8 B3	C32	F2	8 H1	C63	B4	9 O4	Q5	C2	9 J2	R18	D2	7 E3	R48	C2	9 J2	R78	G4	9 K2	TP4	C4	9 M2	
C3	G5	8 C1	C33	C4	8 H3	CR1	D4	9 M1	Q6	F4	9 J2	R19	D5	7 F1	R49	C2	9 J2	R79	F2	9 K2				
C4	G5	8 C3	C34	G5	8 H3	CR2	C4	9 N2	Q7	F4	9 K2	R20	D5	7 F1	R50	D2	9 J1	R80	F2	9 K1	U1A	B4	7 A1	
C5	E5	7 E1	C35	G2	8 I1	CR3	C5	9 O3	Q8	E2	9 K1	R21	D5	7 F1	R51	D2	9 J1	R81	G2	9 L1	U1B	B4	7 A1	
C6	E4	7 E2	C36	F5	8 I3	CR4	D4	9 O2	Q9	F2	9 K1	R22	C3	8 F1	R52	D1	9 J2	R82	G3	9 K2	U1C	B5	7 A1	
C7	E4	7 E3	C37	G5	8 I3				Q10	G3	9 K2	R23	B2	8 F2	R53	E4	9 J2	R83	F2	9 L1	U2A	B3	7 A3	
C8	D4	7 E1	C38	G2	8 I1	J1	G1	7 D3	Q11	F1	9 K2	R24	B1	8 F3	R54	D2	9 J2	R84	F1	9 L1	U2B	B3	7 A3	
C9	D3	7 E2	C39	G2	8 I1	J2	A4	7 F3	Q12	F1	9 L2	R25	B3	8 G3	R55	F3	9 J2	R85	F1	9 L2	U2C	B4	7 A3	
C10	D2	7 E3	C40	F5	8 I3	J3	D2	8 G1	Q13	G2	9 L1	R26	D2	8 G1	R56	E3	9 J1	R86	D5	9 N2	U3A	B5	7 B1	
						J4	A3	9 I4	Q14	C5	9 M3	R27	C3	8 H2	R57	D2	9 J1	R87	B5	9 N4	U3B	B1	7 B1	
C11	C1	8 F2	C41	C2	9 I2	J5	H4	9 L2	Q15	C5	9 O3	R28	D2	8 H2	R58	E3	9 J2	R88	D5	9 N3	U4A	B2	7 B4	
C12	D3	8 F2	C42	D2	9 I2	J6	H2	9 L1	Q16	C3	9 J1	R29	C4	8 H2	R59	F3	9 J2	R89	B5	9 N4	U4B	B2	7 B4	
C13	C2	8 F3	C43	D3	9 J1	J7	D5	7 E1				R30	C4	8 I3	R60	F4	9 J2	R90	B5	9 O4				
C14	E3	8 F1	C44	D3	9 J1							R31	B4	8 I3	R61	F4	9 J2	R91	A5	9 N4	U4C	B3	7 B4	
C15	E3	8 F1	C46	E3	9 J2	L1	E3	8 F1	R1	B5	7 B2	R32	C4	8 H3	R62	E2	9 K1	R92	C5	9 O3	U5	E1	7 C2	
C16	C3	8 F2	C47	E3	9 K2	L2	F2	8 G1	R2	B4	7 A2	R33	C4	8 H3	R63	F3	9 J1	R93	B5	9 O4	U6	E5	7 E1	
C17	D3	8 G2	C48	F1	9 K2	L3	F2	8 H1	R3	B4	7 A2	R34	C4	8 H3	R64	F3	9 J1	R94	C5	9 O4	U7	E4	7 E2	
C18	E2	8 G1	C49	G3	9 K2	L4	G2	8 I1	R4	B3	7 A3	R35	B4	8 I3	R65	F4	9 K2	R95	A5	9 O4	U8	E3	7 E3	
C19	E2	8 G1	C50	C5	8 K2	L5	G4	9 K2	R5	B3	7 B2	R36	B4	8 I3	R66	E2	9 K1	R96	B4	9 O3	U9	C2	8 G3	
C20	D3	8 G3	C51	F2	9 K1	L6	C4	9 M2	R6	B2	7 B3										U10	A5	8 H3	
						L7	B4	9 M4	R7	B5	7 C1											U11	C4	8 H3
C21	F2	8 G1	C52	G3	9 L2	L8	D4	9 N3	R8	B4	7 B2	R37	C2	9 I1	R67	E2	9 K1	R97	B4	9 O4	U12	B4	9 O4	
C22	F2	8 H1	C53	F1	9 L1	L9	F2	8 G1	R9	B1	7 C1	R38	G2	8 I1	R68	E2	9 K1	R98	C5	9 P4				
C23	D3	8 H2	C54	G5	8 L2				R10	B3	7 B3	R39	B2	9 I1	R69	E1	9 K2	R99	D4	9 O2				
C24	D4	8 H2	C55	C4	9 N2	P1	A1	7 A3				R40	C2	9 I1	R70	F1	9 K2	R100	C3	9 J1				
C25	C4	8 H3	C56	D4	9 N1	P3	D2	8 A3	R11	B2	7 C3	R41	C2	9 I2	R71	G4	9 K2	R101	C3	9 J1				
C26	F5	8 H3	C57	C4	9 N3	P7	D5	7 A3	R12	C2	7 D2	R42	C2	9 I2	R72	G4	9 K2							
C27	F2	8 H1	C58	D4	9 N4				R13	C4	7 D1	R43	C1	9 I2	R73	G2	9 K1							
C28	C3	8 H2	C59	A5	9 N4	Q1	C2	9 I1	R14	C3	7 D2	R44	D2	9 I2	R74	F2	9 K1							
C29	B5	8 H2	C60	C4	9 O2	Q2	C2	9 I1	R15	C1	7 D3	R45	C3	9 J1	R75	F1	9 K2							
C30	A5	8 H2	C61	D4	9 O2	Q3	D2	9 J2	R16	D4	7 E1	R46	C2	9 J1	R76	G3	9 K2							



## SCHEMATIC DIAGRAM < 8 > DAC BOARD

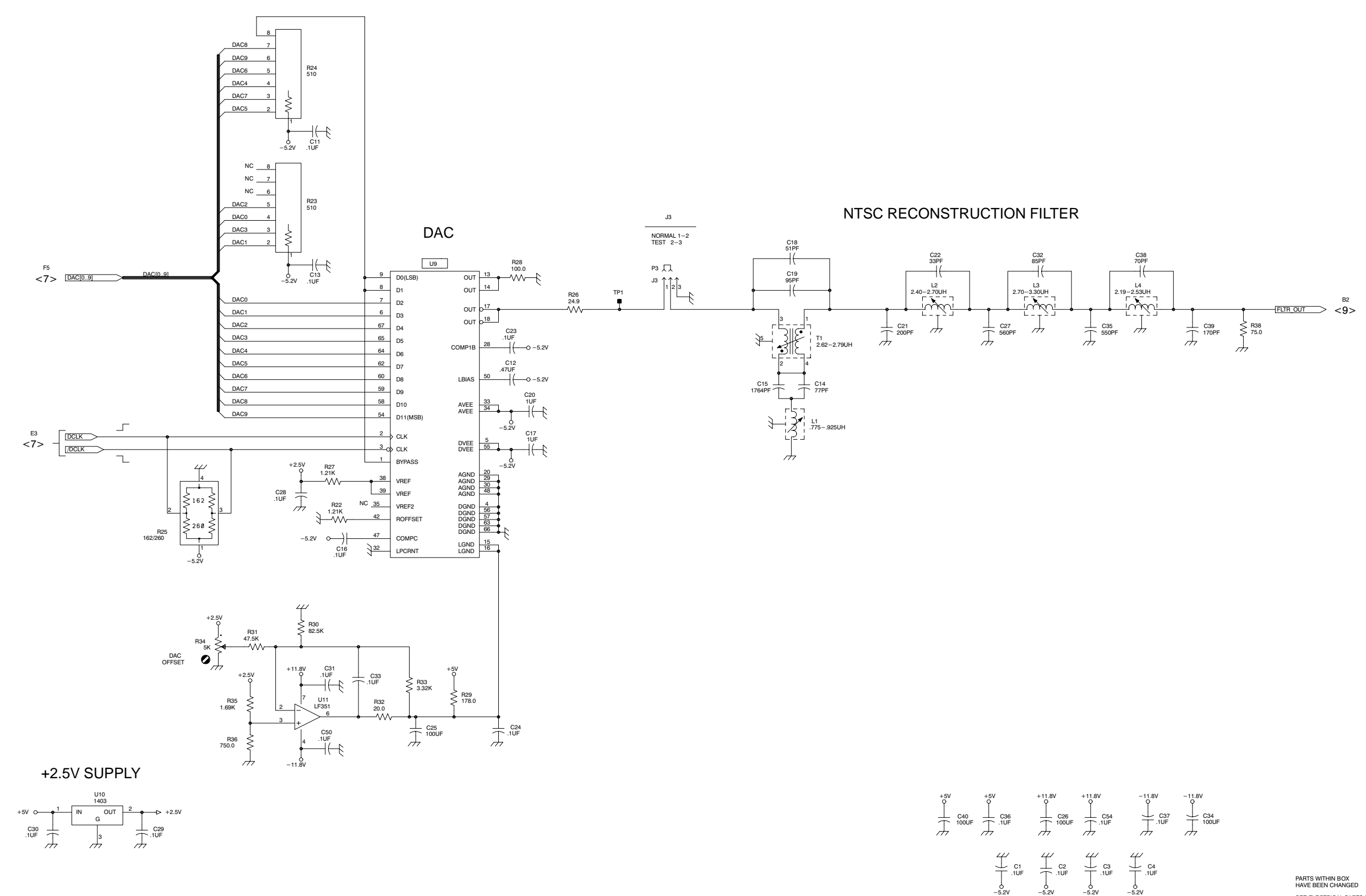
The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A4.** *Partial Assembly A4 also shown on Schematics 7 and 9.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C1	F5	A1	L1	E3	F1
C2	F5	B3	L2	F2	G1
C3	G5	C1	L3	F2	H1
C4	G5	C3	L4	G2	I1
C11	C1	F2			
			P3	D2	
C12	D3	F2			
C13	C2	F3	R22	C3	F1
C14	E3	F1	R23	B2	F2
C15	E3	F1	R24	B1	F3
C16	C3	F2	R25	B3	G3
			R26	D2	G1
C17	D3	G2			
C18	E2	G1	R27	C3	H2
C19	E2	G1	R28	D2	H2
C20	D3	G3	R29	C4	H2
C21	F2	G1	R30	C4	I3
			R31	B4	I3
C22	F2	H1			
C23	D3	H2	R32	C4	H3
C24	D4	H2	R33	C4	H3
C25	C4	H3	R34	B4	I3
C26	F5	H3	R35	B4	I2
			R36	B4	I3
C27	F2	H1	R38	G2	I1
C28	C3	H2			
C29	B5	H2	T1	E2	G1
C30	A5	H2			
C31	C4	H3	TP1	D2	G2
C32	F2	H1	U9	C2	G3
C33	C4	H3	U10	A5	H3
C34	G5	H3	U11	C4	H3
C35	G2	I1			
C36	F5	I3			
C37	G5	I3			
C38	G2	I1			
C39	G2	I1			
C40	F5	I3			
C50	C5	K2			
C54	G5	L2			
J3	D2	G1			

A B C D E F G H

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PARTS WITHIN BOX  
HAVE BEEN CHANGED  
SEE ELECTRICAL PARTS LIST  
IN REAR OF MANUAL

PART OF A4 DAC BOARD

## SCHEMATIC DIAGRAM <9> DAC BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A4.** *Partial Assembly A4 also shown on Schematics 7 and 8.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C41	C2	I2	Q11	F1	K2	R74	F2	K1
C42	D2	I2	Q12	F1	L2	R75	F1	K2
C43	D3	J1	Q13	G2	L1	R76	G3	K2
C44	D3	J1	Q14	C5	M3	R77	F1	K2
C46	E3	J2	Q15	C5	O3	R78	G4	K2
			Q16	C3	J1			
C47	E3	K2				R79	F2	K2
C48	F1	K2	R37	C2	I1	R80	F2	K1
C49	G3	K2	R39	B2	I1	R81	G2	L1
C51	F2	K1	R40	C2	I1	R82	G3	K2
C52	G3	L2	R41	C2	I2	R83	F2	L1
			R42	C2	I2			
C53	F1	L1				R84	F1	L1
C55	C4	N2	R43	C1	I2	R85	F1	L2
C56	D4	N1	R44	D2	I2	R86	D5	N2
C57	C4	N3	R45	C3	J1	R87	B5	N4
C58	D4	N4	R46	C2	J1	R88	C5	N3
			R47	D2	J1			
C59	A5	N4				R89	B5	N4
C60	C4	O2	R48	C2	J2	R90	B5	O4
C61	D4	O2	R49	C2	J2	R91	A5	N4
C62	B4	O3	R50	D2	J1	R92	C5	O3
C63	B4	O4	R51	D2	J1	R93	B5	O4
			R52	D1	J2			
CR1	D4	M1				R94	C5	O4
CR2	C4	N2	R53	E4	J2	R95	A5	O4
CR3	C5	O3	R54	D2	J2	R96	B4	O3
CR4	D4	O2	R55	F3	J2	R97	B4	O4
			R56	E3	J1	R98	C5	P4
J4	A3	I4	R57	D2	J1			
J5	H4	L2				R99	D4	O2
J6	H2	L1	R58	E3	J2	R100	C3	J1
			R59	F3	J2	R101	C3	J1
L5	G4	K2	R60	F4	J2			
L6	C4	M2	R61	F4	J2	T2	D4	O1
L7	B4	M4	R62	E2	K1			
L8	D4	N3				TP2	D4	M1
L9	C4	O2	R63	F3	J1	TP3	E4	M1
			R64	F3	K1	TP4	C4	M2
Q1	C2	I1	R65	F4	K2			
Q2	C2	I1	R66	E2	K1			
Q3	D2	J2	R67	E2	K1			
Q4	D2	J2				U12	B4	O4
Q5	C2	J2						
			R68	E2	K1			
Q6	F4	J2	R69	E1	K2			
Q7	F4	K2	R70	F1	K2			
Q8	E2	K1	R71	G4	K2			
Q9	F2	K1	R72	G4	K2			
Q10	G3	K2	R73	G2	K1			



A B C D E F G H

1

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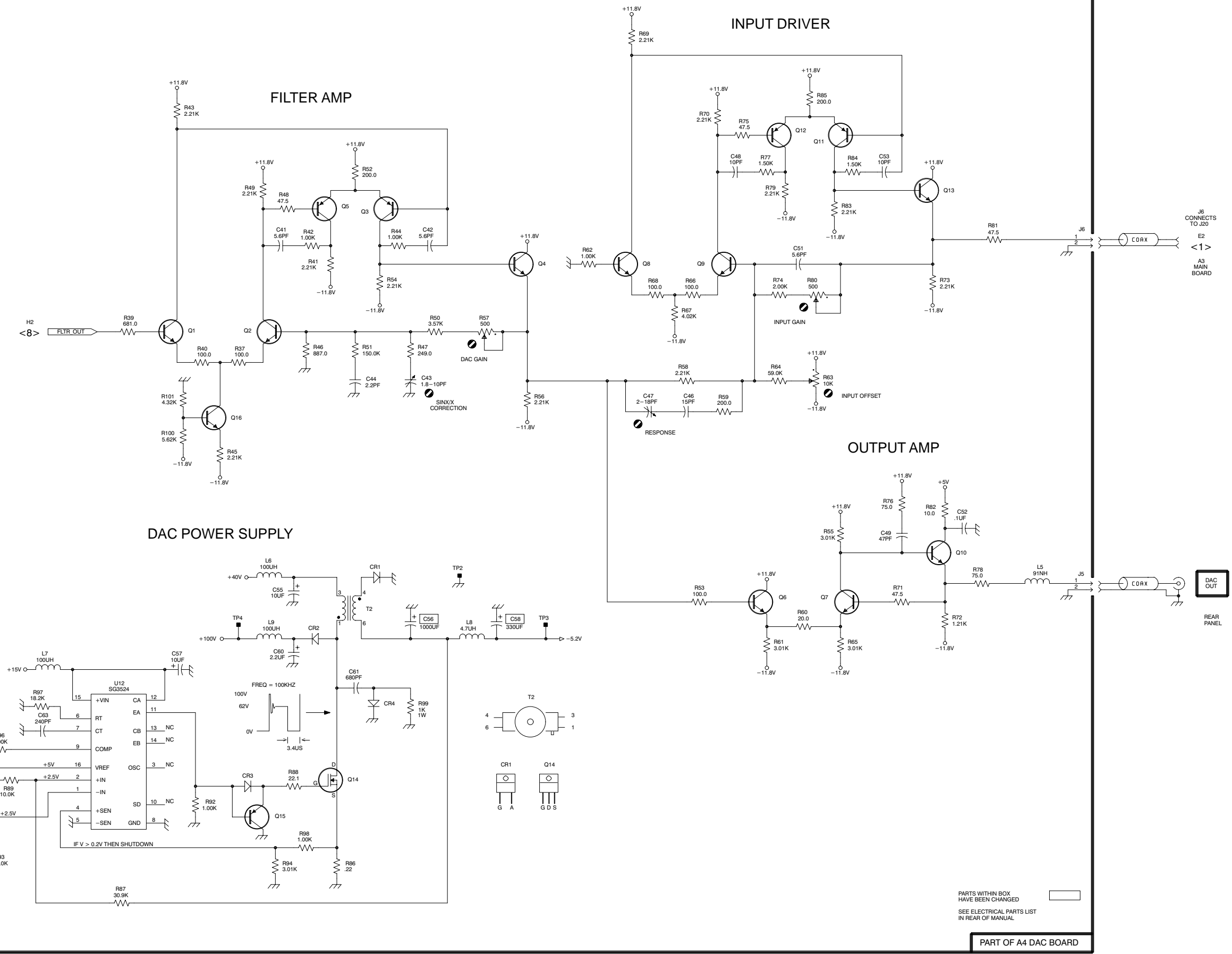
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J4 CONNECTS TO J8  
A4  
<6>  
A3  
MAIN BOARD

1	NC
2	+100V
3	+40V
4	+15V
5	+5V
6	-5.2V
7	-11.8V
8	-11.8V
9	-11.8V
10	+11.8V

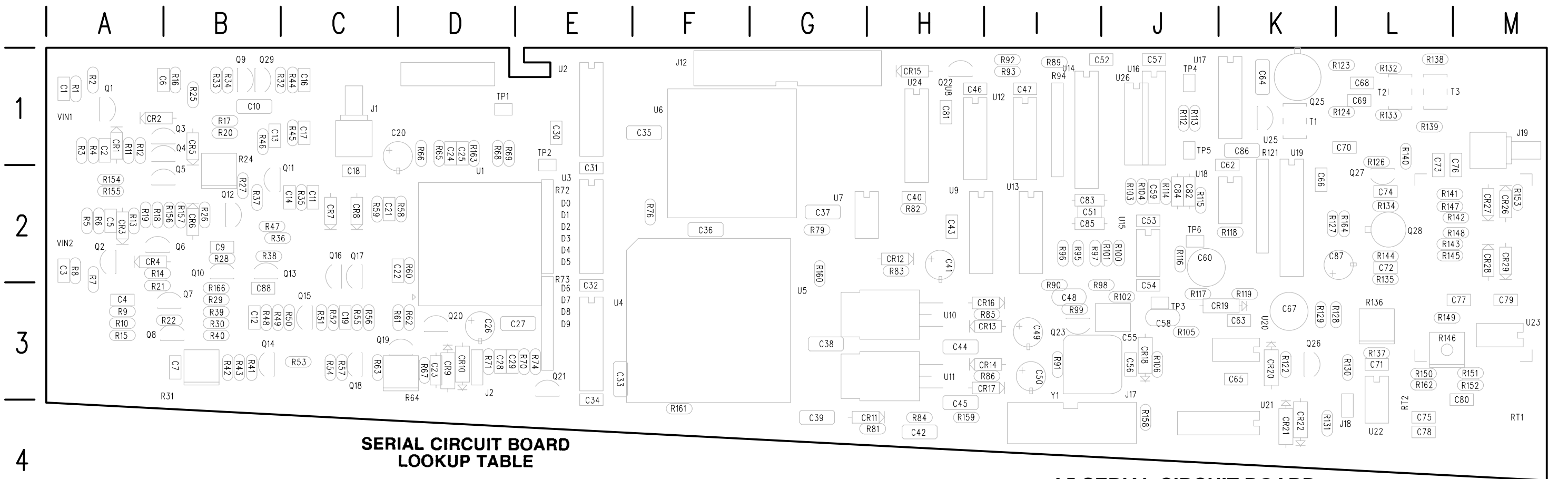


J6 CONNECTS TO J20  
E2  
<1>  
A3  
MAIN BOARD

REAR PANEL  
DAC OUT

PARTS WITHIN BOX HAVE BEEN CHANGED  
SEE ELECTRICAL PARTS LIST IN REAR OF MANUAL

PART OF A4 DAC BOARD



**SERIAL CIRCUIT BOARD  
LOOKUP TABLE**

**A5 SERIAL CIRCUIT BOARD**

STATIC SENSITIVE DEVICES

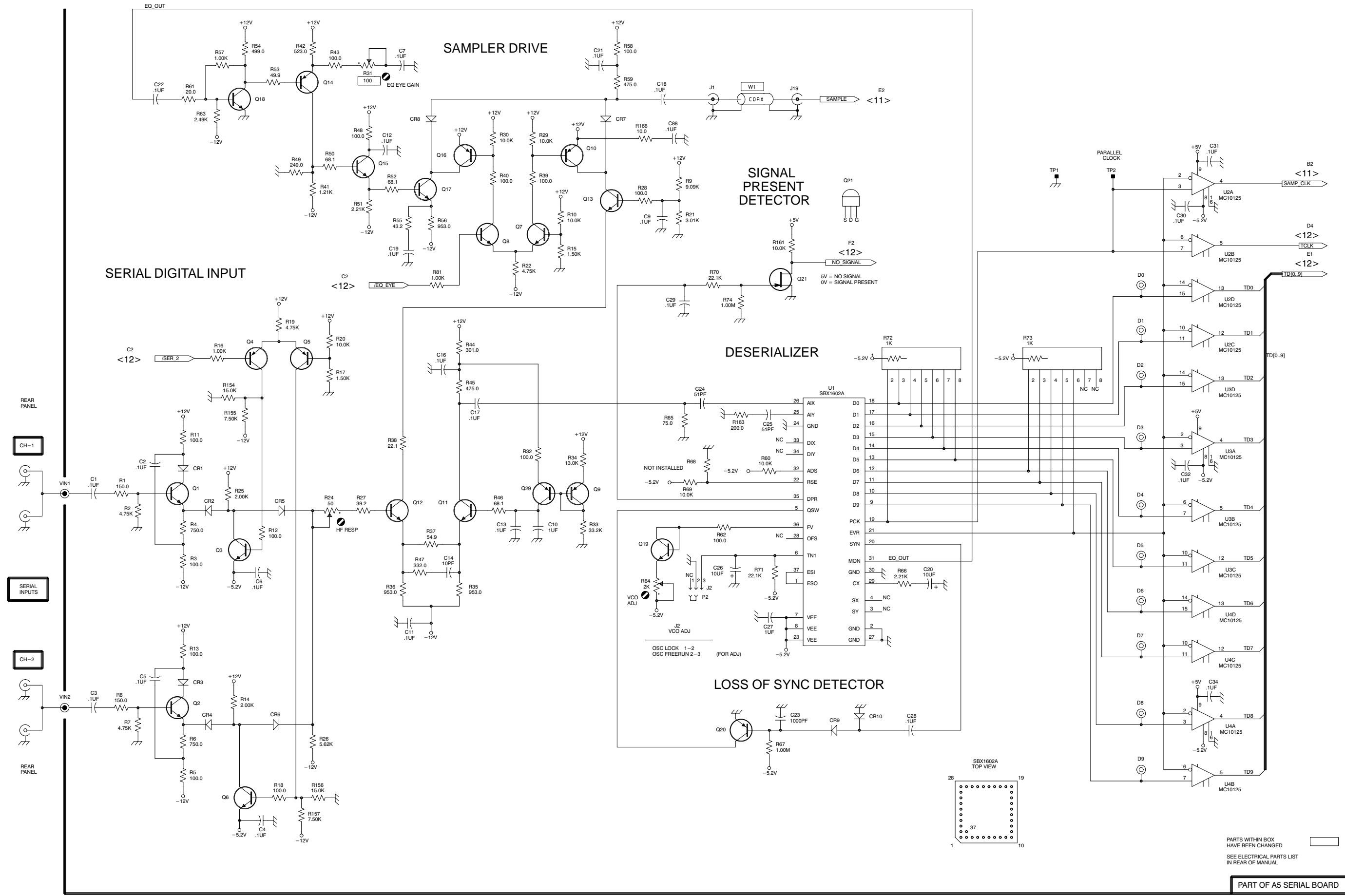
The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A5.** Partial Assembly A5 shown on Schematics 10, 11, and 12.

Use this circuit board lookup table for schematic <10>.

CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC												
C1	A3	10	A1	C45	B4	12	H4	C88	D1	10	B3	J12	H3	12	F1	R7	A4	10	A2	R50	B1	10	C3	R98	B3	11	I3	R147	E1	11	L2	U3D	H3	10	E2				
C2	A3	10	A1	C46	B5	12	H1	J17	A2	12	J3	R8	A4	10	A2	R51	C2	10	C3	R52	C2	10	C3	R99	B4	11	I3	R148	E1	11	L2	U4A	H4	10	E3				
C3	A4	10	A2	C47	B5	12	H1	CR1	B3	10	A1	R9	D1	10	A3	R100	D3	11	J2	R101	D3	11	J2	R100	D3	11	J2	R149	F1	11	L3	U4B	H5	10	E3				
C4	B5	10	A3	C48	B4	11	I3	CR2	B3	10	A1	R10	D2	10	A3	R53	B1	10	C3	R102	B4	11	J3	R102	B4	11	J3	R150	G2	11	L3	U4C	H4	10	E3				
C5	A4	10	A2	C49	B3	12	I3	CR3	B4	10	A2	R11	B3	10	A1	R54	B1	10	C3	R103	D4	11	J2	R103	D4	11	J2	R151	G1	11	M3	U4D	H4	10	E3				
C6	B4	10	A1	C50	B4	12	I3	CR4	B5	10	A2	P2	E4	10		R55	C2	10	C3	R104	D4	11	J3	R104	D4	11	J3	R152	G1	11	M3	U5	E1	12	G3				
C7	C1	10	B3	C51	D3	11	I2	CR5	B3	10	B1	Q1	A3	10	A1	R56	C2	10	C3	R105	D5	11	J3	R105	D5	11	J3	R153	E2	11	M2	U6	F3	12	F1				
C9	D2	10	B2	C52	B5	12	I1	CR6	B5	10	B2	Q2	A4	10	A2	R57	B1	10	C3	R106	A4	11	J3	R106	A4	11	J3	R154	B3	10	A2	U7	C1	12	G2				
C10	D3	10	B1	C53	D3	11	J2	CR7	D1	10	C2	Q3	B4	10	B1	R58	D1	10	D2	R107	G3	11	J1	R107	G3	11	J1	R155	B3	10	A2	U8A	B2	11	H1				
C11	C4	10	C2	C54	B4	11	J3	CR8	C1	10	C2	Q4	B2	10	B1	R59	D1	10	C2	R108	B3	10	A2	R108	B3	10	A2	R156	B5	10	B2	U8B	B3	11	H1				
C12	C1	10	B3	C55	B4	11	J3	CR9	E5	10	D3	Q5	B2	10	B2	R60	E3	10	D2	R109	E4	11	J1	R109	E4	11	J1	R157	B5	10	B2	U9A	C4	11	H2				
C13	D3	10	B1	C56	A4	11	J3	CR10	F4	10	D3	Q6	B5	10	B2	R61	B1	10	C3	R110	D4	11	J2	R110	D4	11	J2	R158	A2	12	J4	U9B	C5	11	H2				
C14	C4	10	C2	C57	B5	12	J1	CR11	B3	12	G4	Q7	B2	10	A2	R62	E3	10	D3	R111	D4	11	J2	R111	D4	11	J2	R159	A2	12	H4	U10	B3	12	H3				
C16	C3	10	C1	C58	B4	11	J3	CR12	B3	12	H2	Q8	D2	10	B3	R63	B1	10	C3	R112	D5	11	J3	R112	D5	11	J3	R160	B2	12	G2	U11	B4	12	H3				
C17	C3	10	C1	C59	D4	11	J2	CR13	B3	12	H3	Q9	D3	10	B1	R64	D4	10	D4	R113	D5	11	J3	R113	D5	11	J3	R161	E2	10	F4	U12A	C2	11	I1				
C18	D1	10	C2	C60	E5	11	J2	CR14	B4	12	H3	Q10	D1	10	B2	R65	E3	10	D1	R114	E4	11	K2	R114	E4	11	K2	R162	G2	11	L3	U12B	D2	11	I1				
C19	C2	10	C3	C62	D4	11	K2	CR15	D5	12	H1	Q11	D1	10	B2	R66	F4	10	D1	R115	E5	11	K3	R115	E5	11	K3	R163	E3	10	D1	U13A	C4	11	I2				
C20	F4	10	C1	C63	E5	11	K3	CR16	B3	12	H3	Q12	C3	10	C2	R67	E5	10	D3	R116	E4	11	K2	R116	E4	11	K2	R164	F5	11	L2	U13B	C3	11	I2				
C21	D1	10	C2	C64	G5	11	K1	CR17	B3	12	H3	Q13	G3	10	B2	R68	E3	10	D1	R117	D5	11	K3	R117	D5	11	K3	R165	D1	10	B3	U13C	C3	11	I2				
C22	A1	10	C2	C65	E5	11	K3	CR18	A4	11	J3	Q14	D2	10	C2	R69	E3	10	D1	R118	F5	11	K3	R118	F5	11	K3	R166	D1	10	B3	U13D	C4	11	I2				
C23	E4	10	D3	C66	C5	12	K2	CR19	E4	11	J3	Q15	B1	10	B3	R70	E2	10	E3	R119	C1	11	K1	R119	C1	11	K1	RT1	G1	11	M4	U14	E2	11	I1				
C24	E3	10	D1	C67	E5	11	K3	CR20	E5	11	K3	Q16	C1	10	C3	R71	E4	10	D3	R120	F2	10	E2	R120	F2	10	E2	RT2	G1	11	L4	U15	D3	11	J2				
C25	E3	10	D1	C68	D1	11	L1	CR21	F4	11	K4	Q17	C1	10	C2	R72	F2	10	E2	R121	F5	11	K2	R121	F5	11	K2	U16A	G2	11	J1	U16A	G2	11	J1				
C26	E4	10	D3	C69	D1	11	L1	CR22	F4	11	K4	Q18	C2	10	C2	R73	G2	10	E3	R122	F4	11	K3	R122	F4	11	K3	T1	C1	11	K1	U17	G4	11	J1				
C27	E4	10	D3	C70	C1	11	L1	CR26	E1	11	M2	Q19	B1	10	C3	R74	E2	10	E3	R123	F5	11	K3	R123	F5	11	K3	T2	D1	11	L1	U18	D4	11	J2				
C28	F5	10	D3	C71	G2	11	L3	CR27	E1	11	M2	Q20	D4	10	C3	R76	F3	12	F2	R124	H2	11	L3	R124	H2	11	L3	T3	D1	11	L1	U19	A1	11	K1				
C29	E2	10	D3	C72	B1	11	L2	CR28	F1	11	M2	Q21	E5	10	D3	R79	D3	12	G2	R125	F4	11	K4	R125	F4	11	K4	U20	E5	11	K3	U20	E5	11	K3				
C30	G2	10	E1	C73	D1	11	L1	CR29	F1	11	M2	Q22	E2	10	E3	R81	C2	10	H4	R126	D1	11	L1	R126	D1	11	L1	TP1	G1	10	D1	U21B	E4	11	K4				
C31	H1	10	E2	C74	C1	11	L2					Q23	E5	12	H1	R82	C1	12	H2	R127	C1	11	L2	R127	C1	11	L2	TP2	G1	10	E1	U22	G2	11	L4				
C32	G3	10	E3	C75	G2	11	L4	D0	G2	10	E2	Q24	B4	11	I3	R83	B2	12	H2	R128	B1	11	L2	R128	B1	11	L2	TP3	E5	11	J3	U23	F1	11	M3				
C33	B5	12	E3	C76	D1	11	L1	D1	G2	10	E2	Q25	C1	11	K1	R84	B3	12	H4	R129	B1	11	L3	R129	B1	11	L3	TP4	G3	11	J1	U24	C2	12	H1				
C34	H4	10	E4	C77	F1	11	L3	D2	G3	10	E2	Q26	F5	11	K3	R85	B3	12	H3	R130	H2	11	L3	R130	H2	11	L3	TP5	E4	11	J1	U25	F5	11	K1				
C35	F4	12	F1	C78	F1	11	L4	D3	G3	10	E2	Q27	C1	11	L2	R86	B4	12	H3	R131	G2	11	L3	R131	G2	11	L3	TP6	E3	11	J2	U26A	G3	11	J1				
C36	B5	12	F2	C79	F1	11	M3	D4	G3	10	E2	Q28	B1	11	L2	R89	E5	12	I1	R132	D1	11	L1	R132	D1	11	L1	U1	E3	10	D2	VIN1	A3	10	A1				
C37	F5	12	G2	C80	F1	11	M4	D5	G4	10	E2	Q29	D3	10	B1	R90	B4	11	I3	R133	D1	11	L1	R133	D1	11	L1	U2A	H1	10	E1	VIN2	A4	10	A2				
C38	B5	12	G3	C81	C5	12	H1	D6	G4	10	E3		R1	A3	10	A1	R91	B4	11	I3	R134	B1	11	L2	R134	B1	11	L2	U2B	H2	10	E1	W1	E1	10				
C39	B5	12	G4	C82	D4	11	J2	D7	G4	10	E3		R2	A3	10	A1	R92	E4	12	I1	R135	B1	11	L3	R135	B1	11	L3	U2C	H2	10	E1							
C40	C1	12	H2	C83	D3	11	I2	D8	G4	10	E3		R3	B4	10	A1	R93	E5	12	I1	R136	H2	11	L3	R136	H2	11	L3	U2D	H2	10	E1							
C41	B3	12	H2	C84	D4	11	J2	D9	G5	10	E3		R4	B3	10	A1	R94	E2	11	I1	R137	G2	11	L3	R137	G2	11	L3	U2E	H3	10	E2							
C42	B3	12	H4	C85	D3	11	I2						R5	B5	10	A2	R95	F2	11	I2	R138	D1	11	L1	R138	D1	11	L1	U3A	H3	10	E2							
C43	A5	12	H2	C86	F5	11	K1	J1	E1	10	C1		R6	B5	10	A2	R96	D3	11	I2	R139	D1	11	L1	R139	D1	11	L1	U3B	H3	10	E2							
C44	B3	12	H3	C87	E5	11	K2	J2	E4	10	D3			B5	10	A2	R97	D3	11	I2	R140	C1	11	L1	R140	C1	11	L1	U3C	H4	10	E2							

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## SCHEMATIC DIAGRAM <11> SERIAL INTERFACE BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A5.** *Partial Assembly A5 also shown on Schematics 10 and 12.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C48	B4	I3	R90	B4	I3	R148	E1	L2
C51	D3	I2	R91	B4	I3	R149	F1	L3
C53	D3	J2	R94	E2	I1	R150	G2	L3
C54	B4	J3	R95	F2	I2	R151	G1	M3
C55	B4	J3	R96	D3	I2	R152	G1	M3
C56	A4	J3	R97	D3	I2	R153	E2	M2
C58	B4	J3	R98	B3	I3	R162	G2	L3
C59	D4	J2	R99	B4	I3	R164	F5	L2
C60	E5	J2	R100	D3	J2	RT1	G1	M4
C62	D4	K2	R101	D3	J2	RT2	G1	L4
C63	E5	K3	R102	B4	J3	T1	C1	K1
C64	G5	K1	R103	D4	J2	T2	D1	L1
C65	E5	K3	R104	D4	J2	T3	D1	L1
C67	E5	K3	R105	D5	J3	TP3	E5	J3
C68	D1	L1	R106	A4	J3	TP4	G3	J1
C69	D1	L1	R112	G3	J1	TP5	E4	J1
C70	C1	L1	R113	E4	J1	TP6	E3	J2
C71	G2	L3	R114	D4	J2	U8A	B2	H1
C72	B1	L2	R115	D4	J2	U8B	B3	H1
C73	D1	L1	R116	E3	J2	U9A	C4	H2
C74	C1	L2	R117	E5	J3	U9B	C5	H2
C75	G2	L4	R118	E4	K2	U12A	C2	I1
C76	D1	L1	R119	E5	K3	U12B	D2	I1
C77	F1	L3	R121	A1	K1	U13A	C4	I2
C78	F1	L4	R122	F5	K3	U13B	C3	I2
C79	F1	M3	R123	C2	K1	U13C	C3	I2
C80	F1	M4	R124	C1	K1	U13D	C4	I2
C82	D4	J2	R126	C1	L2	U14	E2	I1
C83	D3	I2	R127	F5	K2	U15	D3	J2
C84	D4	J2	R128	F4	K3	U16A	G2	J1
C85	D3	I2	R129	F5	K3	U17	G4	J1
C86	F5	K1	R130	H2	L3	U18	D4	J2
C87	E5	K2	R131	F4	K4	U19	A1	K1
CR18	A4	J3	R132	D1	L1	U20	E5	K3
CR19	E4	J3	R133	D1	L1	U21B	E4	K4
CR20	E5	K3	R134	B1	L2	U22	G2	L4
CR21	F4	K4	R135	B1	L3	U23	F1	M3
CR22	F4	K4	R136	H2	L3	U25	F5	K1
CR26	E1	M2	R137	G2	L3	U26A	G3	J1
CR27	E1	M2	R138	D1	L1	Y1	B4	I3
CR28	F1	M2	R139	D1	L1			
CR29	F1	M2	R140	C1	L1			
J18	H2	L4	R141	E2	L2			
Q23	B4	I3	R142	E2	L2			
Q25	C1	K1	R143	E1	L2			
Q26	F5	K3	R144	B1	L2			
Q27	C1	L2	R145	E1	L2			
Q28	B1	L2	R146	G1	L3			
			R147	E1	L2			

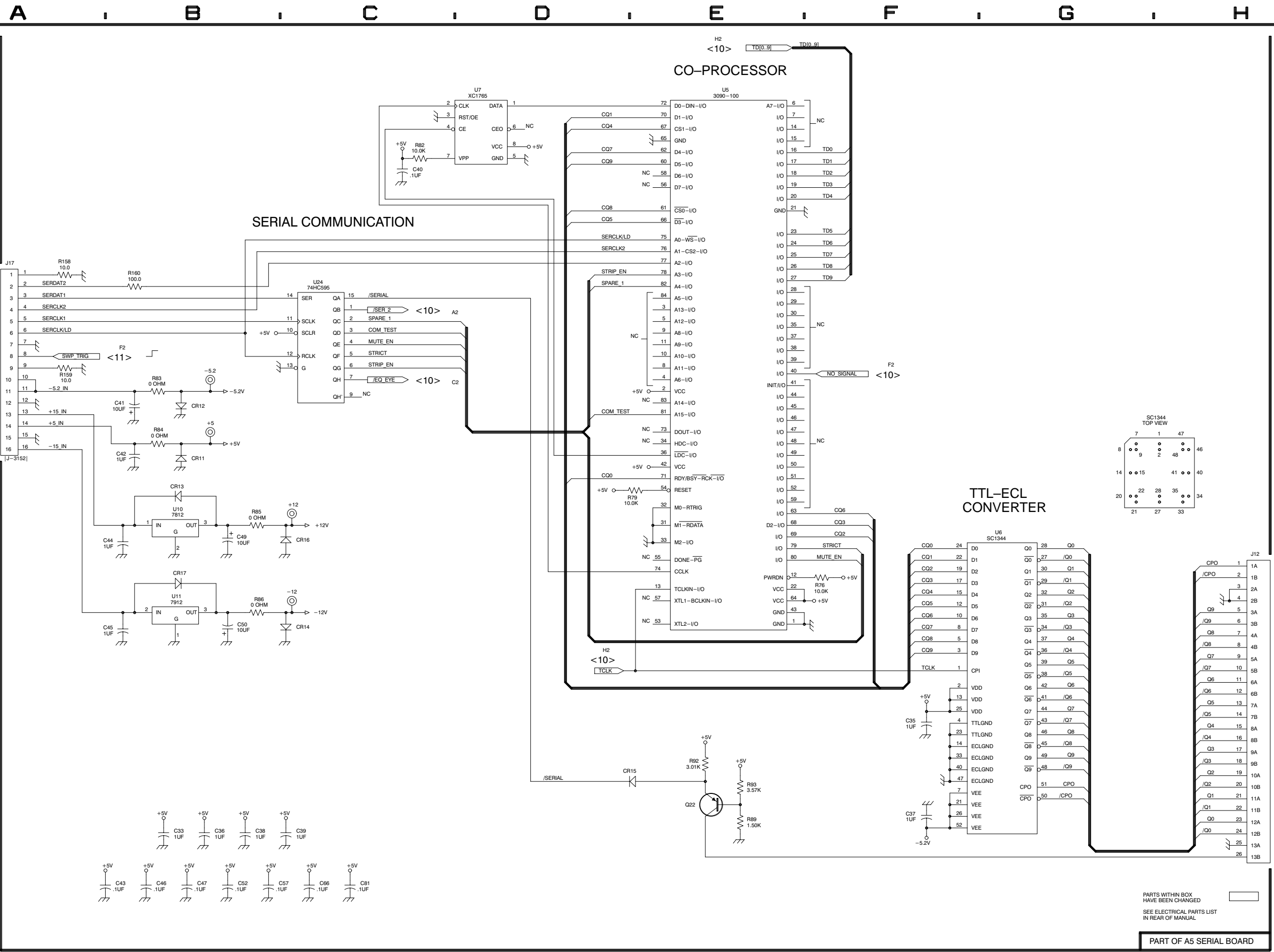


## SCHEMATIC DIAGRAM < 12 > SERIAL INTERFACE BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A5.** *Partial Assembly A5 also shown on Schematics 10 and 11.*

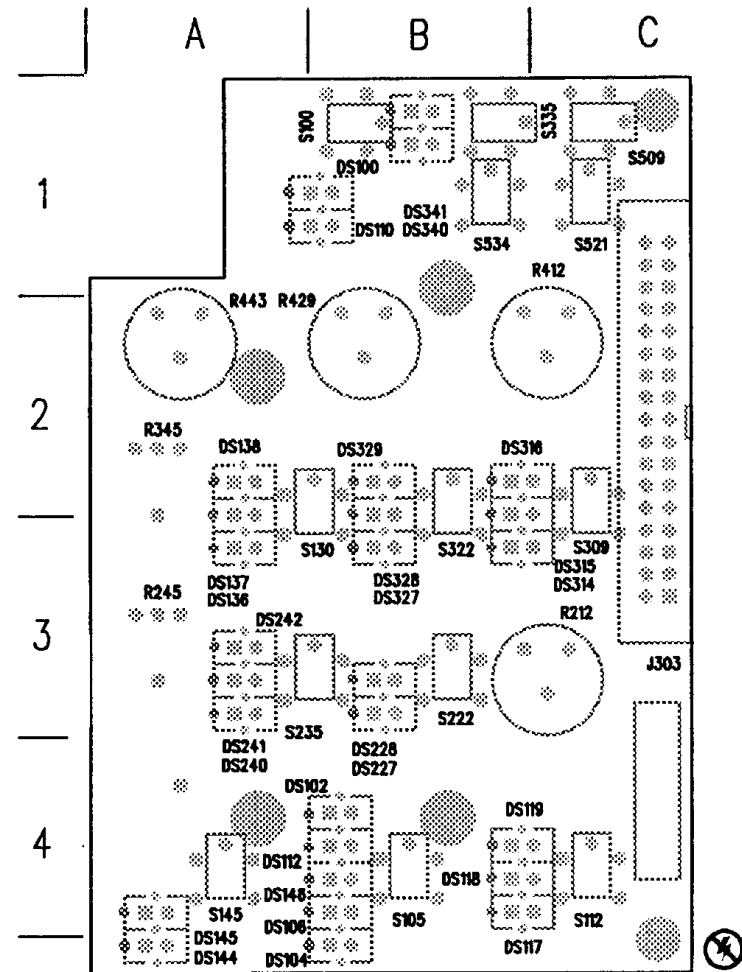
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C33	B5	E3
C35	F4	F1
C36	B5	F2
C37	F5	G2
C38	B5	G3
C39	B5	G4
C40	C1	H2
C41	B3	H2
C42	B3	H4
C43	A5	H2
C44	B3	H3
C45	B4	H4
C46	B5	H1
C47	B5	I1
C49	B3	I3
C50	B4	I3
C52	B5	I1
C57	B5	J1
C66	C5	K2
C81	C5	H1
CR11	B3	G4
CR12	B3	H2
CR13	B3	H3
CR14	B4	H3
CR15	D5	H1
CR16	B3	H3
CR17	B3	H3
J12	H3	F1
J17	A2	J3
Q22	E5	H1
R76	F3	F2
R79	D3	G2
R82	C1	H2
R83	B2	H2
R84	B3	H4
R85	B3	H3
R86	B4	H3
R89	E5	I1
R92	E4	I1
R93	E5	I1
R158	A2	J4
R159	A2	H4
R160	B2	G2
U5	E1	G3
U6	F3	F1
U7	C1	G2
U10	B3	H3
U11	B4	H3
U24	C2	H1



PARTS WITHIN BOX  
HAVE BEEN CHANGED

SEE ELECTRICAL PARTS LIST  
IN REAR OF MANUAL

PART OF A5 SERIAL BOARD



**A2 FRONT PANEL CIRCUIT BOARD**

 **Static Sensitive Devices**  
See Maintenance Section

**SCHEMATIC DIAGRAM < 13 >  
FRONT PANEL BOARD**

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

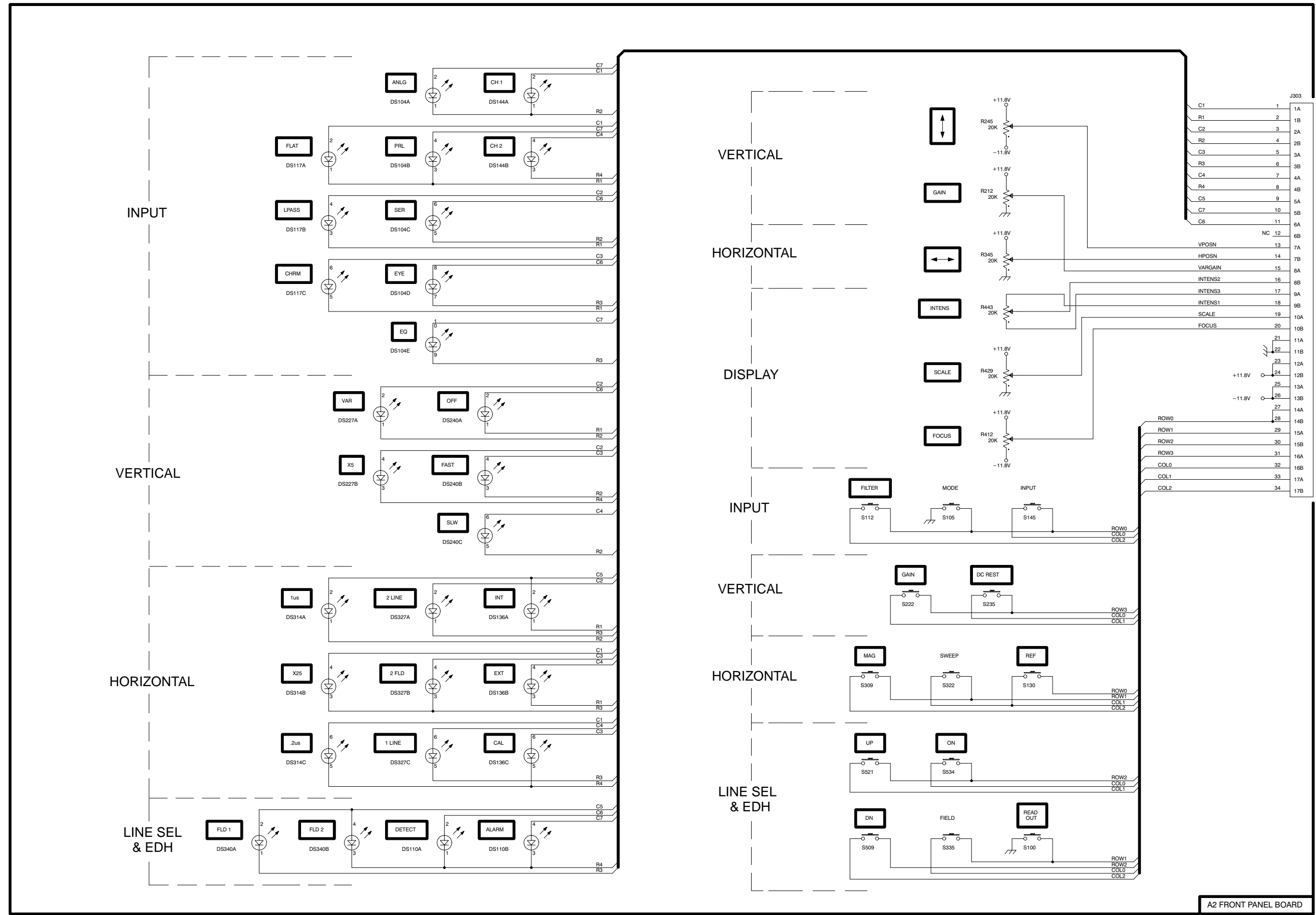
**ASSEMBLY A2.**

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
DS100	D5	B1	DS328	C4	B3
DS102	C2	B4	DS329	C5	B2
DS104	C1	B4	DS340	B5	B1
DS106	C1	B4	DS341	C5	B1
DS110	C5	B1	J303	H1	C3
DS112	C2	B4			
DS117	B1	C4	R212	F2	C3
DS118	B2	B4	R245	F1	A3
DS119	B2	C4	R345	F2	A2
DS136	D4	A3	R412	F3	C2
DS137	D4	A3	R429	F3	B2
DS138	D5	A2	R443	F2	A2
DS144	D1	A4	S100	F5	B1
DS145	D1	A4	S105	F3	B4
DS146	C2	B4	S112	F3	C4
DS227	C3	B4	S130	F4	B3
DS228	C3	B4	S145	F3	A4
DS240	C3	A4	S222	F4	B3
DS241	C3	A4	S235	F4	B3
DS242	C3	A3	S309	F4	C3
DS314	B4	C3	S322	F4	B3
DS315	B4	C3	S335	F5	B1
DS316	B5	C2	S509	F5	C1
DS327	C4	B3	S521	F5	C1
			S534	F5	B1

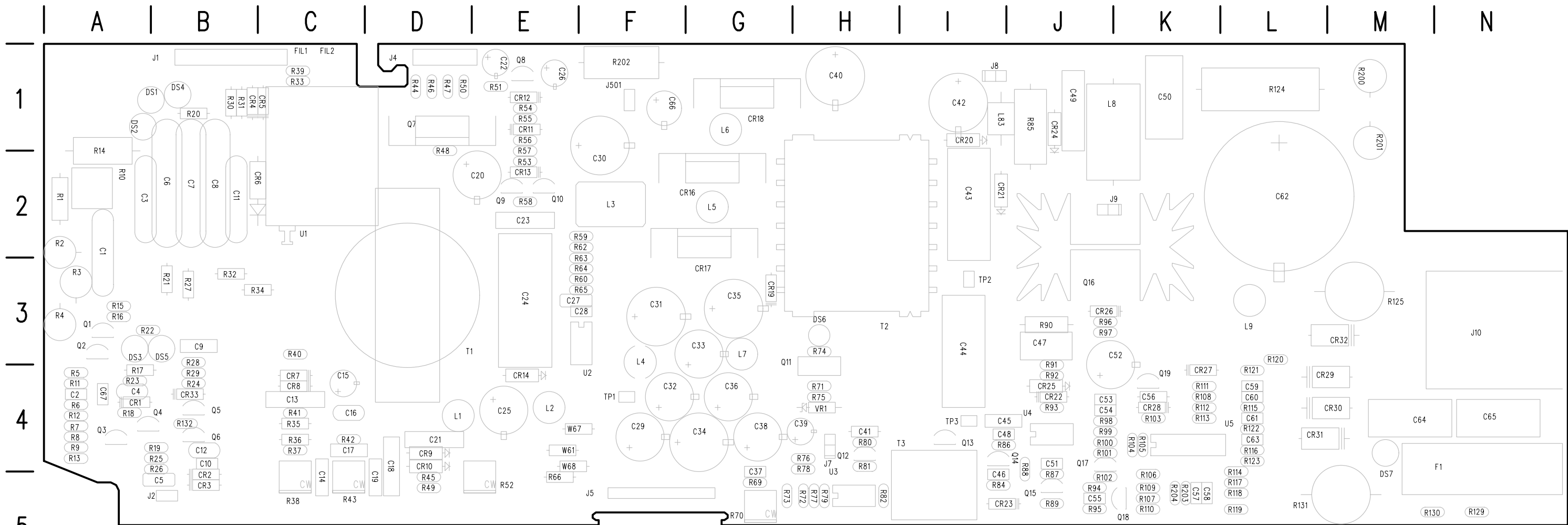


A B C D E F G H

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A2 FRONT PANEL BOARD



The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

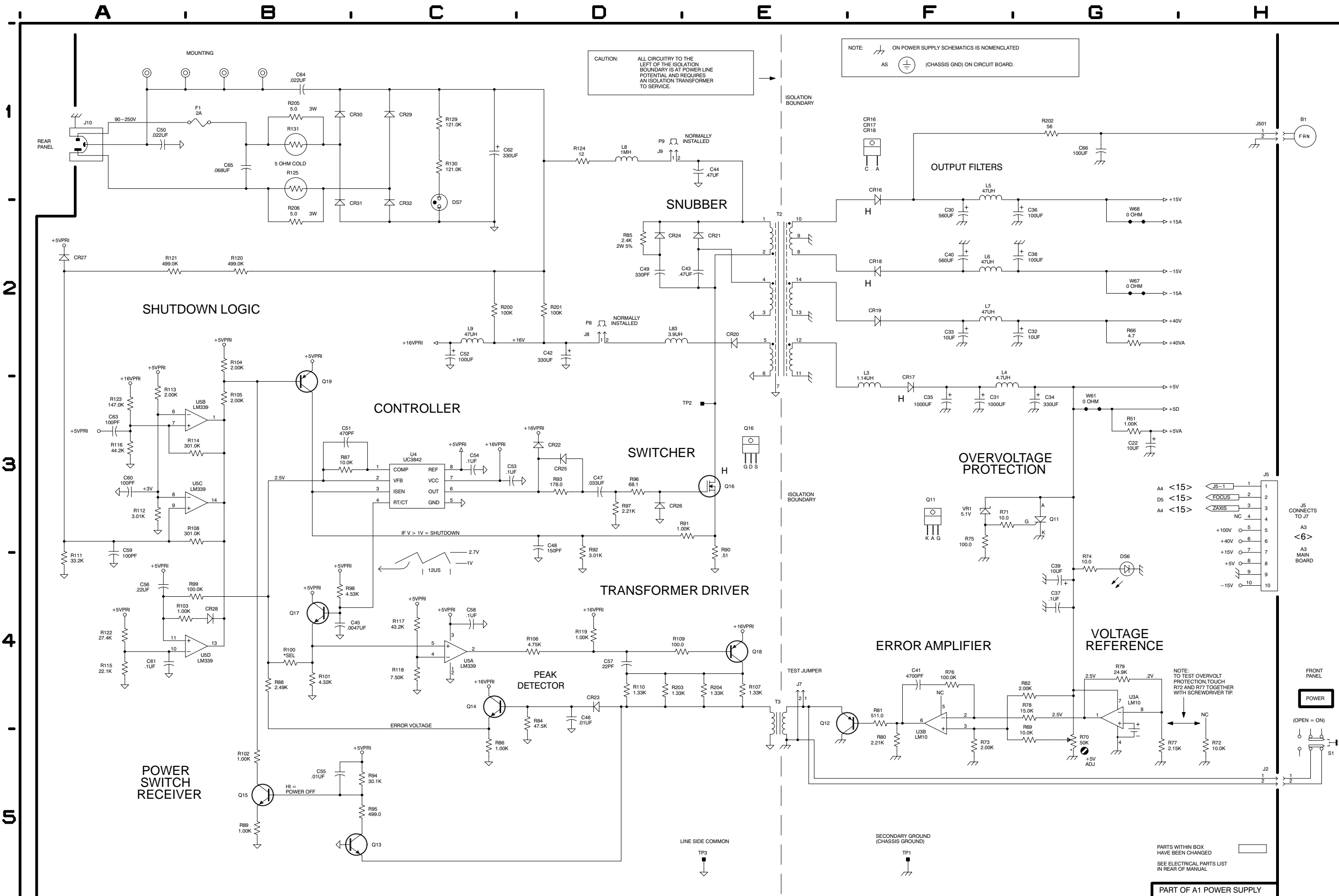
### A1 POWER SUPPLY CIRCUIT BOARD

STATIC SENSITIVE DEVICES

**ASSEMBLY A1.** Partial Assembly A1 shown on Schematics 14 and 15. Use this circuit board lookup table for schematic <14>.

### POWER SUPPLY CIRCUIT BOARD LOOKUP TABLE

CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC	CKT NO.	SCHEM LOC	SCHEM LOC	BD LOC								
C1	F4	15	A2	C36	F2	14	G4	CR3	E5	15	B5	DS5	E4	15	B3	Q3	C4	15	A4	R18	C4	15	A4	R53	B2	15	E2	R92	D3	14	J4	R130	C1	14	M5
C2	B4	15	A4	C37	G4	14	G5	CR4	E2	15	B1	DS6	G4	14	H3	Q4	D4	15	B4	R19	C4	15	A4	R54	A2	15	E1	R93	D3	14	J4	R131	B1	14	L5
C3	D3	15	A2	C38	F2	14	G4	CR5	E2	15	C1	DS7	C1	14	M5	Q5	D4	15	B4	R20	D3	15	B1	R55	A2	15	E1	R94	C5	14	J5	R132	A4	15	B4
C4	C6	15	A4	C39	G4	14	H4	CR6	D3	15	B2	F1	B1	14	N4	Q6	D4	15	B4	R21	D3	15	B3	R56	B2	15	E1	R95	C5	14	J5	R200	C2	14	M1
C5	C5	15	B5	C40	F2	14	H1	CR7	D2	15	C4	CR8	E2	15	C4	Q7	B2	15	D1	R22	E5	15	A3	R57	A2	15	E2	R96	D3	14	J3	R201	A2	14	M1
C6	D3	15	B2	C41	F4	14	H4	CR8	E2	15	C4	CR9	D2	15	D4	Q8	A2	15	E1	R23	C5	15	A4	R58	B3	15	E2	R97	D3	14	J3	R202	G1	14	F1
C7	D3	15	B2	C42	D2	14	I1	CR9	D2	15	D4	FIL1	C3	15	C1	Q9	A2	15	E2	R24	C4	15	B4	R59	B1	15	E2	R98	B4	14	J4	R203	D4	14	K5
C8	E2	15	B2	C43	E2	14	I2	CR10	D2	15	D4	FIL2	C3	15	C1	Q10	B2	15	E2	R25	C4	15	A4	R60	C2	15	E3	R99	A4	14	J4	R204	E4	14	K6
C9	D4	15	B3	C44	E1	14	I3	CR11	A2	15	E1	J1	F3	15	B1	Q11	A2	15	G2	R26	C5	15	B5	R62	B2	15	E2	R100	B4	14	J4	T1	C2	15	D3
C10	C4	15	B4	C45	B4	14	I4	CR12	A2	15	E1	J2	H5	14	A5	Q12	E4	14	H4	R27	D3	15	B3	R63	C2	15	E3	R101	B4	14	J4	T2	E2	14	H3
C11	E2	15	B2	C46	D4	14	I5	CR13	B2	15	E2	J4	F2	15	D1	Q13	B5	14	I4	R28	C3	15	B4	R64	C1	15	E3	R102	B5	14	J5	T3	E4	14	H4
C12	C4	15	B4	C47	D3	14	J3	CR14	C1	15	E4	J5	H3	14	F5	Q14	C4	14	J4	R29	D4	15	B4	R65	B1	15	E3	R103	A4	14	K4				
C13	D2	15	C4	C48	D3	14	I4	CR16	F1	14	F2	J6	E4	14	H4	Q15	B5	14	J5	R30	E2	15	B1	R66	G2	14	E5	R104	B2	14	K4				
C14	F2	15	C5	C49	D2	14	J1	CR17	F3	14	G3	J7	E4	14	H4	Q16	E3	14	J3	R31	E3	15	B1	R69	G5	14	G5	R105	B3	14	K4	TP1	F5	14	F4
C15	C2	15	C4	C50	A1	14	K1	CR18	F2	14	G1	J8	D2	14	I1	Q17	B4	14	J4	R32	E2	15	B3	R70	G5	14	G5	R106	D4	14	K5	TP2	E3	14	I3
C16	D2	15	C4	C51	B3	14	J4	CR19	F2	14	G3	J9	D1	14	J2	Q18	F4	14	K5	R33	E3	15	C1	R71	F3	14	H4	R107	E4	14	K5	TP3	E5	14	I4
C17	F3	15	C4	C52	C2	14	J3	CR20	E2	14	I1	J10	A1	14	N3	Q19	B2	14	K4	R34	D2	15	B3	R72	H6	14	H5	R108	A3	14	K4				
C18	D2	15	D4	C53	C3	14	J4	CR21	E2	14	I2	J501	H1	14	F1	R1	E4	15	A2	R35	F3	15	C4	R73	F5	14	G5	R109	D4	14	K5	U1	D1	15	C2
C19	F2	15	D5	C54	C3	14	J4	CR22	D3	14	J4	L1	B2	15	D4	R2	E4	15	A2	R36	F1	15	C4	R74	G4	14	H3	R110	D4	14	K5	U2	B2	15	F4
C20	B2	15	E2	C55	B5	14	J5	CR23	D4	14	I5	L2	D1	15	E4	R3	E4	15	A3	R37	F2	15	C4	R75	F3	14	H4	R111	A3	14	K4	U3A	G4	14	H5
C21	C2	15	D4	C56	A4	14	K4	CR24	D2	14	J1	L3	F3	14	F2	R4	E4	15	A3	R38	F2	15	C5	R76	F4	14	H4	R112	A3	14	K4	U3B	F4	14	H5
C22	G3	14	E1	C57	D4	14	K5	CR25	D3	14	J4	L4	F3	14	F3	R5	D5	15	A4	R39	E3	15	C1	R77	G5	14	H5	R113	A3	14	K4	U4	C3	14	J4
C23	B3	15	E2	C58	C4	14	K5	CR26	D3	14	J3	L5	F1	14	G2	R6	B4	15	A4	R40	C2	15	C3	R78	G4	14	H5	R114	A3	14	L5	U5A	C4	14	L4
C24	B2	15	E3	C59	A3	14	L4	CR27	A2	14	K4	L6	F2	14	G1	R7	C5	15	A4	R41	D2	15	C4	R79	G4	14	H5	R115	A4	14	L4	U5B	A3	14	L4
C25	D1	15	E4	C60	A3	14	L4	CR28	B4	14	K4	L7	F2	14	G3	R8	B4	15	A4	R42	F3	15	C4	R80	F5	14	H4	R116	A3	14	L4	U5C	A3	14	L4
C26	A2	15	E1	C61	A4	14	L4	CR29	C1	14	L4	L8	D1	14	J1	R9	B4	15	A4	R43	F2	15	C5	R81	F4	14	H4	R117	C4	14	L5	U5D	A4	14	L4
C27	B1	15	E3	C62	C1	14	L2	CR30	B1	14	L4	L9	C2	14	L3	R10	F4	15	A2	R44	F2	15	D1	R82	G4	14	H5	R118	C4	14	L5				
C28	B1	15	E3	C63	A3	14	L4	CR31	B1	14	L4	L83	D2	14	I1	R11	B4	15	A4	R45	D2	15	D5	R84	D4	14	I5	R119	D4	14	L5				
C29	D1	15	F4	C64	B1	14	M4	CR32	C1	14	M3	P8	D2	14		R12	B4	15	A4	R46	F2	15	D1	R85	D2	14	J1	R120	B2	14	L3				
C30	F2	14	F2	C65	B1	14	N4	CR33	D4	15	B4	P9	D1	14		R13	B4	15	A4	R47	F3	15	D1	R86	C5	14	I4	R121	A2	14	L4				
C31	F3	14	F3	C66	G1	14	F1	DS1	E2	15	A1	Q1	E5	15	A3	R14	E5	15	A2	R48	B3	15	D2	R87	B3	14	J5	R122	A4	14	L4				
C32	F2	14	F4	C67	D5	15	A4	DS2	E3	15	A1	Q2	E5	15	A3	R15	E5	15	A3	R49	D2	15	D5	R88	B4	14	J4	R123	A3	14	L4				
C33	F2	14	G3					DS3	E4	15	A3					R16	E5	15	A3	R50	F3	15	D1	R89	B5	14	J5	R124	D1	14	L1				
C34	G3	14	G4	CR1	C4	15	A4	DS4	E3	15	B1					R17	D4	15	A4	R51	G3	14	E1	R90	E3	14	J3	R125	B1	14	M3				
C35	F3	14	G3	CR2	C4	15	B5													R52	D2	15	E5	R91	D3	14	J4	R129	C1	14	N5				



## SCHEMATIC DIAGRAM < 15 > POWER SUPPLY BOARD

The schematic diagram and circuit board illustration have an alphanumeric grid to assist in locating parts within that diagram or circuit board.

**ASSEMBLY A1.** *Partial Assembly A1 also shown on Schematic 14.*

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C1	F4	A2	FIL1	C3	C1	R32	E2	B3
C2	B4	A4	FIL2	C3	C1	R33	E3	C1
C3	D3	A2				R34	D2	B3
C4	C5	A4	J1	F3	B1	R35	F3	C4
C5	C5	B5	J4	F2	D1	R36	F1	C4
C6	D3	B2	L1	B2	D4	R37	F2	C4
C7	D3	B2	L2	D1	E4	R38	F2	C5
C8	E2	B2				R39	E3	C1
C9	D4	B3	Q1	E5	A3	R40	C2	C3
C10	C4	B4	Q2	E5	A3	R41	D2	C4
C11	E2	B2	Q3	C4	A4			
C12	C4	B4	Q4	D4	B4	R42	F3	C4
C13	D2	C4	Q5	D4	B4	R43	F2	C5
C14	F2	C5				R44	F2	D1
C15	C2	C4	Q6	D4	B4	R45	D2	D5
			Q7	B2	D1	R46	F2	D1
C16	D2	C4	Q8	A2	E1			
C17	F3	C4	Q9	A2	E2	R47	F3	D1
C18	D2	D4	Q10	B2	E2	R48	B3	D2
C19	F2	D5				R49	D2	D5
C20	B2	E2	R1	E4	A2	R50	F3	D1
			R2	E4	A2	R52	D2	E5
C21	C2	D4	R3	E4	A3			
C23	B3	E2	R4	E4	A3	R53	B2	E2
C24	B2	E3	R5	D5	A4	R54	A2	E1
C25	D1	E4				R55	A2	E1
C26	A2	E1	R6	B4	A4	R56	B2	E1
			R7	C5	A4	R57	A2	E2
C27	B1	E3	R8	B4	A4			
C28	B1	E3	R9	B4	A4	R58	B3	E2
C29	D1	F4	R10	F4	A2	R59	B1	E2
C67	D5	A4				R60	C2	E3
CR1	C4	A4	R11	B4	A4	R62	B2	E2
CR2	C4	B5	R12	B4	A4	R63	C2	E3
CR3	D5	B5	R13	E5	A4			
CR4	E2	B1	R14	E3	A2	R64	C1	E3
CR5	E2	C1	R15	E5	A3	R65	B1	E3
						R132	D4	B4
CR6	D3	B2	R16	E5	A3			
CR7	D2	C4	R17	D4	A4	T1	C2	D3
CR8	E2	C4	R18	C4	A4			
CR9	D2	D4	R19	C4	A4	U1	D1	C2
CR10	D2	D4	R20	D3	B1	U2	B2	F4
CR11	A2	E1	R21	D3	B3			
CR12	A2	E1	R22	E5	A3			
CR13	B2	E2	R23	C5	A4			
CR14	C1	E4	R24	C4	B4			
CR33	D4	B4	R25	C4	A4			
DS1	E2	A1	R26	C5	B5			
DS2	E3	A1	R27	D3	B3			
DS3	E4	A3	R28	D3	B4			
DS4	E3	B1	R29	C4	B4			
DS5	E4	B3	R30	E2	B1			
			R31	E3	B1			

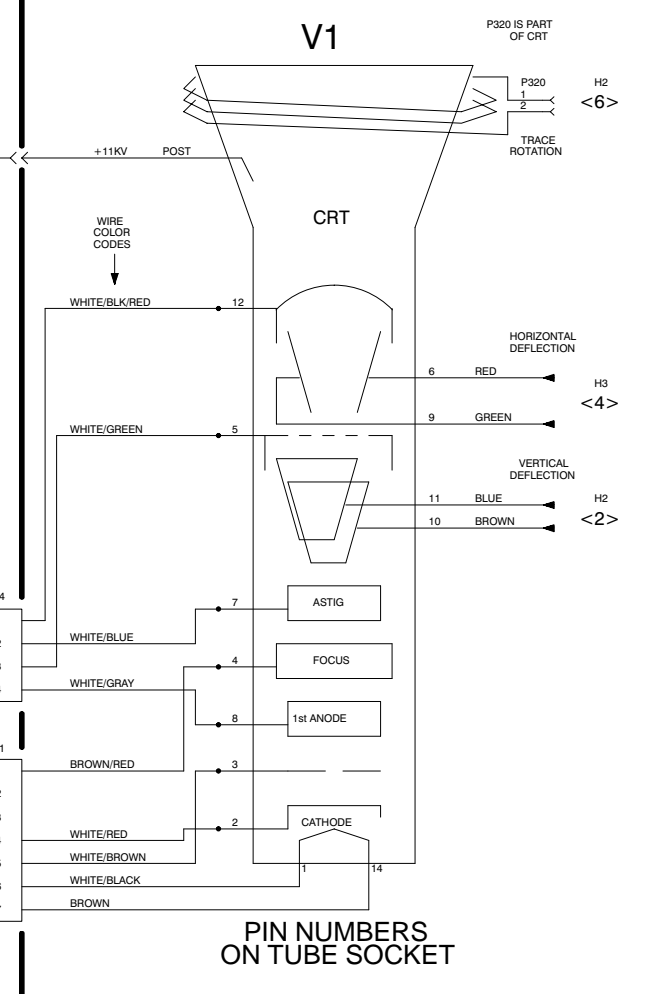
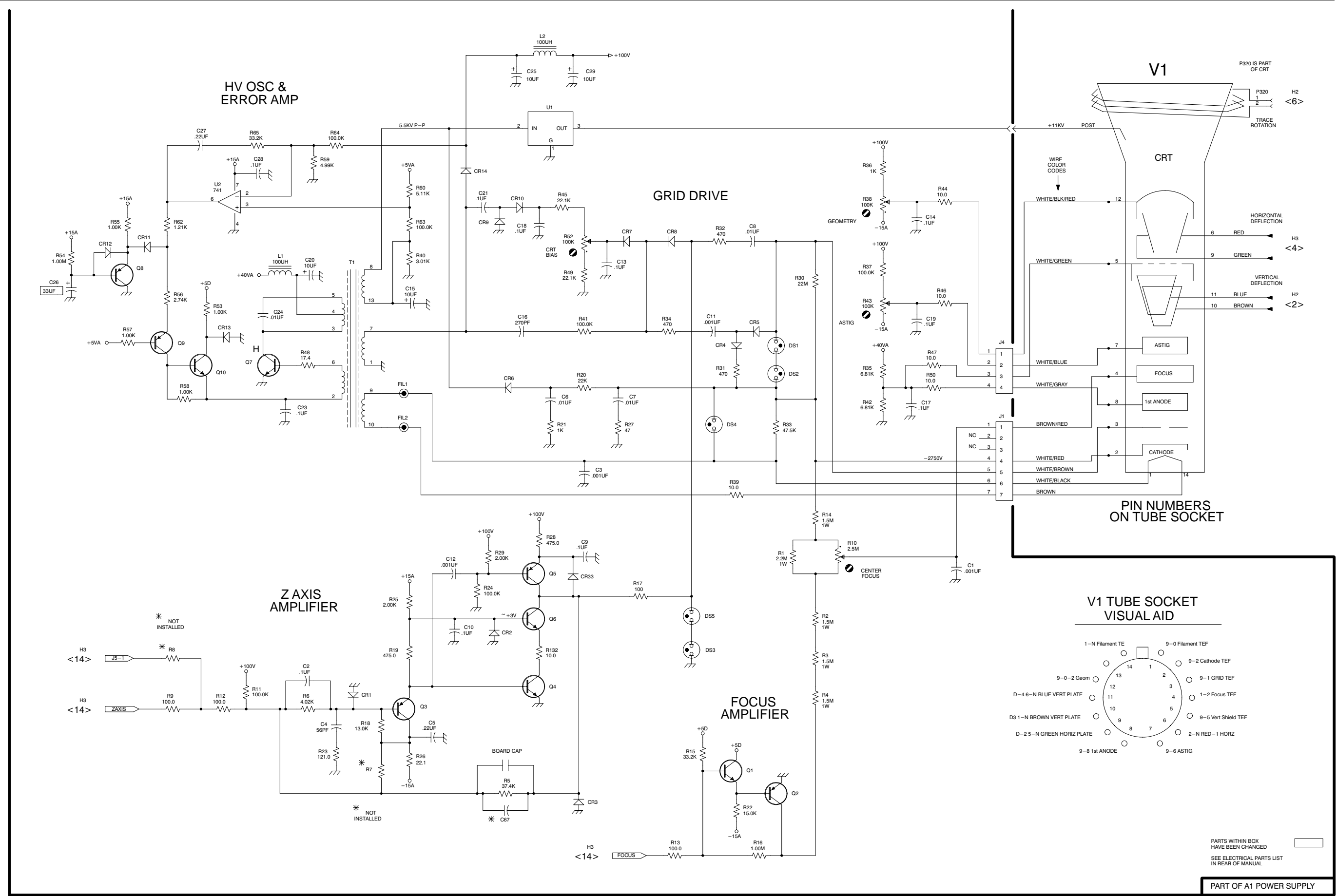
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PARTS WITHIN BOX HAVE BEEN CHANGED  
SEE ELECTRICAL PARTS LIST IN REAR OF MANUAL  
PART OF A1 POWER SUPPLY





# **Replaceable Mechanical Parts**





# Replaceable Mechanical Parts

This section contains a list of the components that are replaceable for the 1730D. Use this list to identify and order replacement parts. There is a separate Replaceable Mechanical Parts list for each instrument.

## 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. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument 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.

## Using the Replaceable Mechanical Parts List

The tabular information in the Replaceable Mechanical Parts list is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replaceable parts.

### **Cross Index–Mfr. Code Number to Manufacturer**

The Mfg. Code Number to Manufacturer Cross Index for the mechanical parts list is located immediately after this page. The cross index provides codes, names, and addresses of manufacturers of components listed in the mechanical parts list.

### **Abbreviations**

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1.

### **Chassis Parts**

Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts list.

## Column Descriptions

<b>Figure &amp; Index No. (Column 1)</b>	Items in this section are referenced by figure and index numbers to the illustrations.
<b>Tektronix Part No. (Column 2)</b>	Indicates part number to be used when ordering replacement part from Tektronix.
<b>Serial No. (Column 3 and 4)</b>	Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.
<b>Qty (Column 5)</b>	This indicates the quantity of mechanical parts used.
<b>Name and Description (Column 6)</b>	<p>An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.</p> <p>Following is an example of the indentation system used to indicate relationship.</p> <pre> <b>1 2 3 4 5      Name &amp; Description</b> Assembly and/or Component Mounting parts for Assembly and/or Component *MOUNTING PARTS*/*END MOUNTING PARTS*     Detail Part of Assembly and/or Component     Mounting parts for Detail Part         *MOUNTING PARTS*/*END MOUNTING PARTS*             Parts of Detail Part             Mounting parts for Parts of Detail Part                 *MOUNTING PARTS*/*END MOUNTING PARTS* </pre> <p>Mounting 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. <b>Mounting parts must be purchased separately, unless otherwise specified.</b></p>
<b>Mfr. Code (Column 7)</b>	Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)
<b>Mfr. Part Number (Column 8)</b>	Indicates actual manufacturer's part number.

## Cross Index – Mfr. Code Number To Manufacturer

Mfr. Code	Manufacturer	Address	City, State, Zip Code
OKB01	STAUFFER SUPPLY	810 SE SHERMAN	PORTLAND OR 97214
06383	PANDUIT CORP	17301 RIDGELAND	TINLEY PARK IL 60477-3048
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125-4632
18677	SCANBE MFG CO DIV OF ZERO CORP	3445 FLETCHER AVE	EL MONTE CA 91731
30817	INSTRUMENT SPECIALTIES CO INC	EXIT 53 RT 80	DELAWARE WATER GAP PA 18327
31918	ITT SCHADOW INC	8081 WALLACE RD	EDEN PRAIRIE MN 55344-2224
34785	DEK INC	3480 SWENSON AVE	ST CHARLES IL 60174-3450
70903	COOPER BELDEN ELECTRONICS WIRE AND CO SUB OF COOPER INDUSTRIES INC		
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
75915	LITTELFUSE INC SUB TRACOR INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
80126	PACIFIC ELECTRICORD CO	747 W REDONDO BEACH PO BOX 10	GARDENA CA 90247-4203
83385	MICRODOT MFG INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK1373	PATELEC-CEM (ITALY)	10156 TORINO	VAICENTALLO 62/45S ITALY
TK1543	CAMCAR/TEXTRON	600 18TH AVE	ROCKFORD IL 61108-5181

## Replaceable Mechanical Parts

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Dscont	Qty	Name & Description	Mfr. Code	Mfr. Part No.
1-1	426-2102-00			1	FRAME,CRT:BEZEL *MOUNTING PARTS*	80009	426-2102-00
-2	211-0690-02			2	SCREW,MACHINE:6-32 X 0.875,PNH,SST *END MOUNTING PARTS*	TK1543	B20-70430
-3	366-0616-00			5	PUSH BUTTON:0.585 X 0.3 X 0.150	80009	366-0616-00
-4	333-4005-00			1	PANEL,FRONT:1730D,SMALL	80009	333-4005-00
-5	378-0258-00			1	FLTR,CONTRASTIN:GRAY,POLYCARBONATE	80009	378-0258-00
-6	348-0660-00			4	CUSHION,CRT:POLYURETHANE	80009	348-0660-00
-7	333-3981-01			1	PANEL,FRONT:1730D *MOUNTING PARTS*	80009	333-3981-01
-8	211-0721-00			2	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-9	366-1701-01			6	KNOB:GY,0.127 ID X 0.392 OD X 0.4 H	80009	366-1701-01
-10	-----			1	CIRCUIT BD ASSY:FRONT PANEL (SEE A2 REPL) *MOUNTING PARTS*		
-11	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-12	366-0616-00			13	PUSH BUTTON:0.585 X 0.3 X 0.150	80009	366-0616-00
-13	426-2101-04			1	FRAME SECT,CAB.:FRONT *MOUNTING PARTS*	80009	426-2101-04
-14	211-0721-00			3	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-15	260-2465-00			1	SWITCH,PUSH:0.4A,125VAC,W/SLDR LUG,BUTTON W/YEL- LOW INDICATOR *MOUNTING PARTS*	31918	602844
-16	210-0405-00			2	NUT,PLAIN,HEX:2-56 X 0.188,BRS CD PL	73743	12157-50
-17	211-0100-00			2	SCREW,MACHINE:2-56 X 0.750,PNH,STL *END MOUNTING PARTS*	83385	ORDER BY DESCR
-18	174-2648-00			1	CA ASSY,SP: (PWR SWITCH TO A1J3)	80009	174-2648-00
-19	-----			1	CIRCUIT BD ASSY:MAIN (SEE A3 REPL) *MOUNTING PARTS*		
-20	211-0721-00			8	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-21	-----			1	CIRCUIT BD ASSY:GRATICULE LIGHT (SEE A3A1 REPL)		
-22	337-3321-00			1	SHIELD,ELEC:CKT BD 1730	80009	337-3321-00
-23	337-3802-00			1	SHIELD,ELEC:LEXAN *MOUNTING PARTS*	80009	337-3802-00
-24	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-25	334-3003-00			1	MARKER,IDENT:MKD DANGER	80009	334-3003-00
-26	-----			1	CIRCUIT BD ASSY:POWER SUPPLY (SEE A1 REPL) *MOUNTING PARTS*		
-27	211-0720-01			1	SCREW,MACHINE:6-32 X 0.50,PNH,STL,TORX T-15 WITH SLOT	0KB01	211-0720-01
-28	129-1410-00			4	SPACER,POST:	80009	129-1410-00

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Dscont	Qty	Name & Description	Mfr. Code	Mfr. Part No.
-29	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-30	211-0014-00			2	SCREW,MACHINE:4-40 X 0.5,PNH,STL *END MOUNTING PARTS*	93907	ORDER BY DESCR
-31	131-3573-00			1	CONN,PLUG,ELEC:MALE,W/LOCKING ADAPTER	80126	B-0779
-32	337-3821-00			1	SHIELD,ELEC:CIRCUIT BOARD,POLYCARBONATE SAFETY CONTROLLED	80009	337-3821-00
-33	175-9872-01			1	CA ASSY,SP,ELEC:2,18 AWG,2.5 L,0-N	80009	175-9872-01
-34	348-0274-00			1	SHLD GSKT,ELEK:FINGER TYPE	30817	97-555CDC
	333-3924-01			1	PANEL,REAR:1730D *MOUNTING PARTS*	80009	333-3924-01
-35	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-36	361-1615-00			1	SPACER,FAN ASSY:ALUMINUM *MOUNTING PARTS*	80009	361-1615-00
-37	211-0721-00			2	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-38	378-0335-00			1	FILTER,AIR:1.6 X 1.6,30PPI,0.188 THK	80009	378-0335-00
-39	-----			1	FAN,DC: (SEE B100 REPL) *MOUNTING PARTS*		
-40	211-0020-00			2	SCREW,MACHINE:4-40 X 1.125,PNH,STL	TK0435	ORDER BY DESCR
-41	378-0399-00			1	DEFLECTOR,AIR:ALUMINUM *END MOUNTING PARTS*	80009	378-0399-00
-42	361-1616-00			1	SPACER,FAN ASSY:ALUMINUM	80009	361-1616-00
-43	131-0106-02			12	CONN,RF JACK:	80009	131-0106-02
-44	210-0255-00			1	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	12327	ORDER BY DESCR
-45	337-3804-00			1	SHIELD,ELEC:BNC	80009	337-3804-00
-46	-----			1	CIRCUIT BD ASSY:SERIAL (SEE A5 REPL) *MOUNTING PARTS*		
-47	211-0721-00			6	SCREW,MACHINE:6-32 X 0.375,PNH,STL *END MOUNTING PARTS*	83486	ORDER BY DESCR
-48	337-3800-00			1	SHIELD,ELEC:CIRCUIT BOARD	80009	337-3800-00
-49	426-2358-00			1	CHASSIS,SUPPORT:1730D *MOUNTING PARTS*	80009	426-2358-00
-50	211-0541-00			3	SCREW,MACHINE:6-32 X 0.25,FLH,100 DEG,STL *END MOUNTING PARTS*	93907	ORDER BY DESCR
-51	200-2519-00			1	CAP,CRT SOCKET:NATURAL LEXAN	80009	200-2519-00
-52	426-2096-00			1	MOUNT,RESILIENT:CRT REAR *MOUNTING PARTS*	80009	426-2096-00
-53	210-0457-00			2	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL *END MOUNTING PARTS*	78189	511-061800-00
-54	136-1167-01			1	SKT,CRT ASSY	80009	136-1167-01
-55	346-0120-00			4	STRAP,TIEDOWN,E:5.5 L MIN,PLASTIC,WHITE	06383	SST1.5M
-56	337-3487-00			1	SHIELD,ELEC:CRT,STL	80009	337-3487-00
-57	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	07416	ORDER BY DESCR
-58	386-4443-00			1	SUPPORT,SHIELD:CRT,FRONT,PLASTIC	80009	386-4443-00
-59	-----			1	CIRCUIT BD ASSY:DAC (SEE A4 REPL) *MOUNTING PARTS*		
-60	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL	83486	ORDER BY DESCR
	214-3903-01			2	SCREW,JACK:4-40 X 0.312 EXT THD,4-40 INT THD,0.188 HEX,STEEL,CAD PLATE	80009	214-3903-01

## Replaceable Mechanical Parts

Fig. & Index No.	Tektronix Part No.	Serial Number Effective	Dscont	Qty	Name & Description	Mfr. Code	Mfr. Part No.
					*END MOUNTING PARTS*		
-61	351-0688-00			1	GUIDE,CKT BOARD:NYLON,12.0 L	18677	11633-5
-62	348-0171-00			1	GROMMET,PLASTIC:BLACK,U-SHAPED,0.276 ID	80009	348-0171-00
-63	343-0013-00			1	CLAMP,LOOP:0.375 ID,PLASTIC	06915	E6 CLEAR ROUND CABLE CLAMP
-64	426-2446-00			1	FRAME,CHASSIS:ALUMINUM	80009	426-2446-00
-65	211-0720-01			2	SCREW,MACHINE:6-32 X 0.50,PNH,STL,TORX T-15 WITH SLOT	0KB01	211-0720-01
-66	210-0803-00			2	WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL (1730D ONLY)	12327	ORDER BY DESCR
-67	129-1308-00			1	SPACER,POST:6-32 X 0.75,HEX,STL,CAD PL	55566	4538-632-S-3
					STANDARD ACCESSORIES		
-68	161-0216-00			1	CA ASSY,PWR:3,18 AWG,2.5M L,BLACK (STANDARD ONLY)	80126	C7120-25M-BL
	011-0163-00			2	TERM,COAXIAL:BNC,TERMINATION SINGLR ENDED;75 OHM,26DB TO 300MHZ,50 OHM INTERMATABLE	80009	011-0163-00
	070-8361-xx			1	MANUAL,TECH:INSTR,DIGITAL WAVEFORM MONITOR	80009	070-8361-xx
	150-0168-00			3	LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MT	80009	150-0168-00
	159-0021-00			1	FUSE,CARTRIDGE:3AG,2A,250V,FAST BLOW	75915	312 002
	378-0335-00			3	FILTER,AIR:1.6 X 1.6,30PPI,0.188 THK	80009	378-0335-00
					OPTIONAL ACCESSORIES		
	161-0215-00			1	CA ASSY,PWR:3,0.75MU,2.5MM L,GREY (EUROPEAN OPTION A1 ONLY)	80009	161-0215-00
	161-0066-10			1	CA ASSY,PWR: (UNITED KINGDOM OPTION A2 ONLY)	TK1373	24230
	161-0066-11			1	CA ASSY,PWR:3,0.75MM,240V,96.0 L (AUSTRALIAN OPTION A3 ONLY)	80009	161-0066-11
	161-0066-12			1	CA ASSY,PWR:3,18 AWG,98 L,SVT,GREY/BLK,60 DEG C,BME X STR,IEC RCPT,10A/250V (NORTH AMERICAN OPTION A4 ONLY)	70903	CH-77893
	161-0154-00			1	CA ASSY,PWR:3,1.00MM SQ,250V,10A,2.5METER,SWISS (SWISS OPTION A5 ONLY)	80009	161-0154-00
	016-0475-00			1	VIEWING HOOD:	80009	016-0475-00
	200-3897-01			1	COVER,FRONT:1700F02,HOT STAMPED	80009	200-3897-01
	-----			1	PLAIN,CASE:1700F00		
	-----			1	PTD CASE ASSY:1700F02		
	-----			1	RACK ADAPTER,SIDE-BY-SIDE:1700F05		
	-----			1	FILLER PANEL:1700F06		
	-----			1	DRAWER,UTILITY:1700F07		

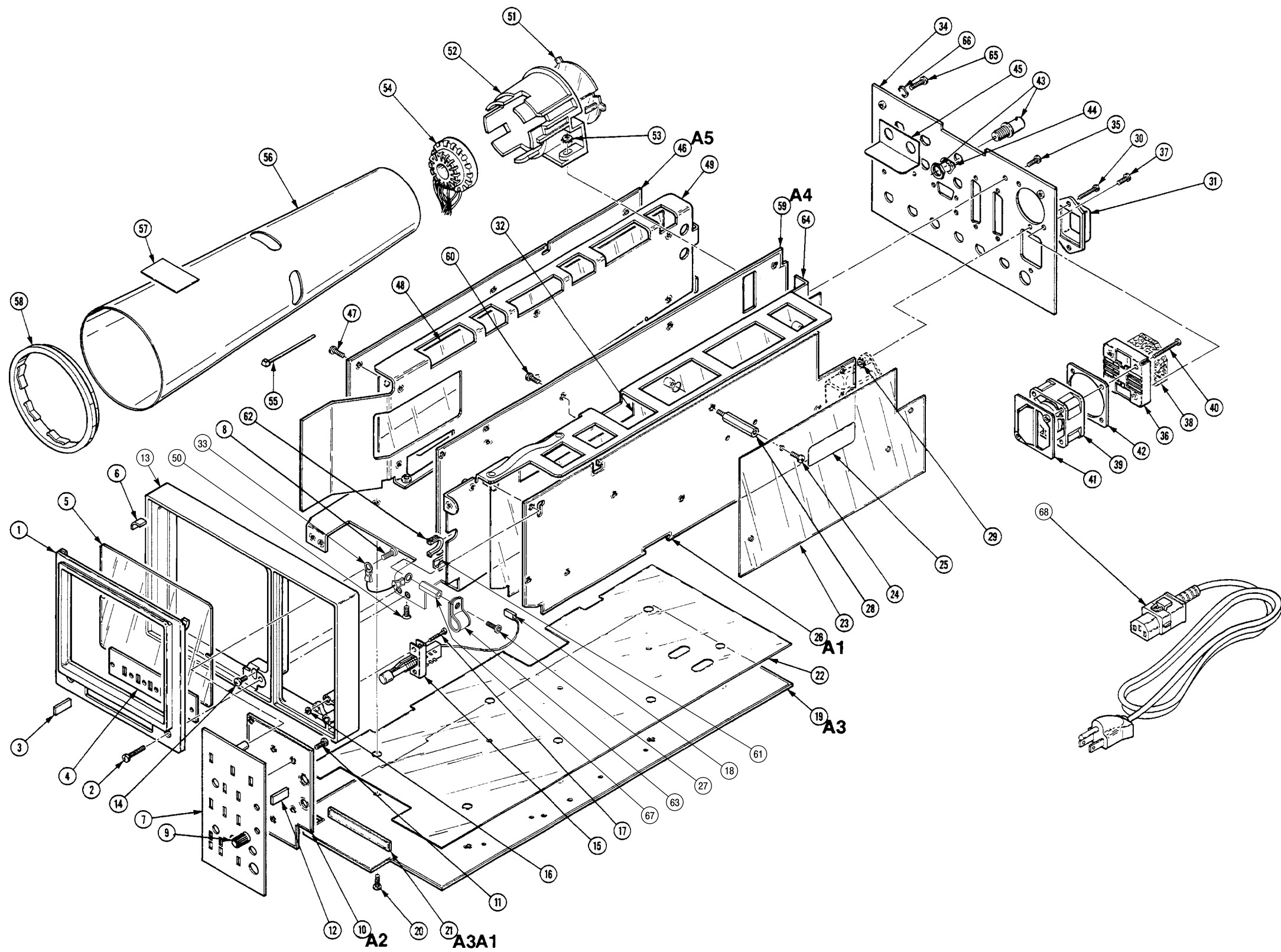


Figure 11-1: Exploded View

